

A NEW APPROACH IN THE SYNTHESIS AND ANALYSIS  
OF ELLIPTIC FILTERS

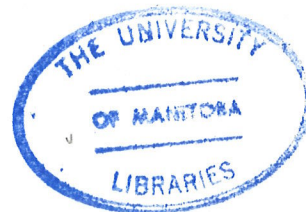
by

Dong Yong Kim

A thesis  
Presented to the University of Manitoba  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy  
in  
Department of Electrical Engineering

Winnipeg, Manitoba

(c) Dong Yong Kim, 1984



A NEW APPROACH IN THE SYNTHESIS AND ANALYSIS  
OF ELLIPTIC FILTERS

BY

DONG YONG KIM

A thesis submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
of the degree of

DOCTOR OF PHILOSOPHY

© 1985

Permission has been granted to the LIBRARY OF THE UNIVERSITY OF MANITOBA to lend or sell copies of this thesis, to the NATIONAL LIBRARY OF CANADA to microfilm this thesis and to lend or sell copies of the film, and UNIVERSITY MICROFILMS to publish an abstract of this thesis.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.



## ABSTRACT

A simple method of pole-zero pairing has been proposed for the active cascade realization of elliptic transfer functions. This simple method of pole-zero pairing is proposed for the enhancement of overall dynamic range. Secondly, the optimum sequencing of individual biquads is developed and it is demonstrated that the commonly accepted sequencing technique does not hold in the case of elliptic functions. This work is an extension for Lueder's method [7].

In addition, the phase, time delay and the time domain characteristics are simultaneously investigated. This aspect has not been widely examined in the past. They are thoroughly analyzed and compiled so that they may be compared and utilized in filter design. Finally, detailed tables are compiled for  $A_p(\text{dB}) = 0.1, 0.2, 0.5, 1.0, 2.0, 3.0$  and  $\omega_s = 1.05, 1.10, 1.15, 1.20, 1.25, 1.30, 1.35, 1.40, 1.45, 1.50, 1.70, 2.00$ . This enables the designer to immediately find the appropriate network function once the specifications are given.

## ACKNOWLEDGEMENTS

The author wishes to express his deepest gratitude to his advisor, Professor H.K. Kim, for his invaluable guidance, encouragement and great assistance throughout the course of this study.

The author also wishes to thank Professor G.O. Martens of the Department of Electrical Engineering and Professor H. Finlayson of the Department of Mathematics, the University of Manitoba, for their moral support and encouragement.

Thanks also goes to the author's wife, Sook Jin Cho, for her typing assistance in the preparation of this manuscript.

The support and encouragement of colleagues in the Department of Electrical Engineering at Chonbuk National University is gratefully acknowledged.

## CONTENTS

| <u>Chapter</u>                                         | page |
|--------------------------------------------------------|------|
| I. INTRODUCTION . . . . .                              | 1    |
| II. ELLIPTIC FUNCTIONS AND POLE-ZERO PAIRING . . . . . | 5    |
| 2.1 Elliptic Transfer Functions . . . . .              | 5    |
| 2.2 Pole-Zero Pairing . . . . .                        | 6    |
| III. SEQUENCING NOTCH SECTIONS . . . . .               | 13   |
| 3.1 Sequence of Low-Pass Notch Type                    |      |
| Biquads . . . . .                                      | 13   |
| 3.2 Illustrative Example . . . . .                     | 20   |
| 3.3 Other Types of Elliptic Function . . . . .         | 26   |
| IV. PHASE AND TIME DOMAIN CHARACTERISTICS . . . . .    | 30   |
| 4.1 Phase and Group-Delay . . . . .                    | 33   |
| 4.2 Unit Step Response . . . . .                       | 50   |
| 4.3 Impulse Responses . . . . .                        | 57   |
| V. CONCLUSION . . . . .                                | 64   |
| APPENDIX I. TABLES OF IMPORTANT PARAMETERS FOR         |      |
| ACTIVE REALIZATIONS . . . . .                          | 69   |
| APPENDIX II. TABLES OF IMPORTANT PARAMETERS FOR        |      |
| PASSIVE REALIZATIONS . . . . .                         | 124  |

## Chapter I

### INTRODUCTION

In the cascade realization of active networks, the given function of order  $n$  must be decomposed into a number of biquads (for  $n$  even) or into a first order function in addition to biquads (for  $n$  odd). In decomposition, there are the problems of pairing the poles and zeros, sequencing of individual biquads and the gain distribution. Therefore, we may optimize the decomposition process in order to enhance an important performance measure such as the dynamic range or sensitivity, for example.

Lueder decomposed the function and maximized the dynamic range of the whole network while minimizing inband losses [7]. He also proposed use of a dynamic programming method to simultaneously implement gain distribution [9]. Halfin [5] solved a similar problem taking a slightly different approach. Moschytz [8] utilized the degrees of freedom of the given problem to minimize the transmission sensitivity and suggested a second-order pole-zero pairing method.

In this thesis we deal with the pole-zero pairing, gain distribution and sensitivity minimization of elliptic filters while making use of specific properties pertaining to elliptic functions in general. Elliptic transfer functions have transmission zeros at specific points on the  $j\omega$  axis cf. Fig. 1 (a), (b).

A low-pass filter realized from an elliptic transfer function produces the magnitude characteristic which is equal-ripple in both the passband and stopband as shown in Fig. 1 (c), (d). As a consequence, the elliptic filter is optimal, i.e. the transition band is minimal, for a given order  $n$  and for given ripple specifications in the passband and stopband.

We will introduce a systematic procedure to generate an  $F=(f_{ij})$  matrix to which the pairing of poles and zeros are assigned. This will yield a biquad which has the flattest possible magnitude response. Subsequently, the particular cascading sequence which results in the transfer functions, from the first input to the biquad outputs with the flattest magnitude, will be developed for the case of elliptic transfer functions with reference to the  $Q$  of individual biquads.

Every pair of poles must take a pair of finite zeros on the  $j\omega$  axis in order to form a low-pass notch function due to the nature of the elliptic transfer functions. A relatively simple method of pole-zero pairing will be developed to improve the overall dynamic range of the realized filter. Subsequently, the gain is distributed to each biquad in a relatively simple manner.

Furthermore, to the author's knowledge, the phase, time delay and the time domain characteristics have not been fully investigated except for a few special cases [12-16].

The main objective of this thesis is to compute the phase, group delay, unit step response and impulse response of elliptic filters so that we may analyze and compare with those of all-pole functions[15]. Detailed tables are attached as appendices.

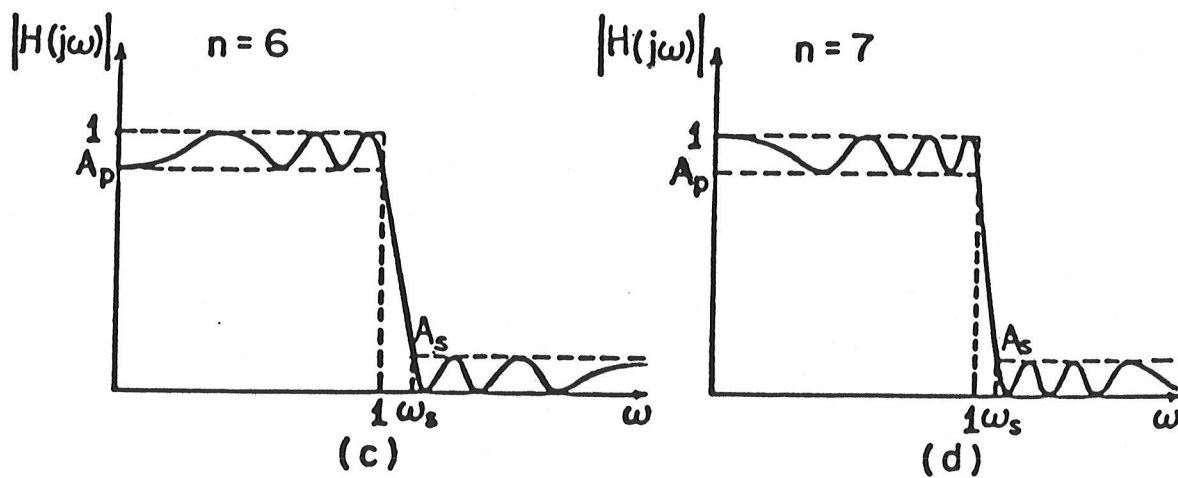
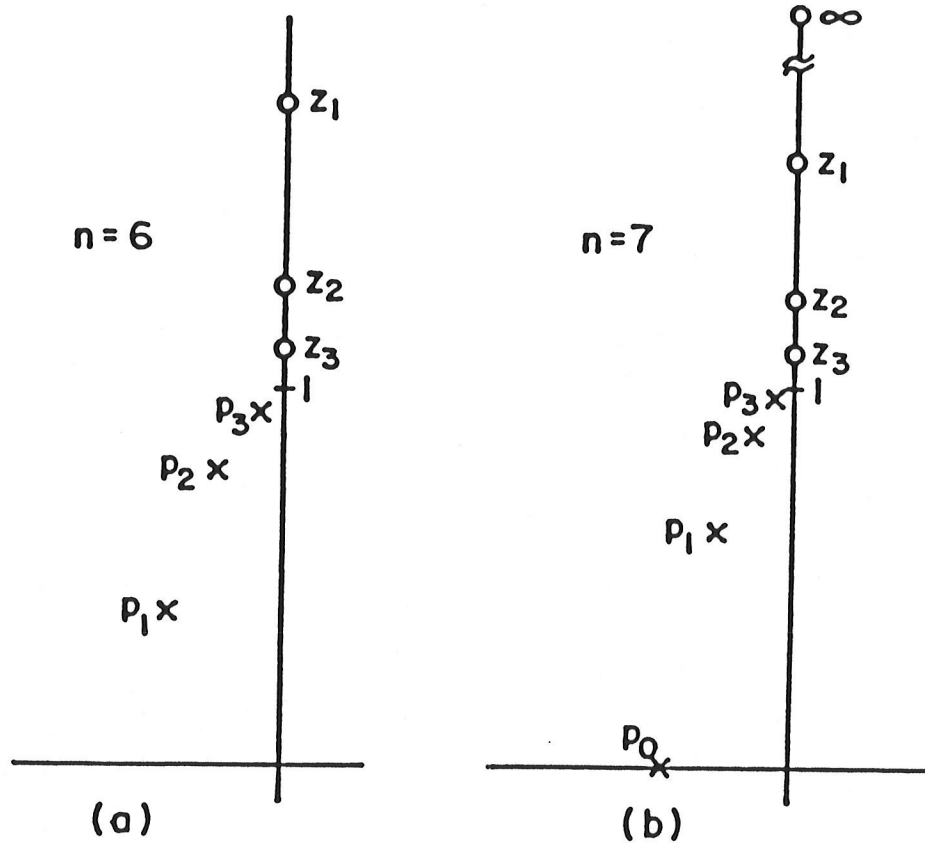


Figure 1. (a) Pole - zero plot of typical elliptic function of  $n=6$ ,  
 (b) Pole - zero plot of typical elliptic function of  $n=7$ ,  
 (c) The magnitude characteristic for  $n=6$ ,  
 (d) The magnitude characteristic for  $n=7$ .

## Chapter II

### ELLIPTIC FUNCTIONS AND POLE-ZERO PAIRING

#### 2.1 Elliptic Transfer Functions

Elliptic functions, first introduced by Cauer, are rational functions of order  $n$  in which the degree of the numerator is equal to that of the denominator for even  $n$  and one less than that of the denominator for odd  $n$ .

Since poles  $p_i$  and zeros  $z_j$  are tabulated in Appendix I, we may write the function in factored form for active realization as follows.

$$H(s) = K \prod_{i,j=1}^{n/2} h_{ij}(s) = K \prod_{i,j=1}^{n/2} \frac{(s - z_j)(s - z_j^*)}{(s - p_i)(s - p_i^*)} \quad \text{for even } n \quad (1a)$$

$$H(s) = K h_0(s) \prod_{i,j=1}^{\frac{n-1}{2}} h_{ij}(s) = K \frac{1}{s + \sigma} \prod_{i,j=1}^{\frac{n-1}{2}} \frac{(s - z_j)(s - z_j^*)}{(s - p_i)(s - p_i^*)} \quad (1b)$$

for odd  $n$

Where  $|p_i| < \omega_s < |z_j|$ , and  $\omega_s$  is the frequency at which the stopband begins, and to be general, the subscripts  $i$  and  $j$  may take on any combination from 1, 2, 3.. as shown in Fig. 1(a), (b). For specified passband ripple  $A_p$  and stopband ripple  $A_s$  and stopband frequency  $\omega_s$  as illustrated in Fig. 1(c), (d), we can refer to Tables in Appendix I and find the order  $n$ , poles  $p_i$  and zeros  $z_j$ .



Subsequently, we write the desired function in the form of (1) for active cascade realization of the individual low-pass notch functions of the type

$$h_{ij}(s) = \frac{(s-z_j)(s-z_j^*)}{(s-p_i)(s-p_i^*)} = \frac{s^2 + \omega_{zj}^2}{s^2 + \frac{\omega_{pi}}{Q_i}s + \omega_{pi}^2} \quad (2)$$

where  $\omega_{zj} = |z_j|$  and  $\omega_{pi} = |p_i|$ ,  $Q_i = \frac{\omega_{pi}}{|p_i + p_i^*|}$ ,  $h_o(s) = \frac{1}{s+1}$ .

## 2.2 Pole-Zero Pairing

Equations (1) and (2) suggest that there could be various ways of associating a pair of zeros with a given pair of poles. There are  $\frac{n}{2}!$  (for even  $n$ ) combinations that suggest a possible optimum pairing for maximum dynamic range. This problem will be solved by pairing the poles and zeros such that the magnitude of  $h_{ij}(s)$  for frequency  $\omega$  is as flat as possible over the filter passband. The magnitude of  $h_{ij}(s)$  and the frequency which maximizes the magnitude is obtained as follows.

$$|h_{ij}|(\omega) = \frac{\left| \omega_{zj}^2 - \omega^2 \right|}{\left\{ (\omega_{pi}^2 - \omega^2)^2 + \left( \frac{\omega_{pi}}{Q_i} \right)^2 \omega^2 \right\}^{1/2}} \quad (3a)$$

$$\omega_{mij} = \left[ \frac{\left(\frac{\omega_{zj}}{\omega_{pi}}\right)^2 \left(1 - \frac{1}{2Q_i^2}\right) - 1}{\left(\frac{\omega_{zj}}{\omega_{pi}}\right)^2 + \frac{1}{2Q_i^2} - 1} \right]^{1/2} \cdot \omega_{pi} \quad (3b)$$

$$\text{and } |h_{ij}|_{\max} = |h_{ij}|_{\omega=\omega_{mij}} \quad (3c)$$

Due to the nature of elliptic functions, the minimum value in the passband  $|h_{ij}|_{\min}$  occurs at the edge of the passband, viz., at  $\omega = 0$  or at  $\omega = 1$  depending on the value of the pole  $Q$ . In order to find the condition for  $Q_i$  such that  $|h_{ij}|_{\min}$  occurs at  $\omega = 0$  we impose  $|h_{ij}(0)| \geq |h_{ij}(1)|$  from which we obtained the condition

$$Q_i \geq \frac{\omega_{pi}}{(\omega_{zj}^2 - 1) \left[ \left(\frac{\omega_{pi}}{\omega_{zj}}\right)^4 - \left(\frac{\omega_{pi}^2 - 1}{\omega_{zj}^2 - 1}\right)^2 \right]^{1/2}} \equiv \alpha_{ij} \quad (4)$$

Thus, we have from (3a) and (4) that

$$|h_{ij}|_{\min} = \left(\frac{\omega_{zj}}{\omega_{pi}}\right)^2 \quad \text{if } Q_i \geq \alpha_{ij} \quad (5a)$$

and

$$|h_{ij}|_{\min} = \frac{\omega_{zj}^2 - 1}{[(\omega_{pi}^2 - 1)^2 + \left(\frac{\omega_{pi}}{Q_i}\right)^2]^{1/2}} \quad \text{otherwise} \quad (5b)$$

In order to find the optimum pole-zero pairing, let us define the flatness matrix  $F$  and its elements as follows. We will take the case of even  $n$  without lack of generality.

|                   |                    |                    |          |                              |      |
|-------------------|--------------------|--------------------|----------|------------------------------|------|
|                   | $z_1$              | $z_2$              | $\dots$  | $z_{\frac{n}{2}}$            |      |
| $p_1$             | $f_{11}$           | $f_{12}$           | $\dots$  | $f_{1\frac{n}{2}}$           | (6a) |
| $p_2$             | $f_{21}$           | $f_{22}$           | $\dots$  | $f_{2\frac{n}{2}}$           |      |
| $\vdots$          | $\vdots$           | $\vdots$           | $\vdots$ | $\vdots$                     |      |
| $p_{\frac{n}{2}}$ | $f_{\frac{n}{2}1}$ | $f_{\frac{n}{2}2}$ | $\dots$  | $f_{\frac{n}{2}\frac{n}{2}}$ |      |

$$F = \begin{bmatrix} f_{11} & f_{12} & \dots & f_{1\frac{n}{2}} \\ f_{21} & f_{22} & \dots & f_{2\frac{n}{2}} \\ \vdots & & & \vdots \\ f_{\frac{n}{2}1} & f_{\frac{n}{2}2} & \dots & f_{\frac{n}{2}\frac{n}{2}} \end{bmatrix} \quad (6b)$$

$$\text{where } f_{ij} = \frac{|h_{ij}|_{\min}}{|h_{ij}|_{\max}}, \quad |h_{ij}|_n(\omega) = \frac{|h_{ij}|(\omega)}{|h_{ij}|_{\max}}. \quad (6c)$$

As shown in Fig. 2 the normalized magnitude  $|h_{ij}|_n = |h_{ij}| / |h_{ij}|_{\max}$  is plotted for various  $Q_i$  for the typical cases of  $n=6$  and  $n=7$ . For illustrative purposes, the special case  $i=j$  was chosen.

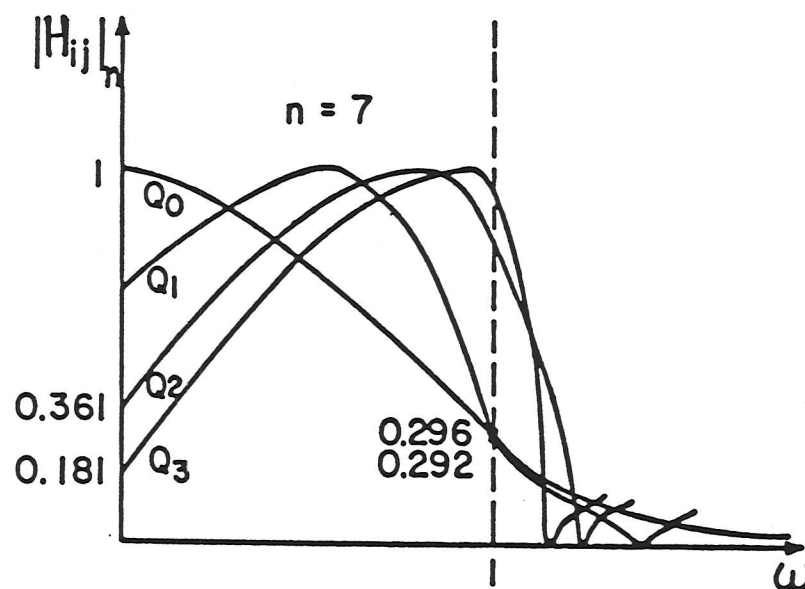
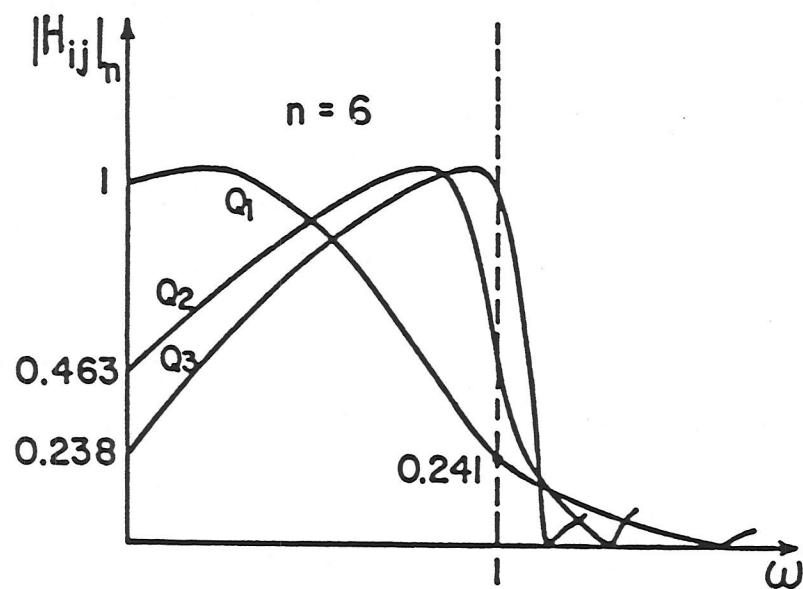


Figure 2. Plots of the normalized magnitude of low-pass notch sections.

Because the maximum value of  $h_{ij}^n$  is unity for each bi-quad and  $f_{ij}$  has its minimum in the passband such that  $0 < f_{ij} < 1$ , the elements in  $F$  are the direct indices of the flatness of all possible pole-zero pairings. The determinant of the  $F$  matrix is taken and expanded into  $\frac{n}{2}!$  terms with each term consisting of  $\frac{n}{2}$  elements. If the element of minimum value in the  $k$ th term is greater than the minimum elements of the  $(\frac{n}{2}! - 1)$  remaining terms, then the pole-zero pairings corresponding to the subscripts of the  $k$ th term yield maximum dynamic range.

Theorem 1:

Let the poles  $p_i$  be numbered beginning from the pole with lowest  $Q$  and let the zeros be numbered beginning from the farthest on the  $j\omega$  axis as shown in Fig. 1 (a), (b).

The optimum pole-zero pairing for the enhancement of the dynamic range coincides with the term consisting of the diagonal elements of the flatness matrix  $F$ . Thus the elliptic functions may be written as

$$H(s) = K \prod_{i=1}^{n/2} h_i \quad (s) = K \prod_{i=1}^{n/2} \frac{(s-z_i)(s-z_i^*)}{(s-p_i)(s-p_i^*)} \quad \text{for even } n \quad (7a)$$

$$H(s) = K h_o \prod_{i=1}^{\frac{n-1}{2}} h_i \quad (s) = K \frac{1}{s+\sigma} \prod_{i=1}^{\frac{n-1}{2}} \frac{(s-z_i)(s-z_i^*)}{(s-p_i)(s-p_i^*)} \quad \text{for odd } n \quad (7b)$$

Proof:

We first examine the functions of the highest Q pole pair,

i.e.,  $p_{\frac{n}{2}}$ .

Since  $Q_{\frac{n}{2}} > \alpha_{\frac{n}{2}}$ , we use (5a) to write:

$$\left| h_{\frac{n}{2}j} \right|_{\min} = (\omega_{zj} / \omega_{p_{\frac{n}{2}}})^2$$

$$\text{and } \left| h_{\frac{n}{2}j} \right|_{\max} = \frac{\omega_{zj}^2 \{1 - (\frac{\omega_m}{\omega_{zj}})^2\}}{\{(\omega_{p_{\frac{n}{2}}}^2 - \omega_m^2)^2 + (\frac{\omega_{p_{\frac{n}{2}}}}{Q_{\frac{n}{2}}} \omega_m)^2\}^{1/2}}$$

from (3b) we see, since  $Q_{\frac{n}{2}} \gg 1$ ,  $\omega_{m \frac{n}{2}} \approx \omega_{p_{\frac{n}{2}}}$ .

Noting that  $\omega_{p_{\frac{n}{2}}} \approx \omega_m \approx 1$ , we now obtain the flatness by

$$f_{\frac{n}{2}j} = \frac{\left| h_{\frac{n}{2}j} \right|_{\min}}{\left| h_{\frac{n}{2}j} \right|_{\max}} = \frac{1}{\{[1 - (\frac{1}{\omega_{zj}})^2] Q_{\frac{n}{2}}\}}$$

where  $\omega_{zj}$  is the closest to unity when  $j = \frac{n}{2}$ , thereby maximizing the flatness. Thus  $p_{\frac{n}{2}}$  should be paired with  $z_{\frac{n}{2}}$ .

A similar argument can be carried out for the remaining poles.

$$p_{\frac{n}{2}-1}, p_{\frac{n}{2}-2}, \dots, p_1.$$

End of proof.

The above theorem confirms the results previously obtained [1]. This development differs from Lueder in the sense that the F-matrix is introduced for the special case of elliptic filter functions. The simultaneous solution by dynamic programming is not applied to special functions such as the elliptic functions[5,6].

## Chapter III

## SEQUENCING NOTCH SECTIONS

## 3.1 Sequence of Low-Pass Notch Type Biquads

For cascading the biquads of low-pass notch type, there are  $\frac{n}{2}!$  possible sequences. The objective in this section is to find the particular sequence of the low-pass notch type biquads that yield a decreasing sequence of flatness from the filter input to the various successive outputs.

Let the  $i$ th biquad be denoted by  $h_i(s)$ . Implementing Theorem 1, we let  $j=i$  in (3) and (4) to rewrite.

$$|h_i|(\omega) = \frac{|\omega_{zi}^2 - \omega^2|}{\{(\omega_{pi}^2 - \omega^2)^2 + (\frac{\omega_{pi}}{Q_i})^2 \omega^2\}^{1/2}} \quad (8a)$$

$$\omega_{mi} = \left[ \frac{(\frac{\omega_{zi}}{\omega_{pi}})^2 (1 - \frac{1}{2Q_i^2}) - 1}{(\frac{\omega_{zi}}{\omega_{pi}})^2 + \frac{1}{2Q_i^2} - 1} \right]^{1/2} \cdot \omega_{pi} \quad (8b)$$

$$\alpha_i = \frac{\omega_{pi}}{(\omega_{zi}^2 - 1) \{ (\frac{\omega_{pi}}{\omega_{zi}})^4 - (\frac{\omega_{pi}^2 - 1}{\omega_{zi}^2 - 1})^2 \}^{1/2}} \quad (8c)$$

where  $\omega_{mi}$  is the frequency at which  $|h_i|$  becomes maximum, and  $\alpha_i$  is a criterion such that if  $Q_i \geq \alpha_i$ ,  $|h_i|_{\min}$  occurs at  $\omega = 0$ .



In order to develop a theorem for the cascading sequence of the notch type biquads, let us first assume that the order  $n$  is even, and further classify into two cases:

$$\text{Case (a)} \quad n = 4k \quad k = 1, 2, \dots$$

$$\text{Case (b)} \quad n = 4k - 2 \quad k = 1, 2, \dots$$

Theorem 2:

Let an elliptic function of even order  $n$  be expressed as the product of  $\frac{n}{2}$  biquads as

$$H(s) = K \prod_{i=1}^{\frac{n}{2}} h_i(s)$$

where the subscript is in the order of increasing  $Q$ .

The sequence of biquads for the optimum dynamic range in cascade realization is:

Case (a)

$$H(s) = K h_{\frac{n}{4}} \cdot h_{\frac{n}{4}+1} \cdot h_{\frac{n}{4}-1} \cdot h_{\frac{n}{4}+2} \cdot h_{\frac{n}{4}-2} \dots \quad (9a)$$

$$\text{for } n = 4k, k = 1, 2, \dots$$

and

Case (b)

$$H(s) = K h_{\frac{n+2}{4}} \cdot h_{\frac{n+2}{4}-1} \cdot h_{\frac{n+2}{4}+1} \cdot h_{\frac{n+2}{4}-2} \cdot h_{\frac{n+2}{4}+2} \dots \quad (9b)$$

$$\text{for } n = 4k - 2, k = 1, 2, \dots$$

Proof:

Due to the low-pass notch characteristic of the biquad, the maximum magnitude occurs in the passband, and the passband minimum occurs at the edges, viz., at  $\omega = 0$  or  $\omega = 1$ .

Let us now normalize the magnitude of each biquad as shown in Fig. 3 where  $Q_i$  of  $h_i(s)$  is such that

Case (a)

$$\underbrace{Q_1 < Q_2 \dots < Q_{\frac{n}{4}}}_{\text{first group}} < \underbrace{Q_{\frac{n}{4} + 1} < \dots < Q_{\frac{n}{2}}}_{\text{second group}} \quad (10)$$

and

$$0 < \frac{|h_i|}{|h_i|_{\max}} \leq 1 \text{ for } 0 \leq \omega \leq 1. \quad (11)$$

For  $Q_i \geq \alpha_i$  ( $i = \frac{n}{4} + 1, \dots, \frac{n}{2}$ ) the flatness  $f_i$  is determined by (14a) or closely approximated by (14b).

In (14b),  $(\omega_{pi}/\omega_{zi})$  is smaller than unity due to the low-pass notch characteristic and it decreases as  $i$  increases.

Furthermore since  $Q_i$  increases as  $i$  increases, it is obvious that the flatness  $f_i$  decreases as  $i$  increases.

For  $Q_i < \alpha_i$  ( $i = 1, 2, \dots, \frac{n}{4}$ ), we use (15) to show that the flatness increases with increasing  $Q$  as shown in Fig. 3 until the maximum flatness is attained with the  $Q_{\frac{n}{4}}$  which is located at the midpoint in (10).

For the optimal cascading sequence, therefore, we start with the biquad  $h_{\frac{n}{4}}$  corresponding to  $Q_{\frac{n}{4}}$  from the first group which yields the minimum value at  $\omega=1$ .

The next biquad in the cascade must be  $h_{\frac{n}{4}+1}$  corresponding to  $Q_{\frac{n}{4}+1}$  from the second group which produces the minimum at  $\omega = 0$ .

It can be shown that the magnitude  $\left| h_{\frac{n}{4}} \cdot h_{\frac{n}{4}+1} \right|$  is the flattest among the magnitudes of the product of any two biquads, and the minimum value occurs at  $\omega = 0$ .

This in turn necessitates the choice of the next closest biquad  $h_{\frac{n}{4}-1}$  from the first group as the third biquad in the cascade. This process of choosing the biquads based on the normalized magnitude of biquads versus pole  $Q$  completes the sequence as shown in (9a).

It should also be noted that the minimum of the magnitude of the product of any number of biquads occurs at the frequency where the last biquad in the chain becomes minimum. In Case (b), the midpoint  $Q$  is  $Q_{\frac{n+2}{4}}$ , and the corresponding biquad  $h_{\frac{n}{4}}$  yields the flattest magnitude. Furthermore, for  $Q \geq Q_{\frac{n+2}{4}}$ , all biquads produce minimum at  $\omega=0$  and for  $Q < Q_{\frac{n+2}{4}}$  at  $\omega = 1$ . We start with  $h_{\frac{n+2}{4}}$  and follow the same development as in Case (a) to produce the optimum sequence as given by (9b).

End of proof.

Replacing  $\omega$  in (8a) by  $\omega_{m1}$  of (8b) and carrying out a straight-forward operation, we derive the maximum magnitude  $|h_i|_{\max}$  explicitly in terms of the known parameters  $\omega_{z1}$ ,  $\omega_{p1}$  and  $Q_i$  as

$$|h_i|_{\max} = \left[ \left( \frac{\omega_{z1}}{\omega_{p1}} \right)^4 - \left( 2 - \frac{1}{4Q_i^2} \right) \left( \frac{\omega_{z1}}{\omega_{p1}} \right)^2 + 1 \right]^{\frac{1}{2}} \frac{Q_i}{\left( 1 - \frac{1}{4Q_i^2} \right)^{\frac{1}{2}}} \quad (12)$$

The minimum value  $|h_i|_{\min}$ , on the other hand, depends on the value of  $Q_i$  in comparison with threshold  $\alpha_i$  defined by (8c).

$$|h_i|_{\min} = |h_i(0)| = \left( \frac{\omega_{z1}}{\omega_{p1}} \right)^2 \quad \text{if } Q_i \geq \alpha_i \quad (13a)$$

or

$$|h_i|_{\min} = |h_i(1)| = \frac{\omega_{z1}^2 - 1}{\{ (\omega_{p1}^2 - 1)^2 + \left( \frac{\omega_{p1}}{Q_i} \right)^2 \}^{\frac{1}{2}}} \quad \text{otherwise} \quad (13b)$$

The flatness index is now obtained as

$$f_i = \frac{|h_i|_{\min}}{|h_i|_{\max}} = \frac{\left( 1 - \frac{1}{4Q_i^2} \right)^{\frac{1}{2}}}{\left[ 1 - \left( 2 - \frac{1}{4Q_i^2} \right) \left( \frac{\omega_{p1}}{\omega_{z1}} \right)^2 + \left( \frac{\omega_{p1}}{\omega_{z1}} \right)^4 \right]^{\frac{1}{2}} \cdot Q_i} \quad \text{for } Q_i \geq \alpha_i \quad (14a)$$

Since  $Q_i \gg 1$ , we may approximate  $f_i$  by

$$f_i = \frac{|h_i|_{\min}}{|h_i|_{\max}} = \frac{1}{\left\{ 1 - \left( \frac{\omega_{p1}}{\omega_{z1}} \right)^2 \right\} Q_i} \quad \text{for } Q_i \geq \alpha_i \quad (14b)$$

For  $Q_i < \alpha_i$  we use (12) and (13b) to write

$$f_i = \frac{(\omega_{zi}^2 - 1)(1 - \frac{1}{4Q_i^2})^{\frac{1}{2}}}{\{(\frac{\omega_{zi}}{\omega_{pi}})^4 - (2 - \frac{1}{4Q_i^2})(\frac{\omega_{zi}}{\omega_{pi}})^2 + 1\}^{\frac{1}{2}} \{(\omega_{pi}^2 - 1)^2 + (\frac{\omega_{pi}}{Q_i})^2\}^{\frac{1}{2}} Q_i} \quad (15)$$

When  $n = 10$ , for example, we write five biquads in the order of pole  $Q$ 's to find the cascading sequence as indicated by encircled numbers.

$$H(s) = K h_1(s) \cdot h_2(s) \cdot h_3(s) \cdot h_4(s) \cdot h_5(s)$$

4
2
1
3
5

← cascading sequence

For  $n = 12$ , we have

$$H(s) = K h_1(s) \cdot h_2(s) \cdot h_3(s) \cdot h_4(s) \cdot h_5(s) \cdot h_6(s)$$

5
3
1
2
4
6

When  $n$  is odd, the first order function  $h_0 = \frac{1}{s+\sigma}$  should be properly treated in relation to biquads. If we place  $h_0$  in front in the sequence as  $h_0 \cdot h_2 \cdot h_1 \cdot h_3$ , then the minimum of  $|h_2|$  occurs at  $\omega = 0$  while the minimum of the product

$|h_0 \cdot h_2|$  does not occur at  $\omega = 0$  but at  $\omega = 1$ .

Thus it contradicts the optimum sequencing method proposed in Theorem 2. On the other hand, if we place  $h_0$  as a last entry to the sequence as  $h_2 \cdot h_1 \cdot h_3 \cdot h_0$ , the procedure coincides exactly as presented in Theorem 2. This leads to the realization of the first order section at the last stage of the cascade.

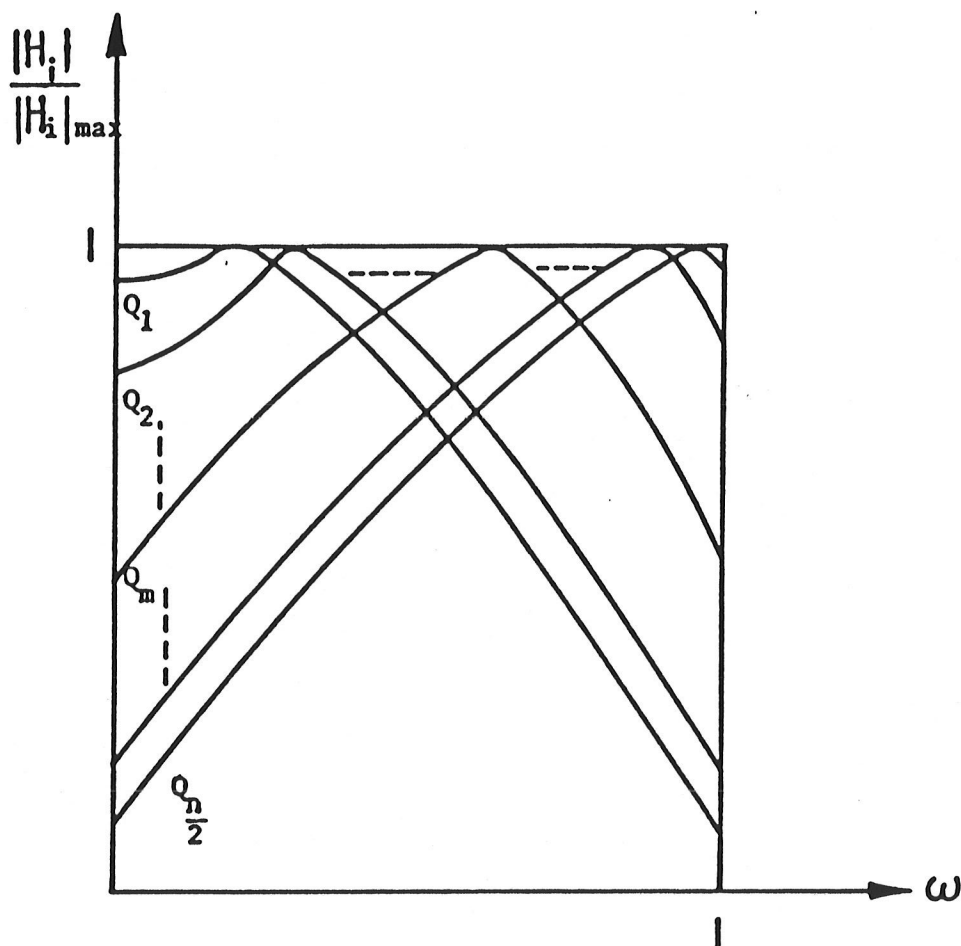


Figure 3. The normalized magnitude of the biquads in which  $Q_m$  corresponding to midpoint  $Q$  exhibits the highest flatness. In case (a)  $m = \frac{n}{4}$ , and in case (b)  $m = \frac{n+2}{4}$ .

### 3.2 Illustrative Example

#### Example 1

Find the pole-zero pairing, cascading sequence and the gain distribution for the optimum dynamic range realization of the elliptic function under the specification  $A_p(\text{dB})=1$ ,  $A_s(\text{dB})\geq 40$  and  $\omega_s=1.1$ .

From the standard table, we find  $n=6$  which yields the pole-zero locations as shown in Fig. 1 (a).

For the purpose of confirmation, let us construct the F matrix.

|                                                 | $z_1$<br>j2.970935 | $z_2$<br>j1.309230 | $z_3$<br>j1.115061 |
|-------------------------------------------------|--------------------|--------------------|--------------------|
| $P_1$<br>-.315089+j.409244<br>( $Q_1=0.8195$ )  | $f_{11}$<br>.2433  | $f_{12}$<br>.1171  | $f_{13}$<br>.0610  |
| $P_2$<br>-.118730+j.874514<br>( $Q_2=3.7165$ )  | $f_{21}$<br>.2913  | $f_{22}$<br>.4821  | $f_{23}$<br>.3105  |
| $P_3$<br>-.023927+j.999416<br>( $Q_3=20.8908$ ) | $f_{31}$<br>.0540  | $f_{32}$<br>.1143  | $f_{33}$<br>.2425  |

The determinant of the above matrix consists of six terms, viz.,  $f_{11} \cdot f_{22} \cdot f_{33}$ ,  $f_{13} \cdot f_{21} \cdot f_{32}$ ,  $f_{12} \cdot f_{23} \cdot f_{31}$ ,  $f_{13} \cdot f_{22} \cdot f_{31}$ ,  $f_{11} \cdot f_{23} \cdot f_{32}$  and  $f_{12} \cdot f_{21} \cdot f_{33}$  where  $f_{ij}$  is computed by (6c), (3c), and (5).

The minimum elements in each of the six terms are  $f_{33} = .2425$ ,  $f_{13} = .0610$ ,  $f_{31} = .0540$ ,  $f_{32} = .1143$  and  $f_{12} = .1171$ . The largest among the six elements is  $f_{33}$  and therefore, we take the term containing  $f_{33}$ , i.e.,  $f_{11} \cdot f_{22} \cdot f_{33}$ .

Subsequently the three biquads are identified as

$$h_1(s) = \frac{(s-z_1)(s-z_1^*)}{(s-p_1)(s-p_1^*)} = \frac{(s^2+8.826455)}{(s^2+0.630179 \ s+0.266762)}$$

$$h_2(s) = \frac{(s-z_2)(s-z_2^*)}{(s-p_2)(s-p_2^*)} = \frac{(s^2+1.714083)}{(s^2+0.237461 \ s+0.778873)}$$

$$h_3(s) = \frac{(s-z_3)(s-z_3^*)}{(s-p_3)(s-p_3^*)} = \frac{(s^2+1.243362)}{(s^2+0.047854 \ s+0.999404)}$$

The normalized magnitude of each biquad is plotted in Fig. 2a. Using Theorem 2, we take the first three biquads of (9b) in the following sequence.

$$\frac{V_2}{V_1} = H(s) = K h_2(s) \cdot h_1(s) \cdot h_3(s).$$

In order to further enhance the dynamic range, we may distribute the gain  $K$  to individual biquads as

$$H(s) = k_2 h_2(s) \cdot k_1 h_1(s) \cdot k_3 h_3(s).$$



The optimum gain distribution among the three biquad sections of the cascade will be performed so as to yield equal magnitude maxima at the output of all intermediate transfer functions.

Assuming  $\max |H(j\omega)| = 1$  and therefore,  $|H(j0)| = 0.891251$ , we obtain  $K = 0.0098$ .

To make the maximum of the first stage equal to the maximum of the overall network, we determine

$$k_2 = \frac{\max |H(j\omega)|}{\max |h_2(j\omega)|} = 0.210712$$

$$k_1 = \frac{\max |H(j\omega)|}{\max |k_2 h_2(j\omega) h_1(j\omega)|} = \frac{k_2 \max |h_2(j\omega)|}{k_2 \max |h_2(j\omega) h_1(j\omega)|} = 0.060907$$

$$k_3 = \frac{K}{k_2 k_1} = 0.762437$$

Another approach is possible that takes the sensitivity into consideration. By selecting a pair of zeros as far apart as possible from a pair of poles, it has been shown that the function sensitivity  $S_{x_i}^{h_i(s)}$  can be reduced [8].

Subsequently, the dynamic range will be maximized through the optimum sequencing of individual biquads and the gain distribution. It can be shown that the optimum sequencing remains the same in spite of the different pole-zero pairing adopted in the second approach.

**Example 2.**

Realize the elliptic filter of the same specifications as in Example 1. Poles and zeros are to be paired to minimize the function sensitivity, and the biquad notch functions are to be sequenced so as to render the maximum dynamic range. The pole of the highest Q will be paired with the farthest zero to generate biquads different from (16).

$$h_1(s) = \frac{s^2 + 1.243362}{s^2 + 0.630179s + 2.66762}$$

$$h_2(s) = \frac{s^2 + 1.714083}{s^2 + 0.237461s + 0.778873} \quad (17a)$$

$$h_3(s) = \frac{s^2 + 8.826455}{s^2 + 0.047854s + 0.999404}$$

The sequencing of biquads for optimum dynamic range is conducted to produce the same result as in Example 1.

$$H(s) = k_2 h_2(s) \cdot k_1 h_1(s) \cdot k_3 h_3(s) \quad (17b)$$

The gain distribution is carried out to further enhance the dynamic range of the whole network.

(17c)

$$k_2 = 0.210712 \quad k_1 = 0.459223 \quad k_3 = 0.101123$$

A recently proposed active circuit [4] using three operational amplifiers has been employed to realize each low-pass notch section in (17).

The cascaded circuit and its magnitude characteristic are shown in Fig. 4 (a), (b), respectively. It has been observed that other possible sequences considerably diminish the dynamic range. The cutoff frequency is denormalized to 1,000 Hz. Element values are listed below. Raytheon RC4156DC type operational amplifiers are used.

|                           |                           |                            |
|---------------------------|---------------------------|----------------------------|
| $C_1=C_2=0.02\mu\text{F}$ | $C_3=C_4=0.02\mu\text{F}$ | $C_5=C_6=9.88\text{nF}$    |
| $R_1=33,512\ (\Omega)$    | $R_9=12,628\ (\Omega)$    | $R_{17}=336,624\ (\Omega)$ |
| $R_2=R_3=9,017$           | $R_{10}=R_{11}=15,407$    | $R_{18}=R_{19}=16,114$     |
| $R_4=159,041$             | $R_{12}=27,498$           | $R_{20}=3,328,856$         |
| $R_5=43,793$              | $R_{13}=33,551$           | $R_{21}=159,347$           |
| $R_6=19,445$              | $R_{14}=7,198$            | $R_{22}=18,043$            |
| $R_7=R_8=9,017$           | $R_{15}=R_{16}=15,407$    | $R_{23}=R_{24}=16,114$     |

All resistance values are in ohms.

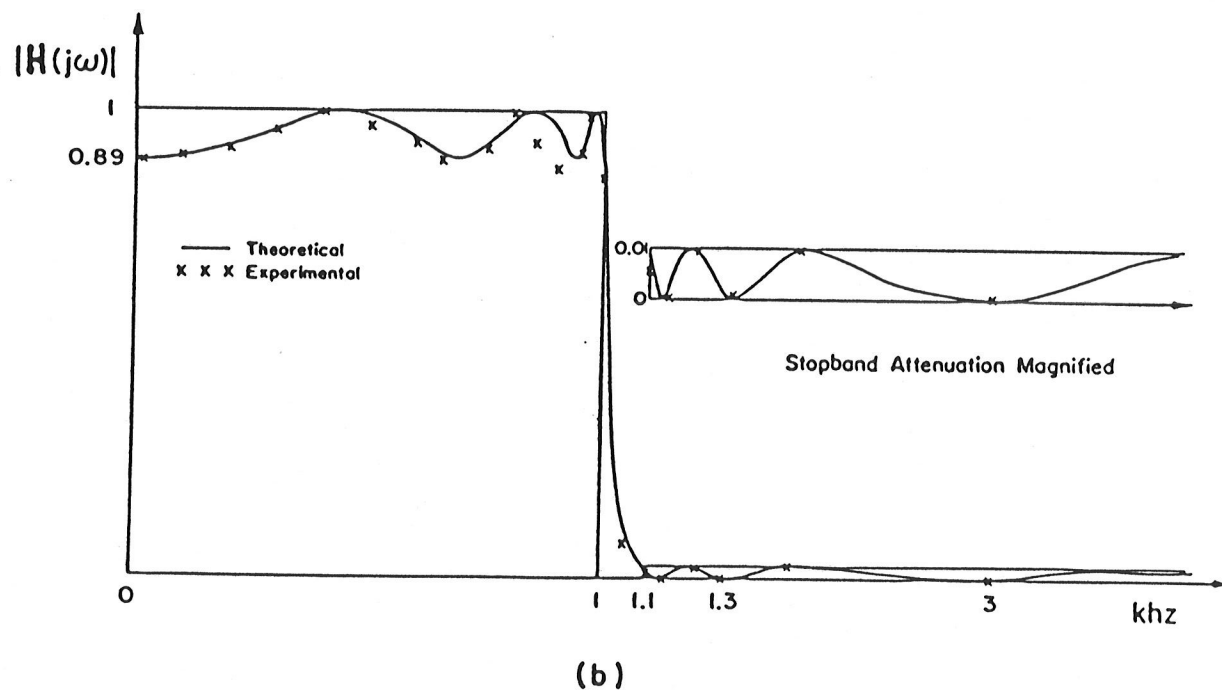
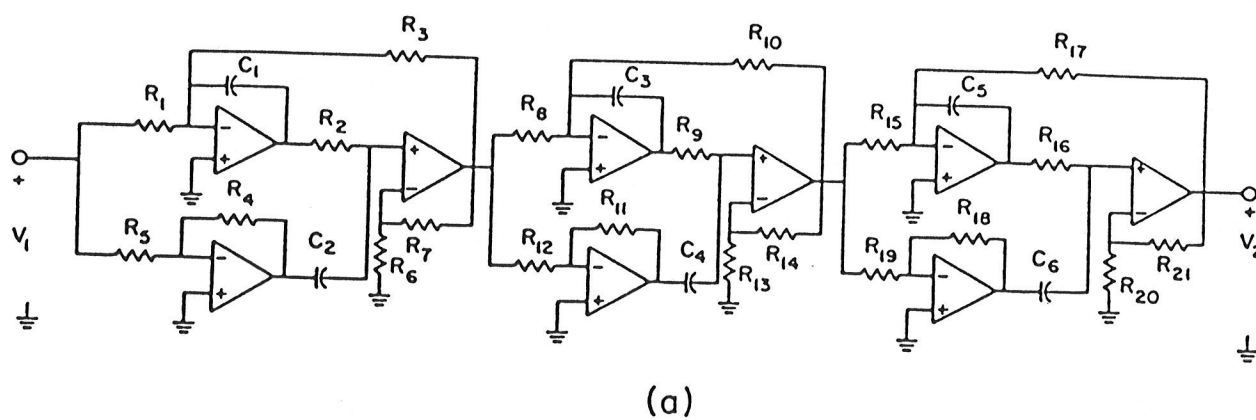


Figure 4. (a) Active Realization of the 6th Order Elliptic Filter of Example 2,  
(b) Magnitude Characteristics.

### 3.3 Other Types of Elliptic Functions

#### A. High-pass Type Elliptic Functions

High-pass type elliptic functions are obtained from the low-pass function through the frequency transformation  $s \rightarrow \frac{1}{s}$ . As a consequence, the passband and the stopband are interchanged. The pole-zero pattern is illustrated in Fig. 5b. The pole-zero pairing for a biquad is

$$h'_1 = \frac{(s - z'_1)(s - z'^*_1)}{(s - p'_1)(s - p'^*_1)} \quad (18)$$

Where  $|z'_1| < |p'_1|$  which gives the high-pass notch characteristic. Thus the development analogous to the case of low-pass type yields the following sequence.

$$H(s) = Kh'_{\frac{n}{4}} \cdot h'_{\frac{n}{4}+1} \cdot h'_{\frac{n}{4}-1} \cdot h'_{\frac{n}{4}+2} \cdot h'_{\frac{n}{4}-2} \dots \quad (19a)$$

for case (a)

$$H(s) = Kh'_{\frac{n+4}{4}} \cdot h'_{\frac{n+2}{4}-1} \cdot h'_{\frac{n+2}{4}+1} \cdot h'_{\frac{n+2}{4}-2} \cdot h'_{\frac{n+2}{4}+2} \dots \quad (19b)$$

for case (b)

#### B. Band-pass Type Elliptic functions

As a consequence of the transformation  $s \rightarrow \frac{s^2 + \omega_0^2}{BWs}$ , where  $\omega_0$  is the center frequency and BW is the band-width, we have the pole-zero location as shown in Fig. 5c as illustrated for  $n = 12$ .

The upper half from the horizontal line intersecting  $\omega_0 = 1$  is similar to the pole-zero pattern of the low-pass function and the lower half, to the pole-zero pattern of the high-pass function. Corresponding to each  $p'_i$  of a low-pass notch function, there exists the  $p'_i$  of the identical  $Q$  for a high-pass notch function. The pole-zero pairing, therefore, should be conducted as shown below.

$$h_i = \frac{(s-z_i)(s-z_i^*)}{(s-p_i)(s-p_i^*)} \quad \text{for low-pass notch section of } Q_i \quad (20a)$$

$$h'_i = \frac{(s-z'_i)(s-z'^*_i)}{(s-p'_i)(s-p'^*_i)} \quad \text{for high-pass notch section of identical } Q_i \quad (20b)$$

For optimal sequencing,  $h'_i$  should accompany  $h_i$  so that a pair of biquads, one of low-pass notch and the other of high-pass notch, form a subsection in the cascade.

$$H(s) = K \left[ h_{\frac{n}{4}} \cdot h'_{\frac{n}{4}} \right] \left[ h_{\frac{n}{4}+1} \cdot h'_{\frac{n}{4}+1} \right] \left[ h_{\frac{n}{4}-1} \cdot h'_{\frac{n}{4}-1} \right] \dots \quad (21a)$$

for case (a)

$$H(s) = K \left[ h_{\frac{n+2}{4}} \cdot h'_{\frac{n+2}{4}} \right] \left[ h_{\frac{n+2}{4}-1} \cdot h'_{\frac{n+2}{4}-1} \right] \left[ h_{\frac{n+2}{4}+1} \cdot h'_{\frac{n+2}{4}+1} \right] \dots \quad (21b)$$

for case (b)

### C. Band-stop Type Elliptic Functions

As a consequence of the transformation  $s \rightarrow \frac{BW s}{s^2 + \omega_0^2}$ ,

which is the inverse of the band-pass case, we have the pole-zero pattern as shown in Fig. 5d. By using the analogy, we can develop the technique which results in a pairing and sequencing similar to (21) but the place of the low-pass notch function and the high-pass notch function is reversed.

$$H(s) = K \begin{bmatrix} h'_{\frac{n}{4}} & h_{\frac{n}{4}} \end{bmatrix} \begin{bmatrix} h'_{\frac{n}{4}+1} & h_{\frac{n}{4}+1} \end{bmatrix} \begin{bmatrix} h'_{\frac{n}{4}-1} & h_{\frac{n}{4}-1} \end{bmatrix} \dots \quad (22a)$$

for case (a)

$$H(s) = K \begin{bmatrix} h'_{\frac{n+2}{4}} & h_{\frac{n+2}{4}} \end{bmatrix} \begin{bmatrix} h'_{\frac{n+2}{4}-1} & h_{\frac{n+2}{4}-1} \end{bmatrix} \begin{bmatrix} h'_{\frac{n+2}{4}+1} & h_{\frac{n+2}{4}+1} \end{bmatrix} \dots \quad (22b)$$

for case (b)

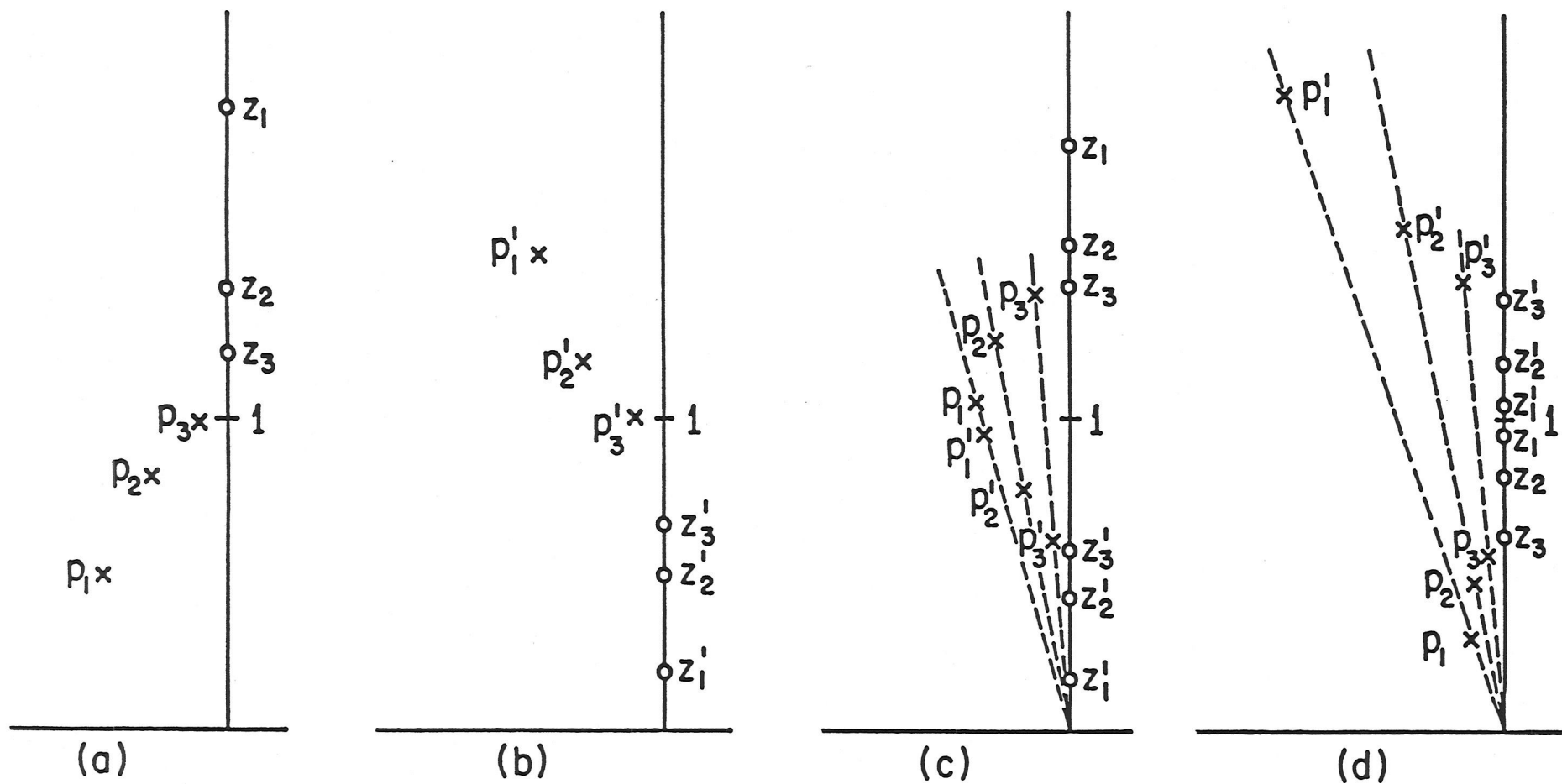


Figure 5. Schematic pole-zero location.  
 (a) Elliptic low-pass function of order 6,  
 (b) Elliptic high-pass function of order 6,  
 (c) Elliptic band-pass function of order 12,  
 (d) Elliptic band-stop function of order 12.



## Chapter IV

## PHASE AND TIME DOMAIN CHARACTERISTICS

For convenience, the elliptic transfer functions may be written as

$$H(s) = K \prod_{i=1}^{n/2} \frac{s^2 + c_i}{s^2 + a_i s + b_i} \quad n: \text{ even} \quad (23a)$$

$$H(s) = \frac{K}{s + c_0} \prod_{i=1}^{(n-1)/2} \frac{s^2 + c_i}{s^2 + a_i s + b_i} \quad n: \text{ odd} \quad (23b)$$

The typical pole-zero locations and the magnitude characteristics are illustrated in Fig. 1 for  $n=6$  and  $n=7$ , respectively.

As shown in Fig. 1(c) and (d), the stopband frequency  $\omega_s$  is the frequency where stopband begins. This parameter is used in this thesis instead of a modular angle  $\theta$  so that we may assign appropriate values for  $\omega_s$ .

$$\theta = \sin^{-1} \frac{1}{\omega_s} \quad (24)$$

Furthermore the passband ripple  $A_p$  (dB) =  $-20 \log A_p$  will be specified instead of the reflection coefficient  $\rho$ .

$$A_p \text{ (dB)} = -10 \log[1 - (\frac{\rho}{100})^2] \quad (25)$$

There are tables in the Appendix I from which we can find the order of the filter function for given passband ripples

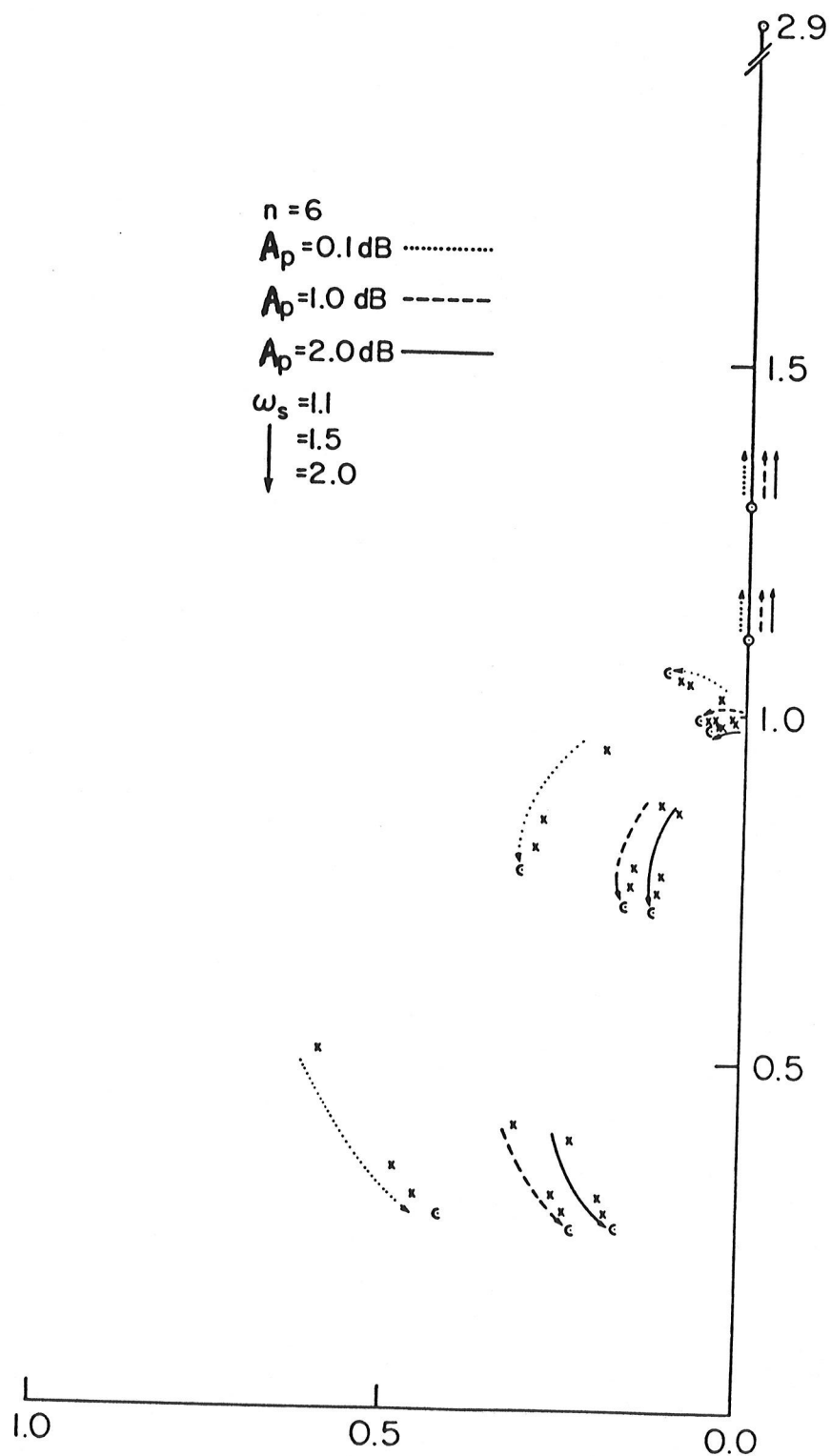


Fig. 6. Pole - zero shifting due to variable stopband frequency  $\omega_s$  and passband ripple  $A_p$ : (a)  $n=6$ .

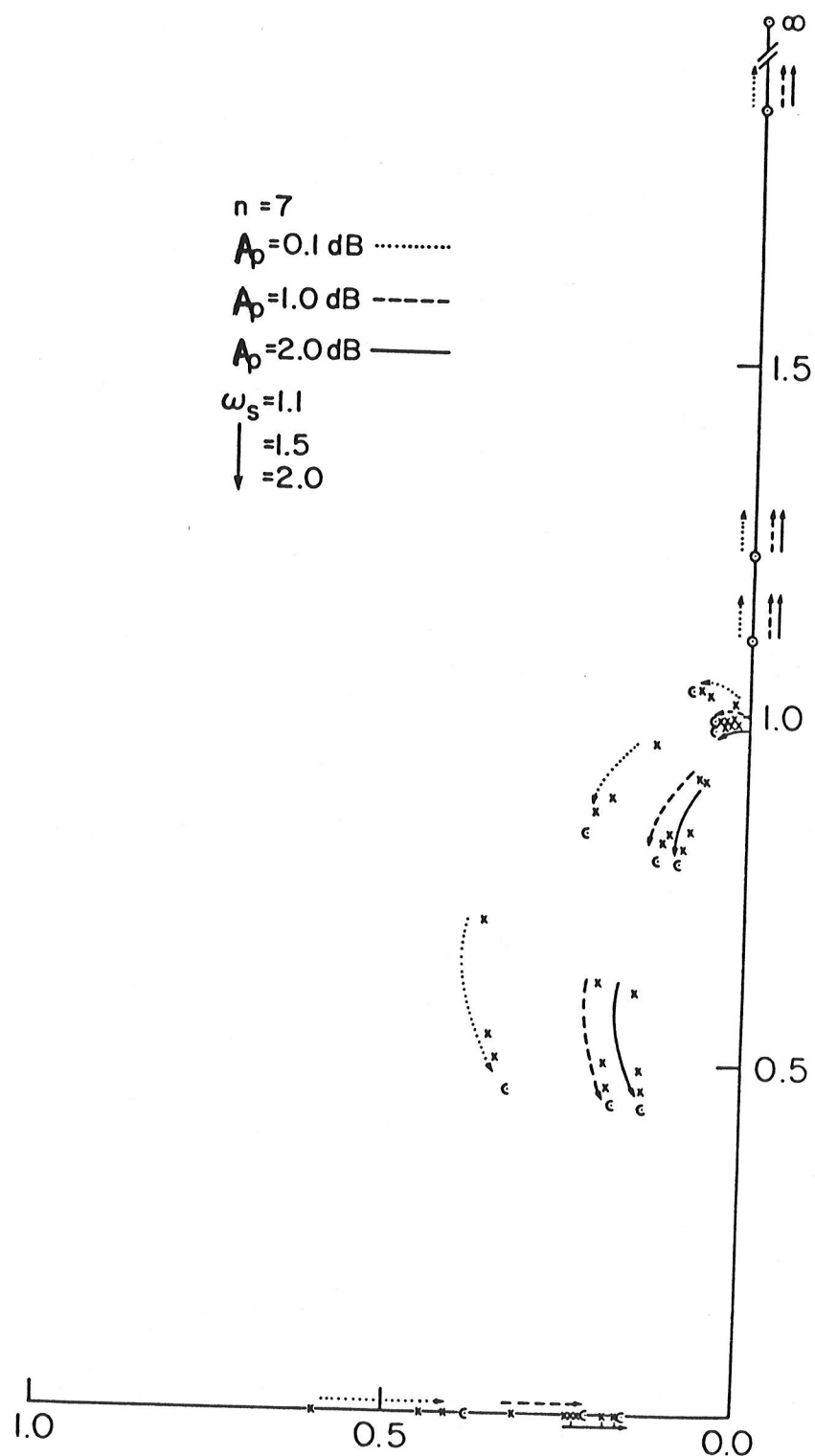


Fig. 6. Pole - zero shifting due to variable stopband frequency  $\omega_s$  and passband ripple  $A_p$ : (b)  $n=7$ .

$A_p$  (dB), stopband attenuation  $A_s$  (dB) and the stopband frequency  $\omega_s$ . For a given passband ripple  $A_p$  and the order  $n$ , the stopband attenuation  $A_s$  becomes larger as  $\omega_s$  assumes larger values. In this thesis, we assign  $\omega_s = 1.1, 2.0$  to observe the way poles and zeros shift in the complex s-plane.

As shown in Fig 6, the pole-Q decreases as  $\omega_s$  increases and the pole location converges to Chebyshev point C. On the other hand, as  $A_p$  increases, poles shift toward the  $j\omega$ -axis inducing higher Q's. The pole on the negative real axis shifts nearer the origin and transmission zeros on the  $j\omega$ -axis, on the other hand, move further away from the origin. Their locations are independent of  $A_p$  values.

#### 4.1 Phase and Group Delay

Since all the zeros are greater than unity (cutoff frequency) and are located on the  $j\omega$ -axis, they do not affect the passband phase characteristic of the elliptic filters. Using (23), the phase is computed as follows.

$$\Phi(\omega) = - \sum_{i=1}^{n/2} \tan^{-1} \frac{a_i \omega}{b_i - \omega^2} + \sum 180^\circ \Big|_{\omega \geq \sqrt{c_i}} \quad (26a)$$

$n : \text{even}$

$$\Phi(\omega) = -\tan^{-1} \frac{\omega}{\sigma_0} - \sum_{i=1}^{(n-1)/2} \tan^{-1} \frac{a_i \omega}{b_i - \omega^2} + \sum 180^\circ \Big|_{\omega \geq \sqrt{c_i}} \quad (26b)$$

$n : \text{odd}$

At every frequency greater than  $j\sqrt{c_i}$  in (23), the phase will be reduced by  $180^\circ$  due to the numerator of (23).

In the passband the phase linearity improves as  $\omega_s$  increases and eventually it approaches that of Chebyshev filter. As seen in Fig. 6 phase linearity improves with increasing  $\omega_s$  due to lower  $Q$  values. Smaller  $A_p$  improves phase linearity for similar reasons. In Fig. 7 and Fig. 8, the phase characteristics are drawn for  $\omega_s = 1.1, 2.0$  and for passband ripples of  $A_p = 0.1$  and  $A_p = 1.0$ .

For even order function, passive ladder realization does not exist. The need for transformers may be eliminated by modifying the function so that the function vanishes at  $s = \infty$ . The order of the numerator is  $(n-2)$  while that of the denominator is  $n$ . There are two kinds of possible transformations: one having a dent at  $s=0$  and the other having no attenuation at  $s=0$ . The former is classified as Case B and the latter as Case C. For comparison, the original even function is called Case A. These three cases are shown in Fig. 9 for  $n=4$  including the locations of the highest  $Q$  pole. Case A is the closest to the  $j\omega$ -axis, Case B and C follow in that order. Phase characteristics of Cases A, B and C are plotted in Fig. 10 for  $n=4$  and  $n=6$ .

Phases of Case A and Case B are almost identical and the linearity improves in Case C due to lower  $Q$  values. Group-delay characteristics are obtained by differentiating (26) with respect to  $\omega$ . They are plotted in Fig. 11 and Fig. 12. As confirmed by the phase curves, the flatness of the group-delay improves for larger  $\omega_s$ , smaller  $A_p$

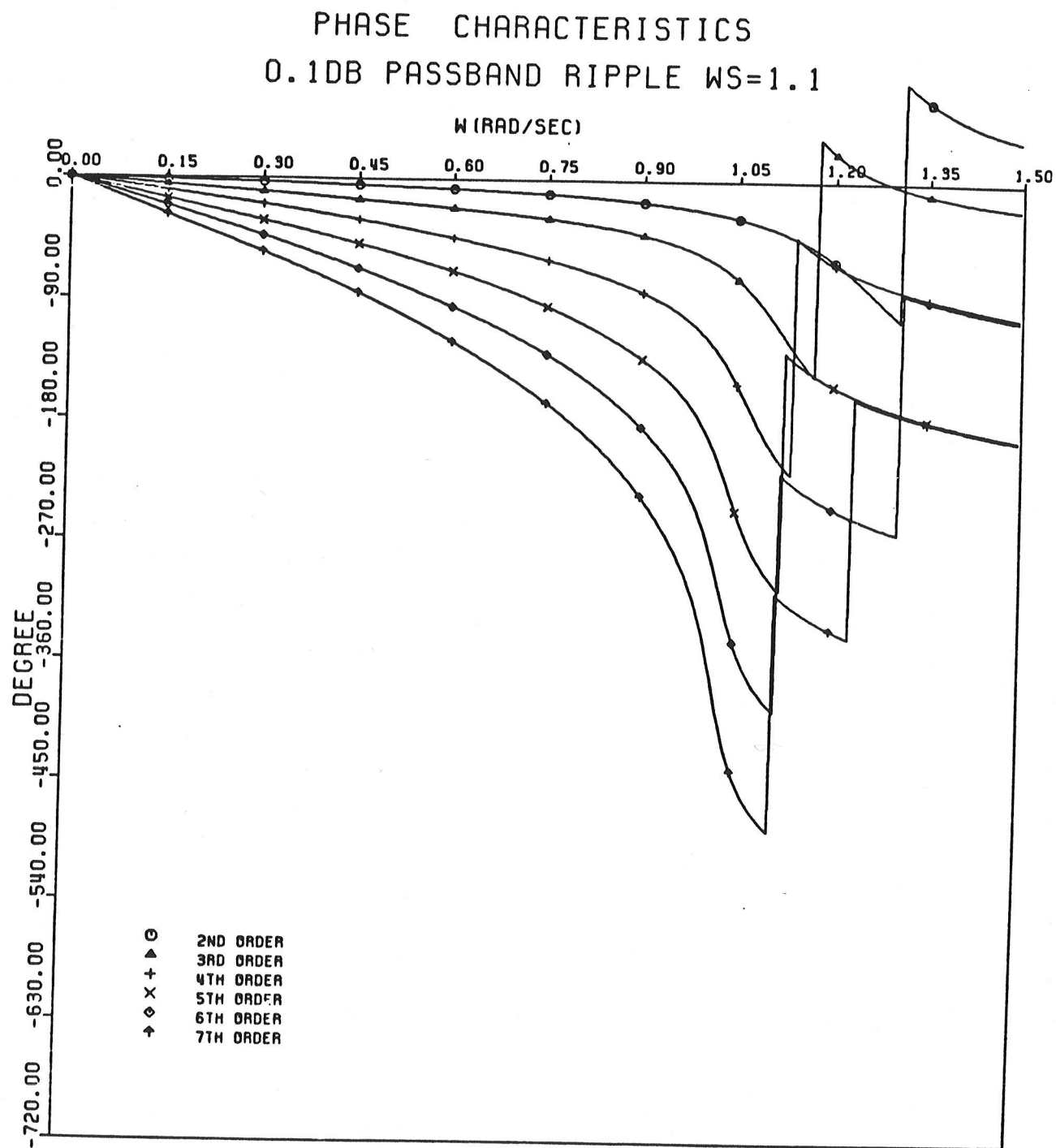


Fig. 7. Phase characteristics for  $A_p = 0.1$ :

(a)  $\omega_s = 1.1$ .

# PHASE CHARACTERISTICS 0.1DB PASSBAND RIPPLE $\omega_s=2.0$

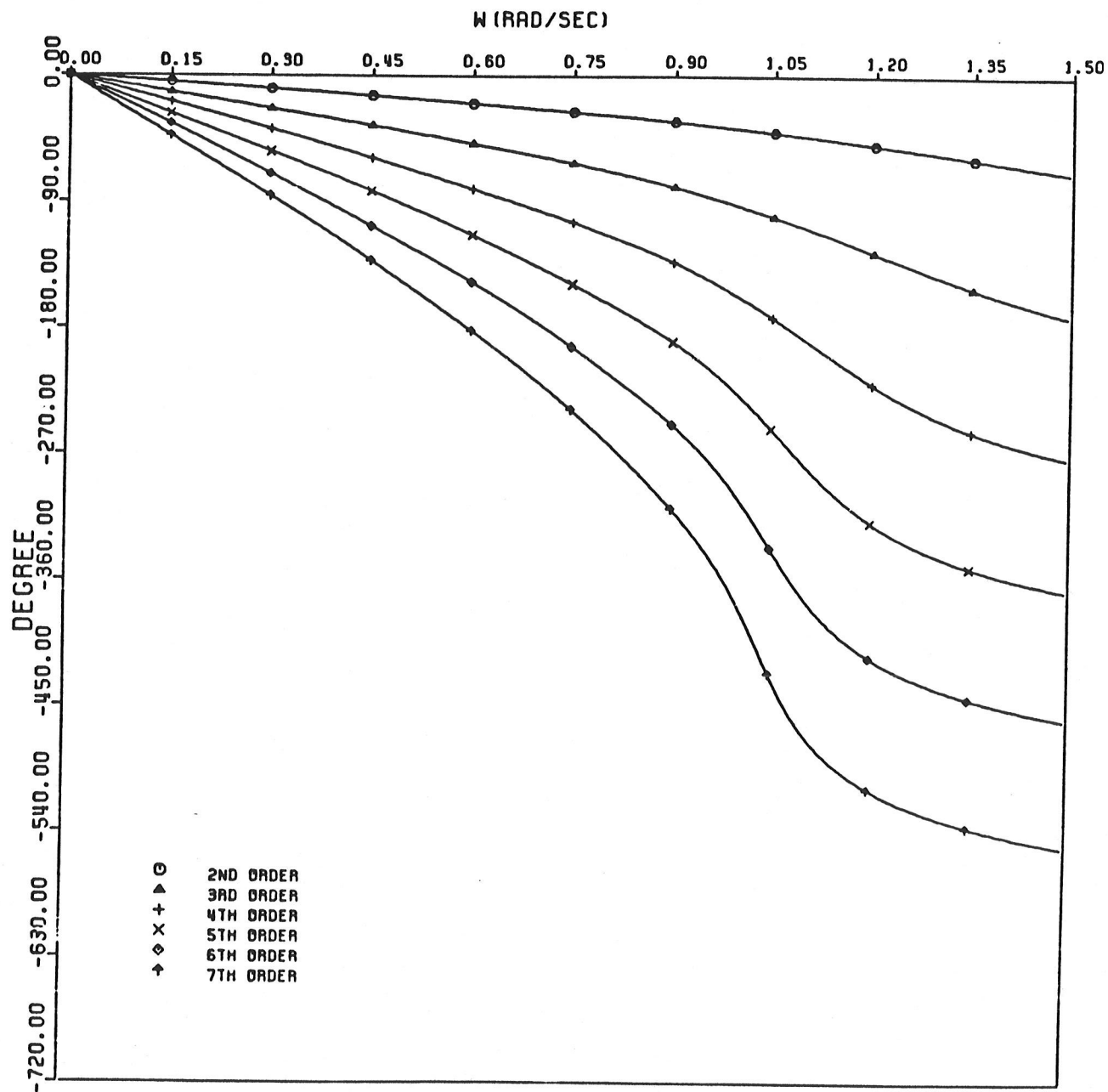


Fig. 7. Phase characteristics for  $A_p = 0.1$ :

(b)  $\omega_s = 2.0$ .

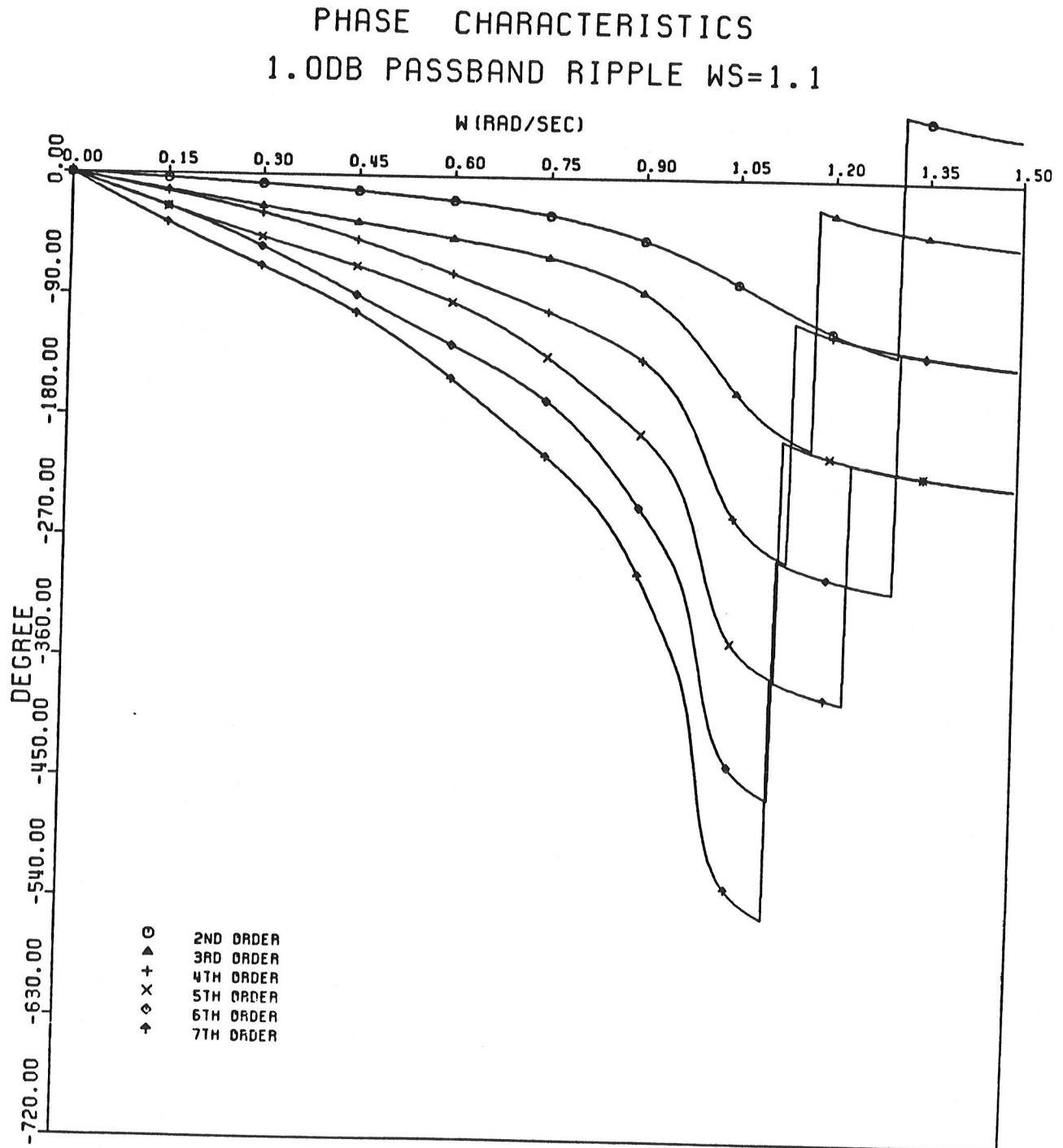


Fig. 8. Phase characteristics for  $A_p = 1.0$ :

(a)  $\omega_s = 1.1$ .



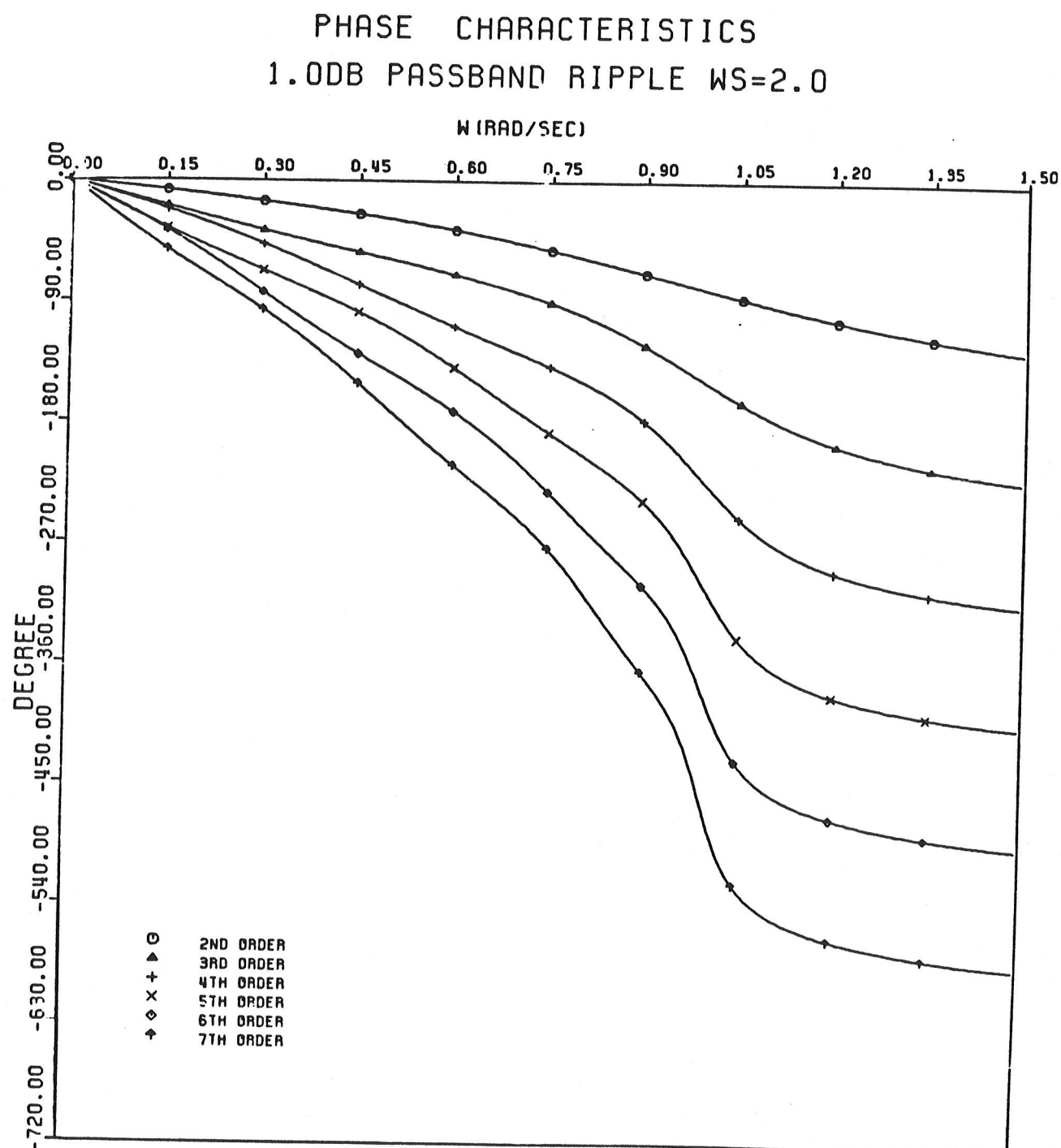
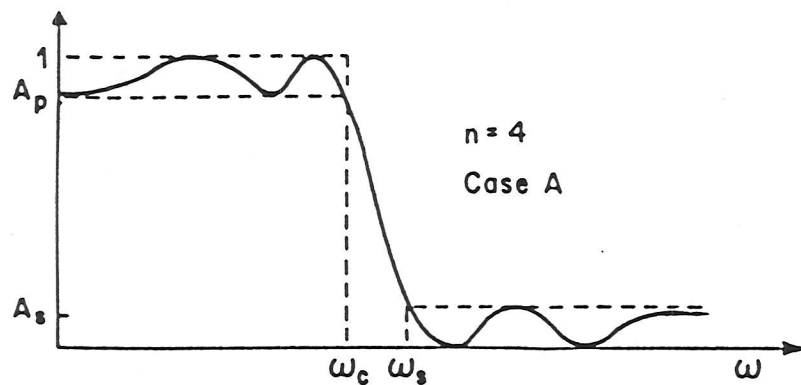
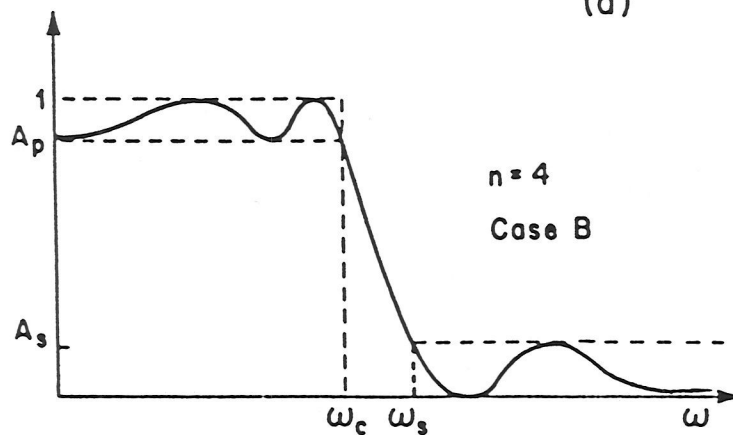


Fig. 8. Phase characteristics for  $A_p = 1.0$ :

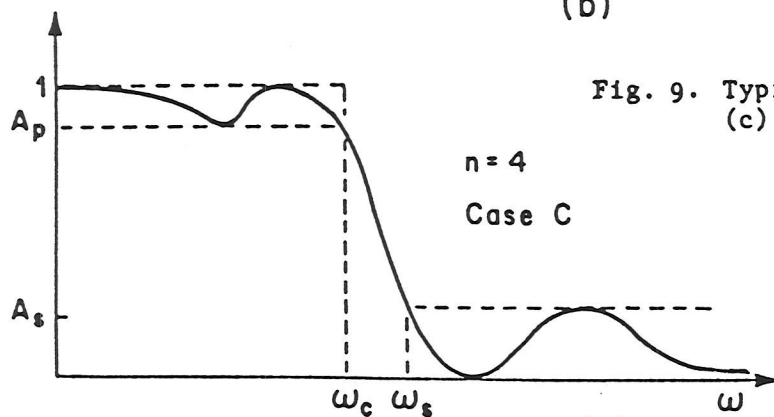
(b)  $\omega_s = 2.0$ .



(a)



(b)



(c)

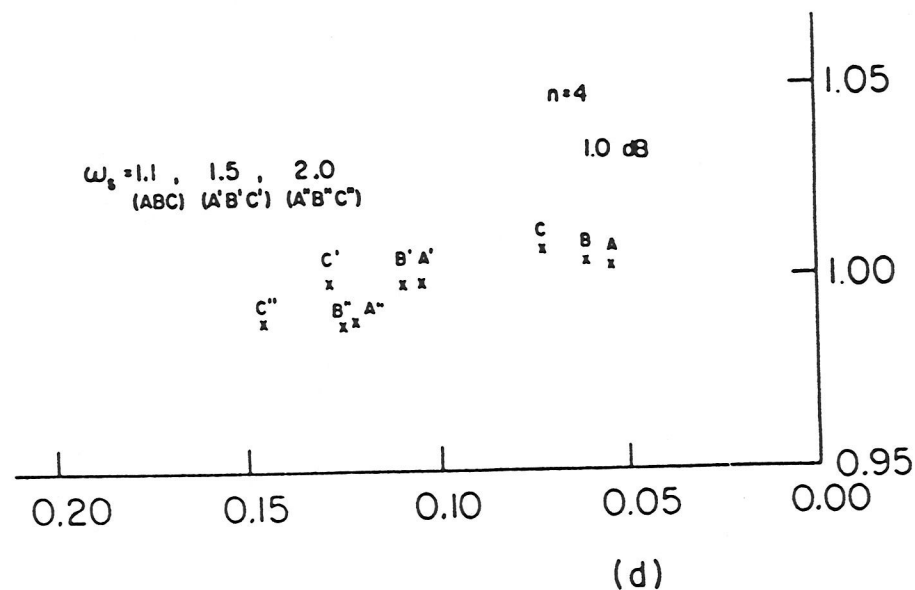


Fig. 9. Typical magnitude characteristics of: (a) Case A, (b) Case B, (c) Case C and (d) high-Q pole shifting.

# PHASE CHARACTERISTICS 1.0DB PASSBAND RIPPLE WS=1.1

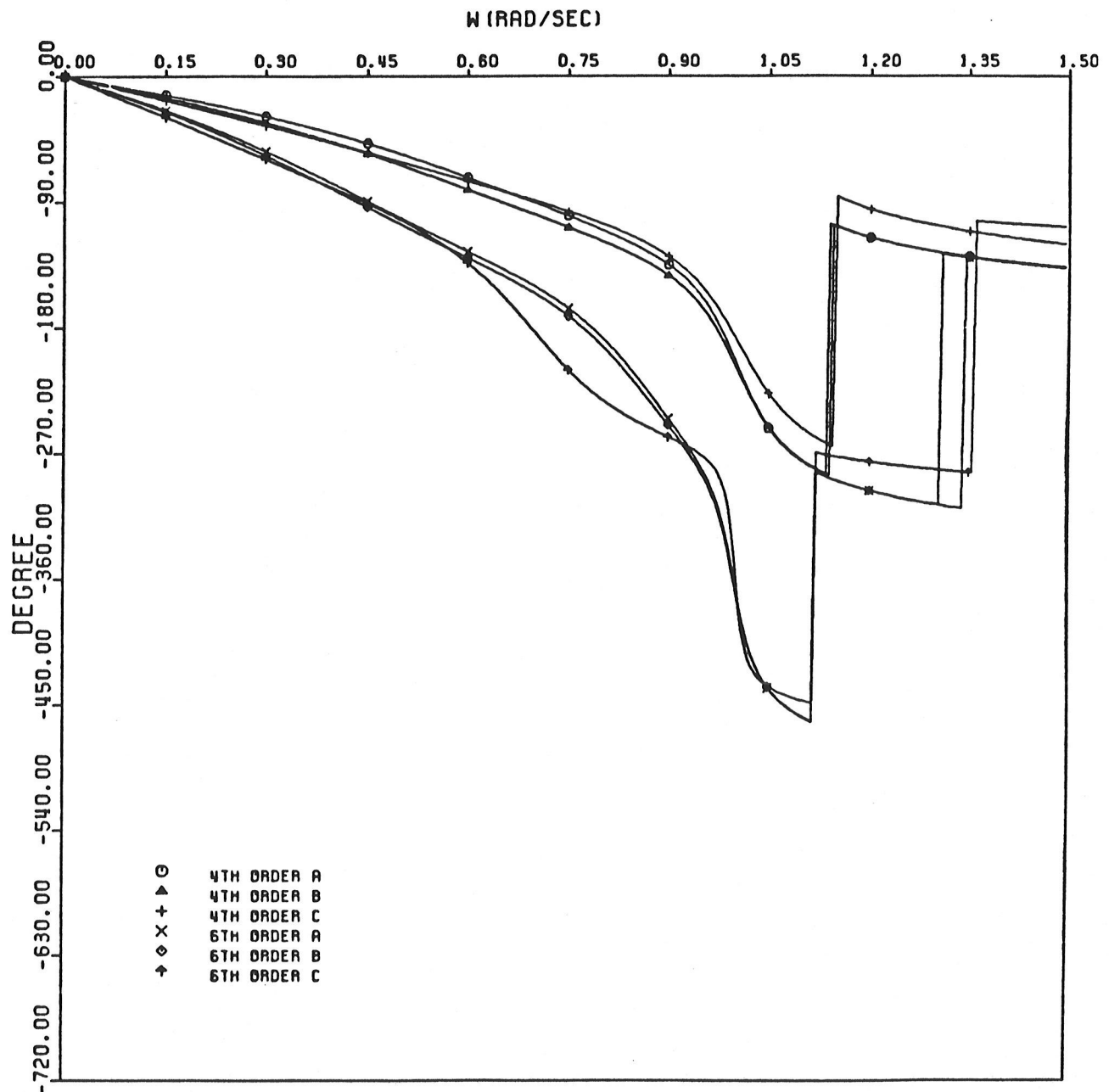


Fig. 10. Phase comparison of Cases A, B, C for  $A_p = 1.0$ :

(a)  $\omega_s = 1.1$ .

# PHASE CHARACTERISTICS 1.0DB PASSBAND RIPPLE $\omega_s=2.0$

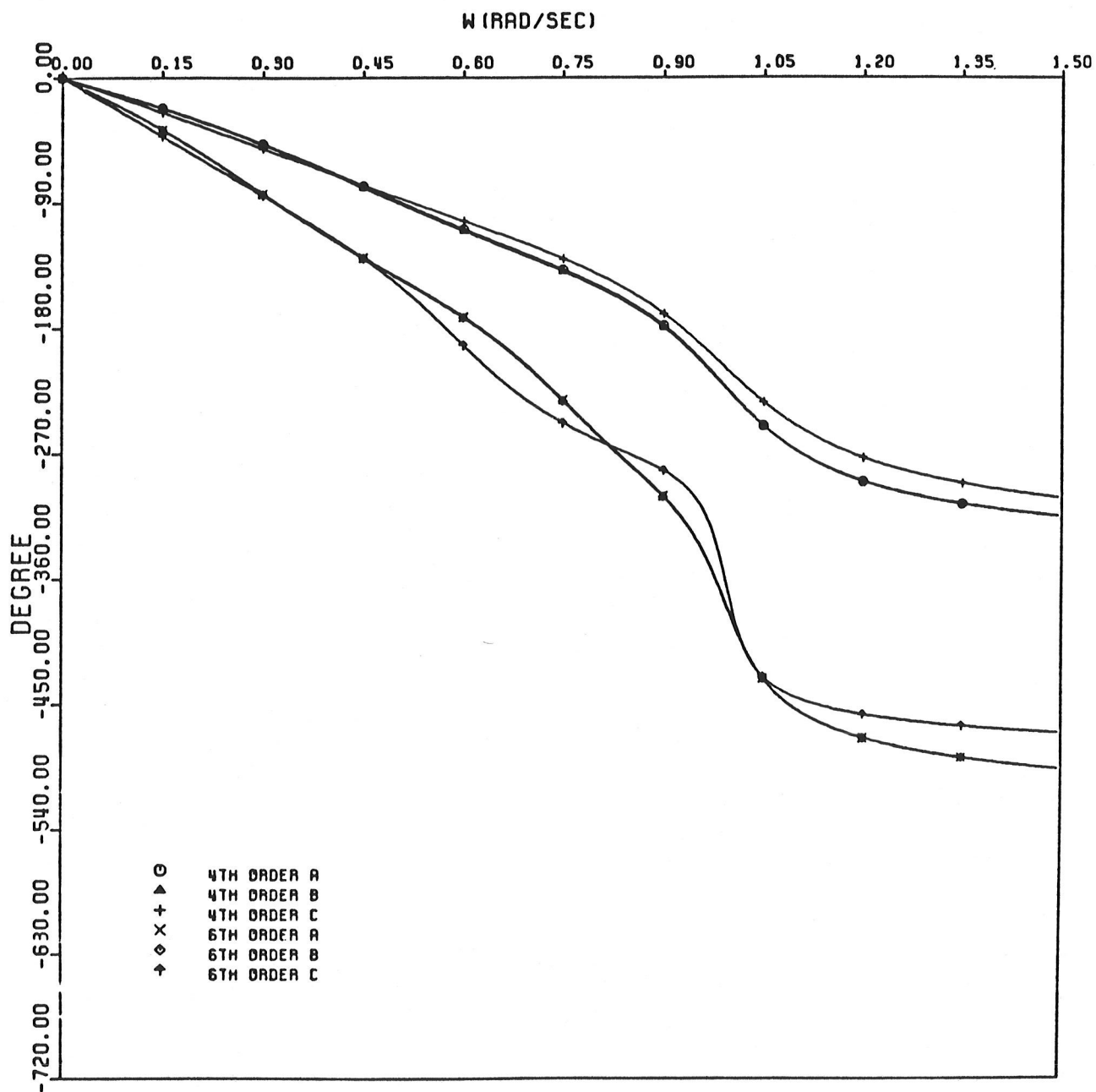
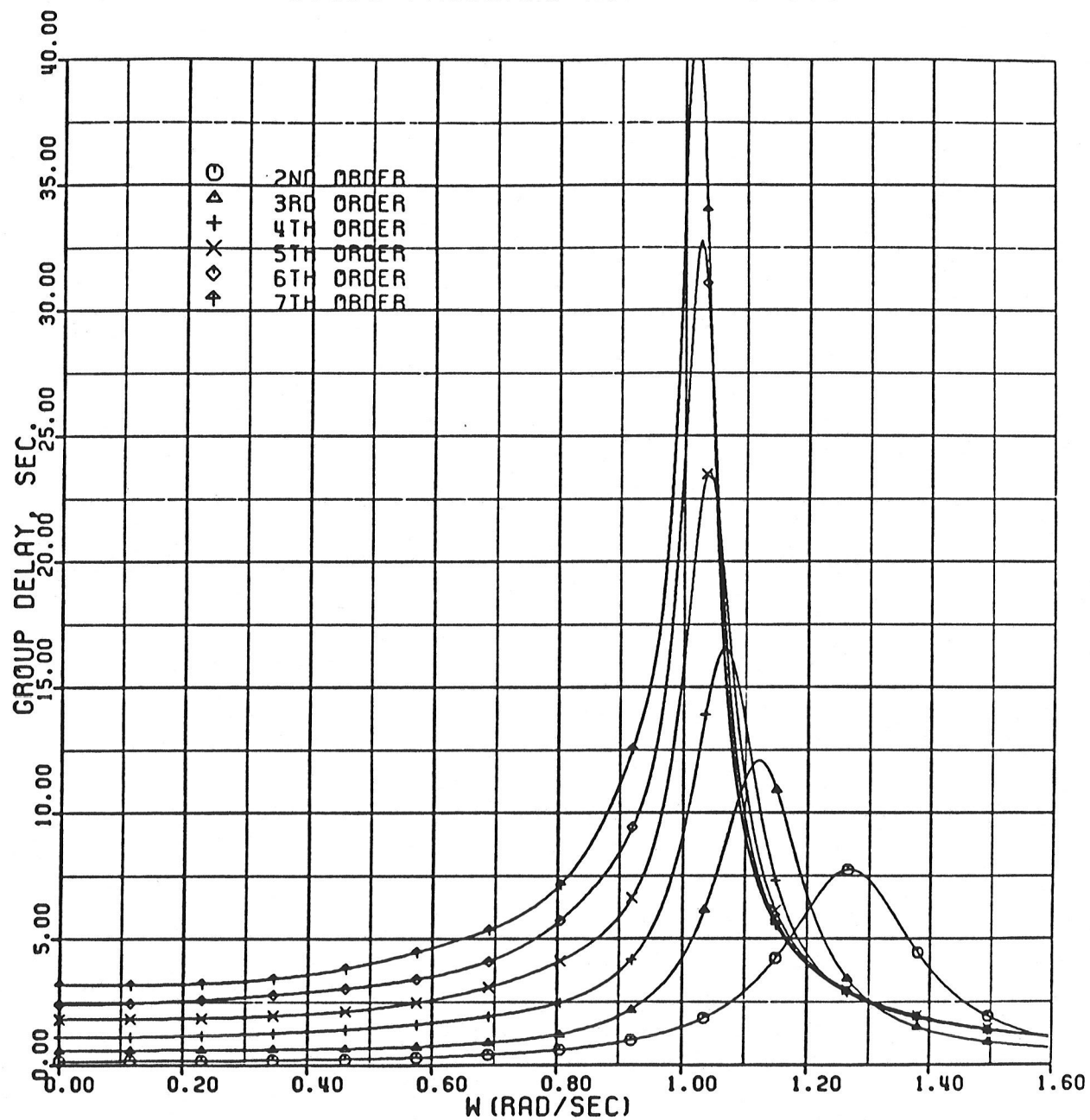


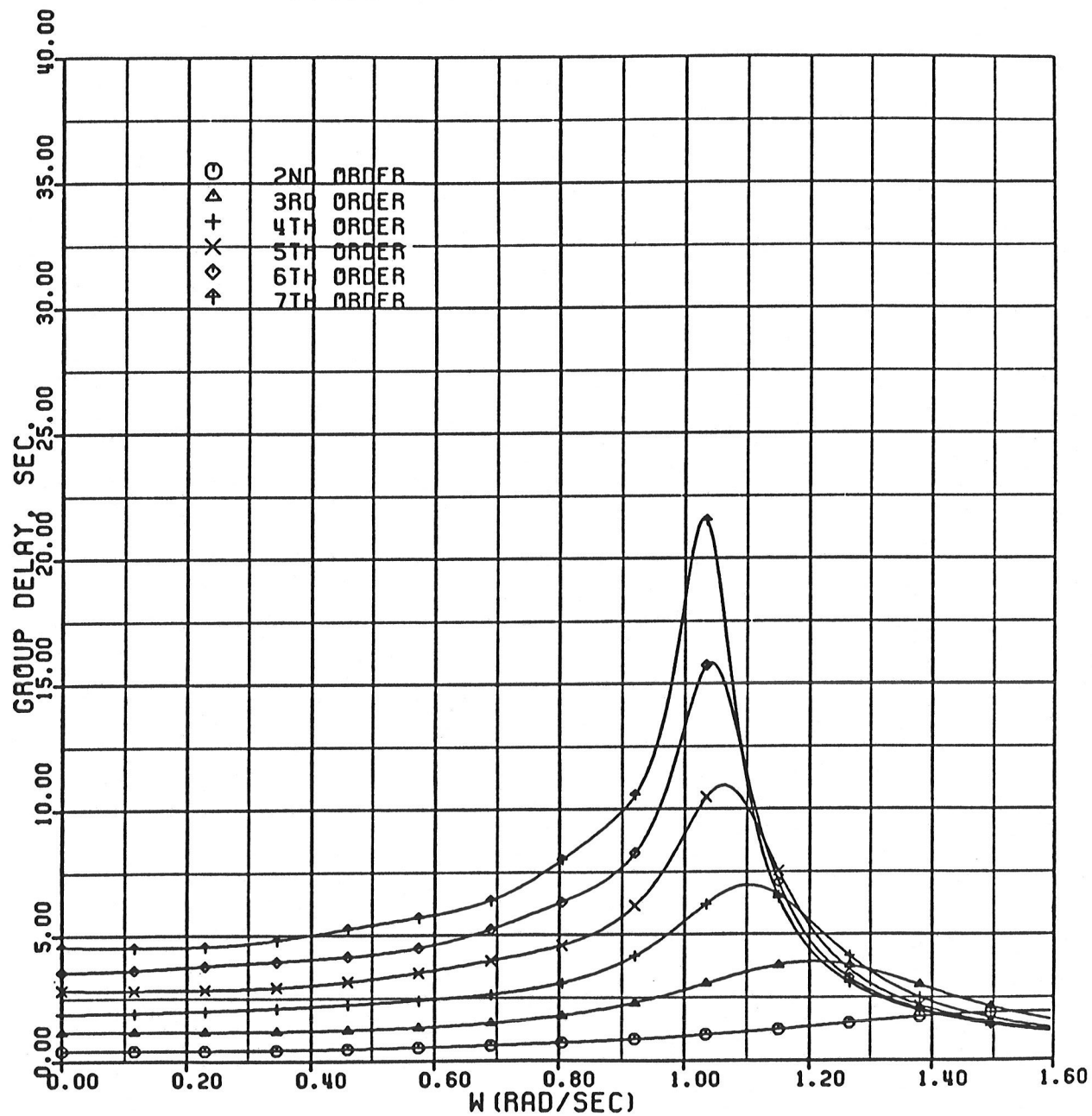
Fig. 10. Phase comparison of Cases A, B, C for  $A_p = 1.0$ :

(b)  $\omega_s = 2.0$ .

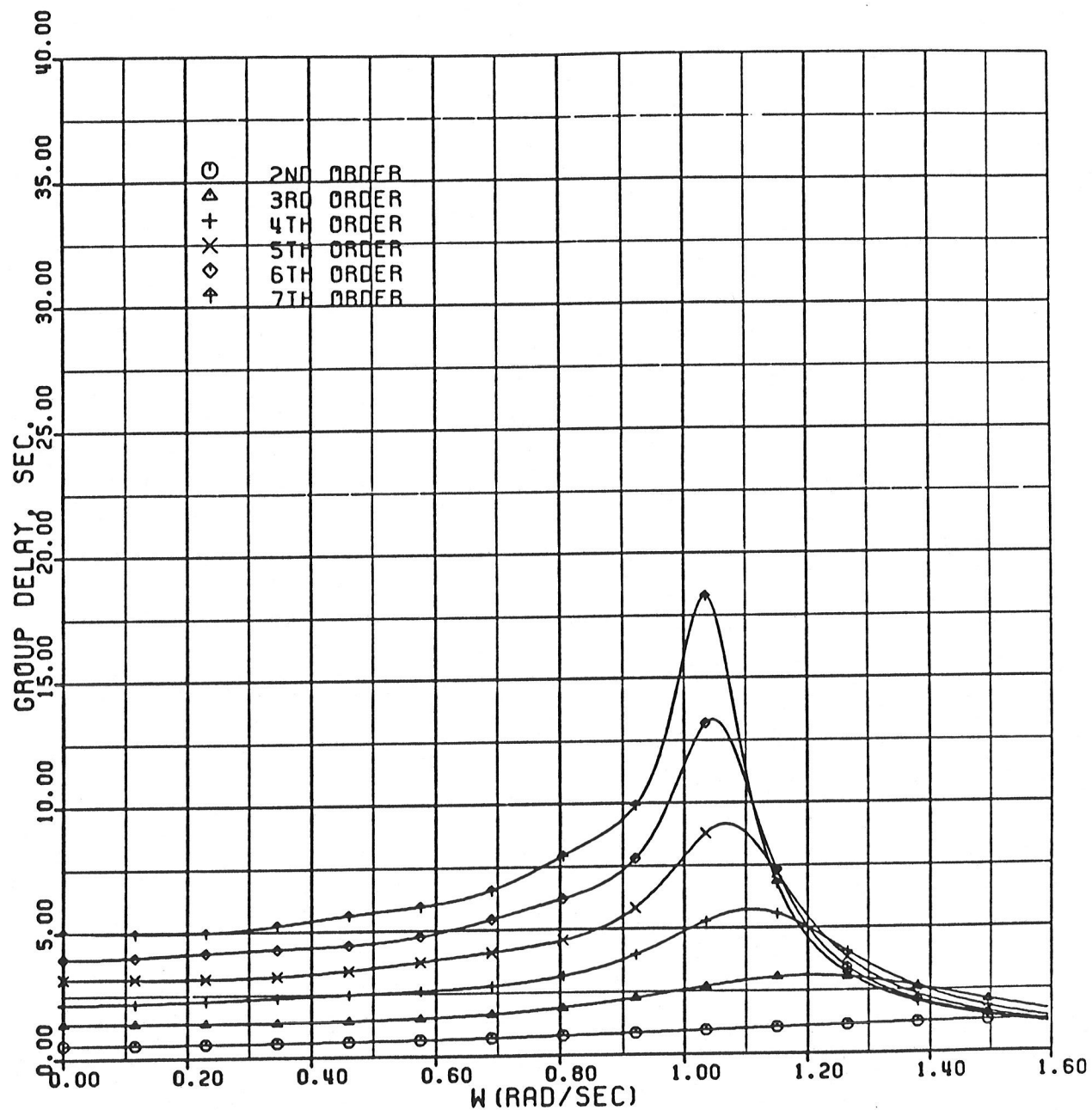
## GROUP-DELAY CHARACTERISTICS

0.1DB PASSBAND RIPPLE  $\omega_s = 1.1$ Fig. 11. Group-delay for  $A_p = 0.1$ :(a)  $\omega_s = 1.1$ .

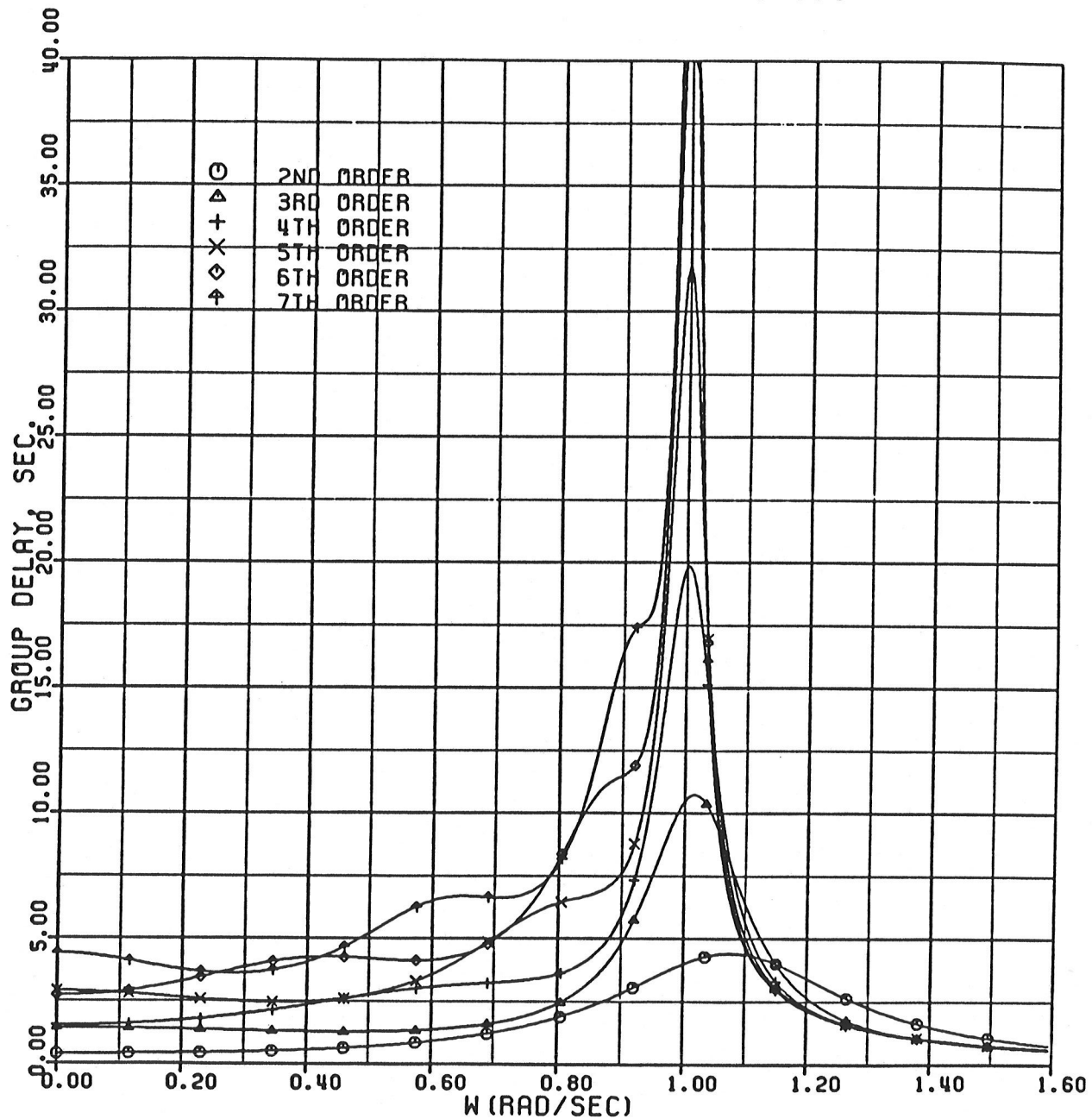
## GROUP-DELAY CHARACTERISTICS

0.1DB PASSBAND RIPPLE  $\omega_s = 1.5$ Fig. 11. Group-delay for  $A_p = 0.1$ :(b)  $\omega_s = 1.5$ .

## GROUP-DELAY CHARACTERISTICS

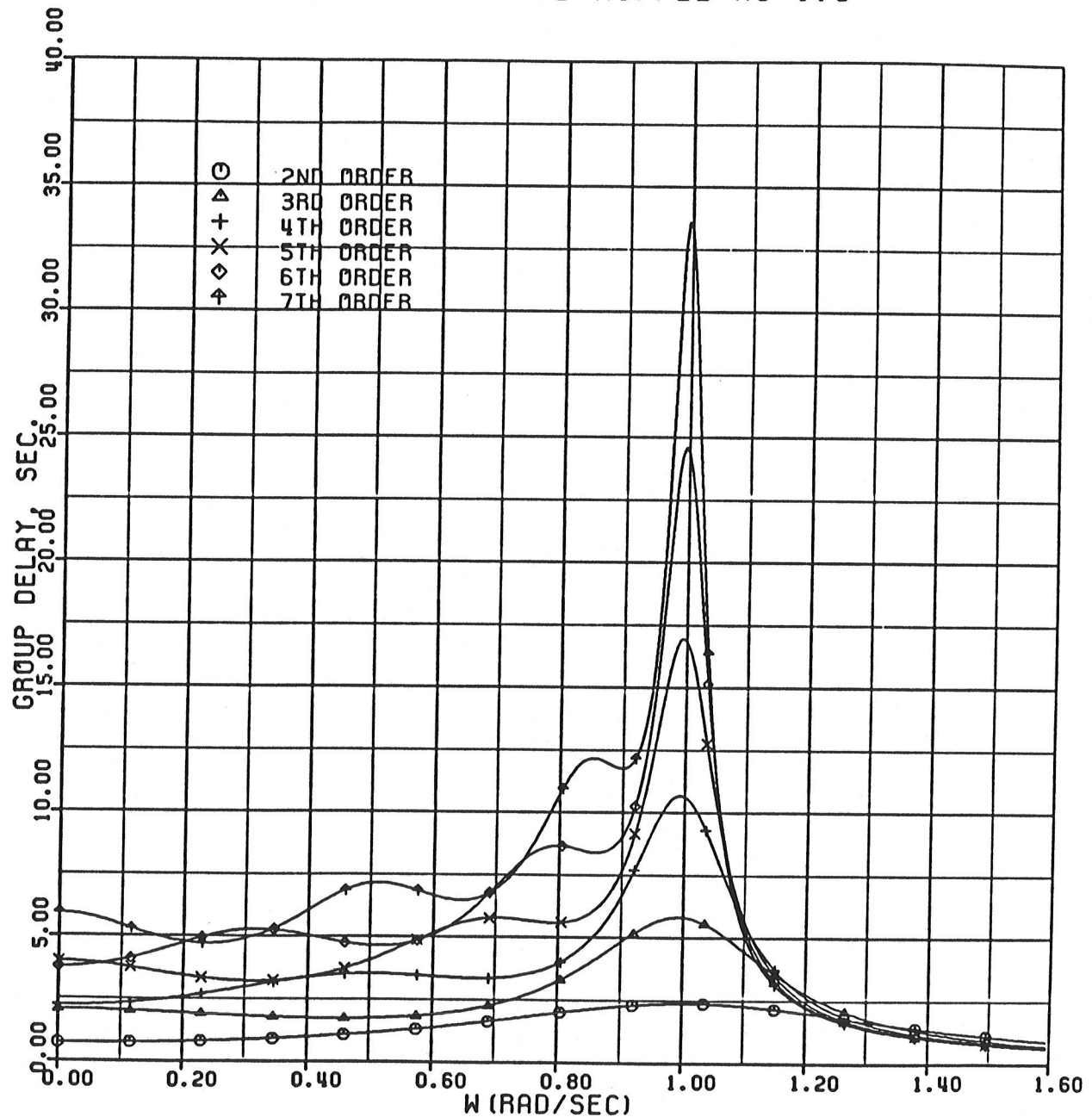
0.1DB PASSBAND RIPPLE  $\omega_s=2.0$ Fig. 11. Group-delay for  $A_p = 0.1$ :(c)  $\omega_s = 2.0$ .

## GROUP-DELAY CHARACTERISTICS

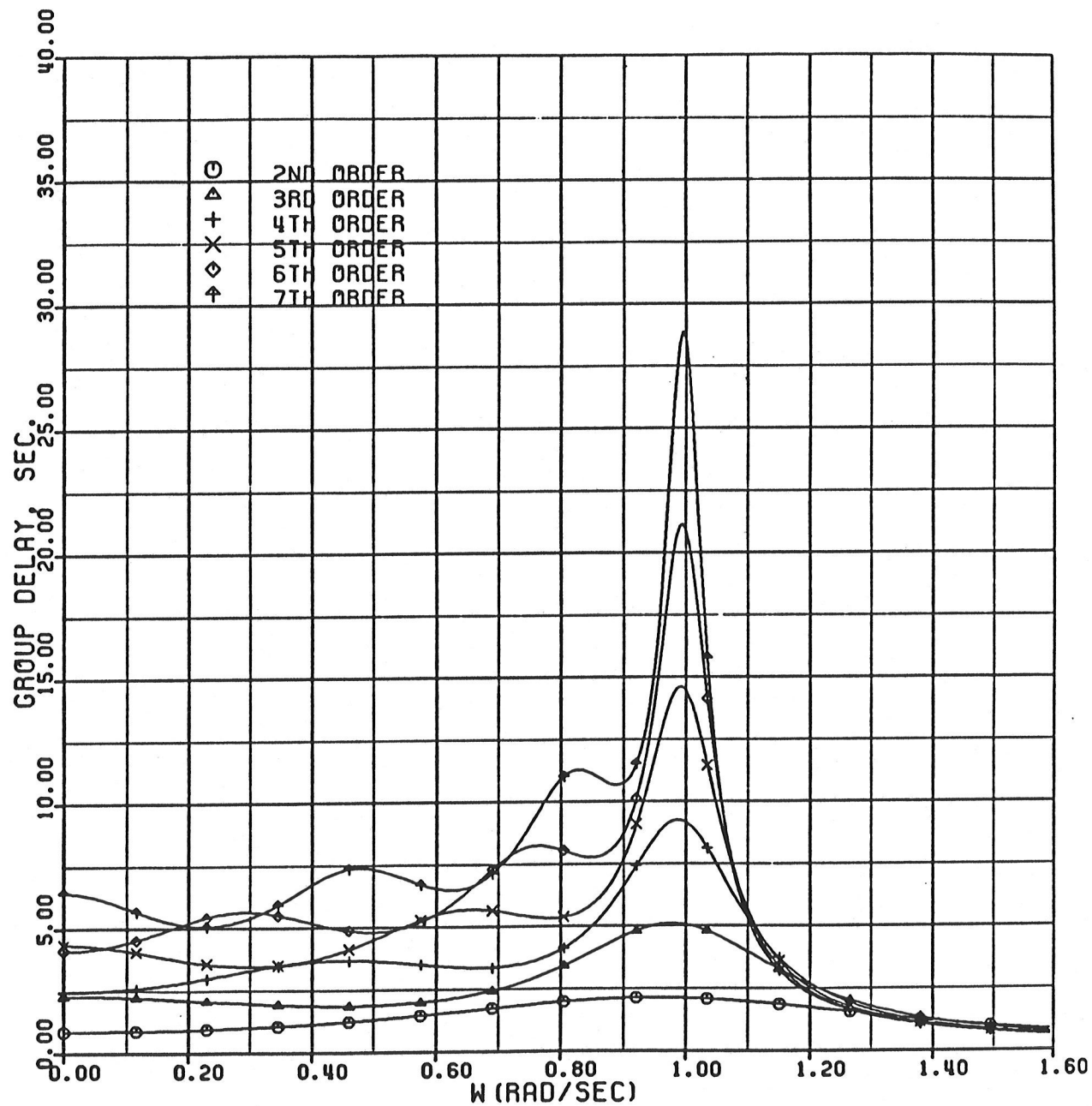
1.0DB PASSBAND RIPPLE  $\omega_s=1.1$ Fig. 12. Group-delay for  $A_p = 1.0$ :(a)  $\omega_s = 1.1$ .



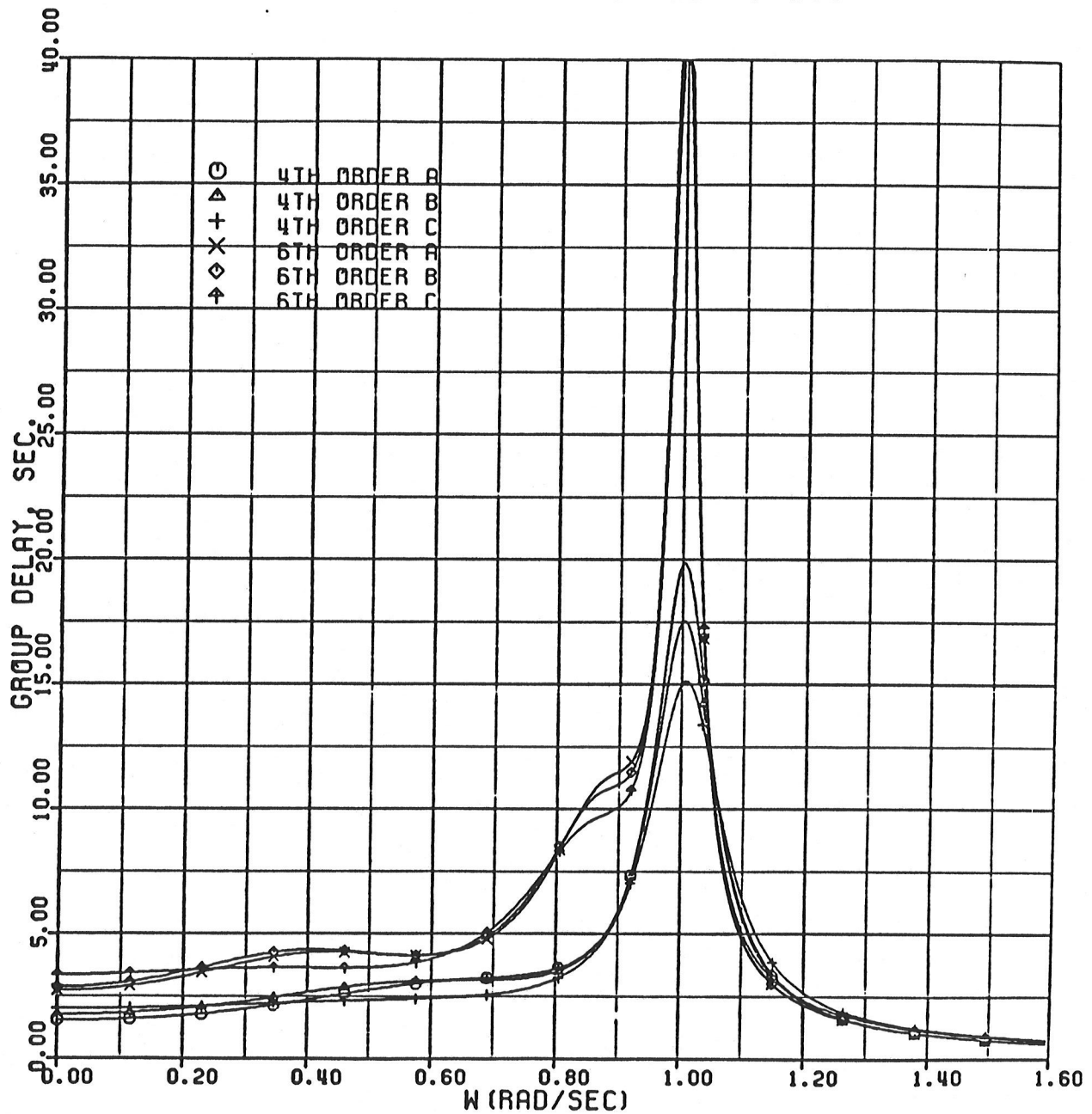
## GROUP-DELAY CHARACTERISTICS

1.0DB PASSBAND RIPPLE  $\omega_s = 1.5$ Fig. 12. Group-delay for  $A_p = 1.0$ :(b)  $\omega_s = 1.5$ .

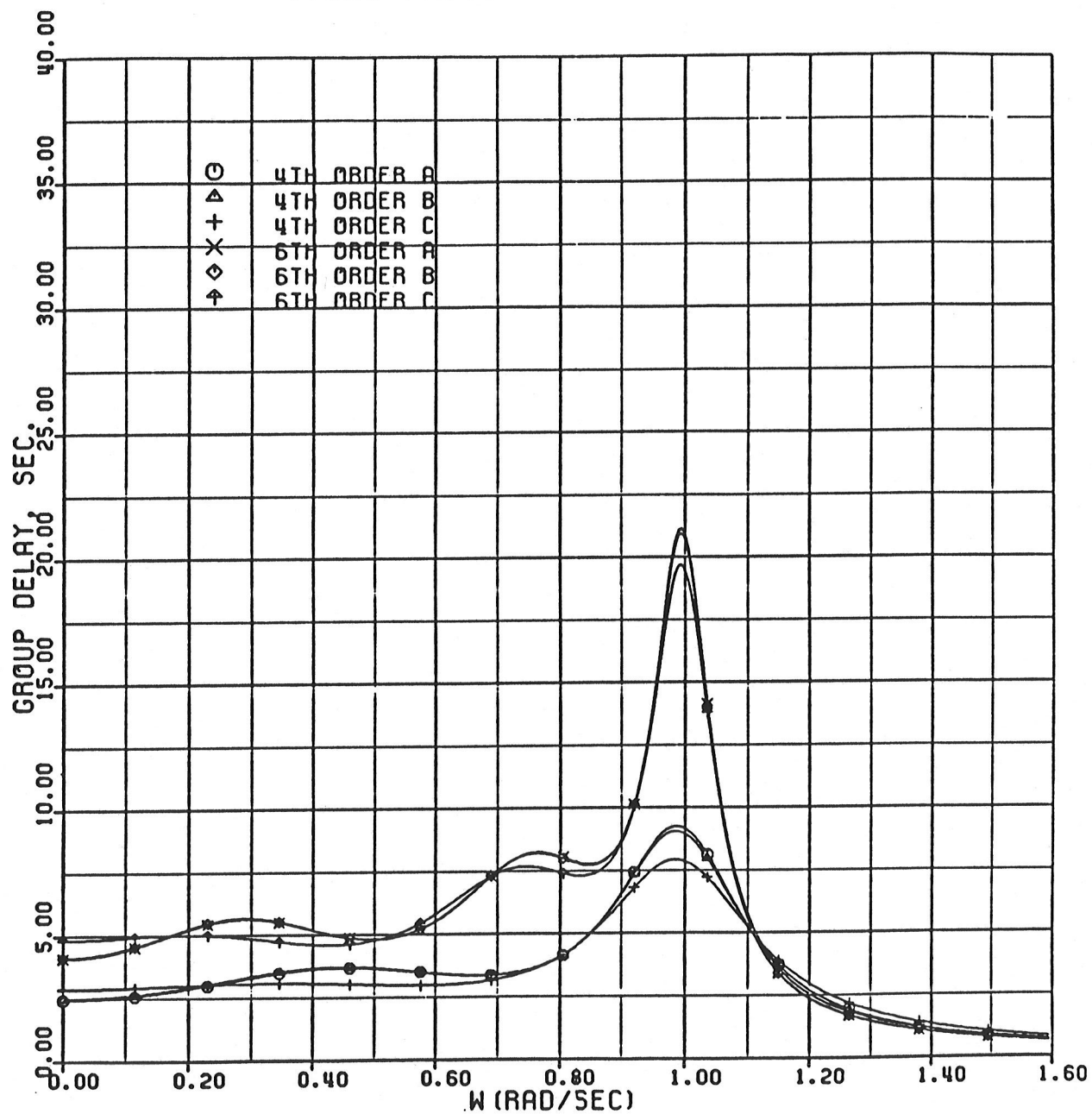
## GROUP-DELAY CHARACTERISTICS

1.0DB PASSBAND RIPPLE  $\omega_s = 2.0$ Fig. 12. Group-delay for  $A_p = 1.0$ :(c)  $\omega_s = 2.0$ .

## GROUP-DELAY CHARACTERISTICS

1.0DB PASSBAND RIPPLE  $\omega_s = 1.1$ Fig. 13. Group-delay comparison for  $A_p = 1.0$ :(a)  $\omega_s = 1.1$ .

## GROUP-DELAY CHARACTERISTICS

1.0DB PASSBAND RIPPLE  $\omega_s = 2.0$ Fig. 13. Group-delay comparison for  $A_p = 1.0$ :(b)  $\omega_s = 2.0$ .

(dB) and lower order  $n$ . Case A, B and C are compared in Fig. 13 for  $n=4$  and  $n=6$ .

#### 4.2 Unit Step Response

Due to the transmission zeros at the finite points on the  $j\omega$ -axis and poles of relatively high  $Q$ , the time domain behavior of the elliptic filters are considerably different from those of all pole function filters such as Butterworth or Chebyshev.

The unit step response can be expressed as follows.

$$a(t) = 1 + \sum_{i=1}^{n/2} A_i e^{-\frac{a_i}{2}t} \cos(\omega_i t + \alpha_i) \quad (27a)$$

$n : \text{even}$

$$a(t) = 1 + A'_0 e^{-\sigma_0 t} + \sum_{i=1}^{(n-1)/2} A'_i e^{-\frac{a_i}{2}t} \cos(\omega_i t + \alpha'_i) \quad (27b)$$

$n : \text{odd}$

where  $\omega_i = \sqrt{b_i - \left(\frac{1}{2}a_i\right)^2}$

The following are observed:

1. Even functions exhibit non-zero values (which decrease with  $\omega_s$ ) at  $t=0$ . Their overshoots are higher than those of odd functions.
2. As  $\omega_s$  increases, the delay time becomes longer.
3. As  $A_p$  increases, the overshoot becomes higher and the delay time becomes longer.

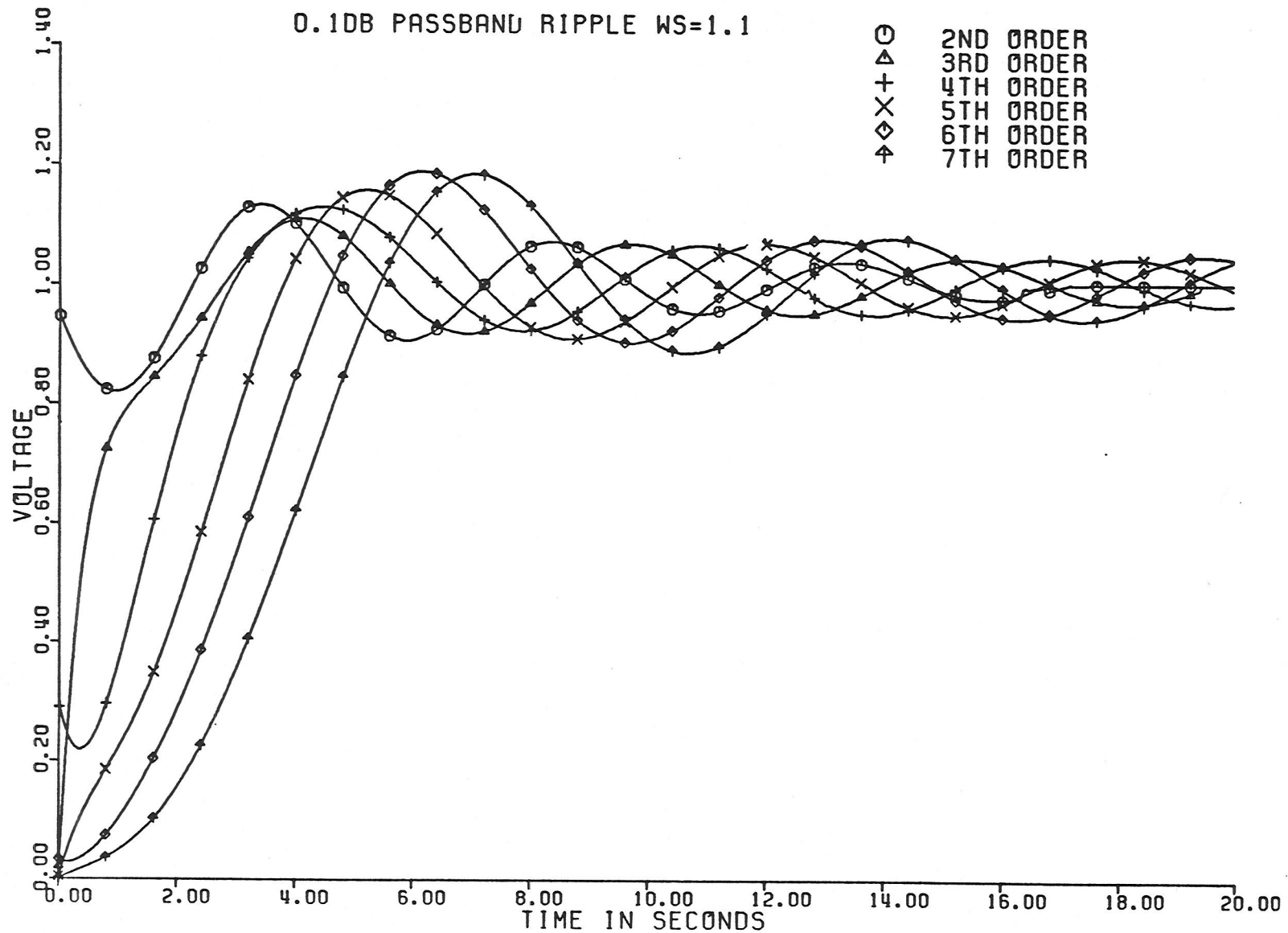


Fig. 14. Unit step response for  $A_p = 0.1$ :

(a)  $\omega_s = 1.1$ .

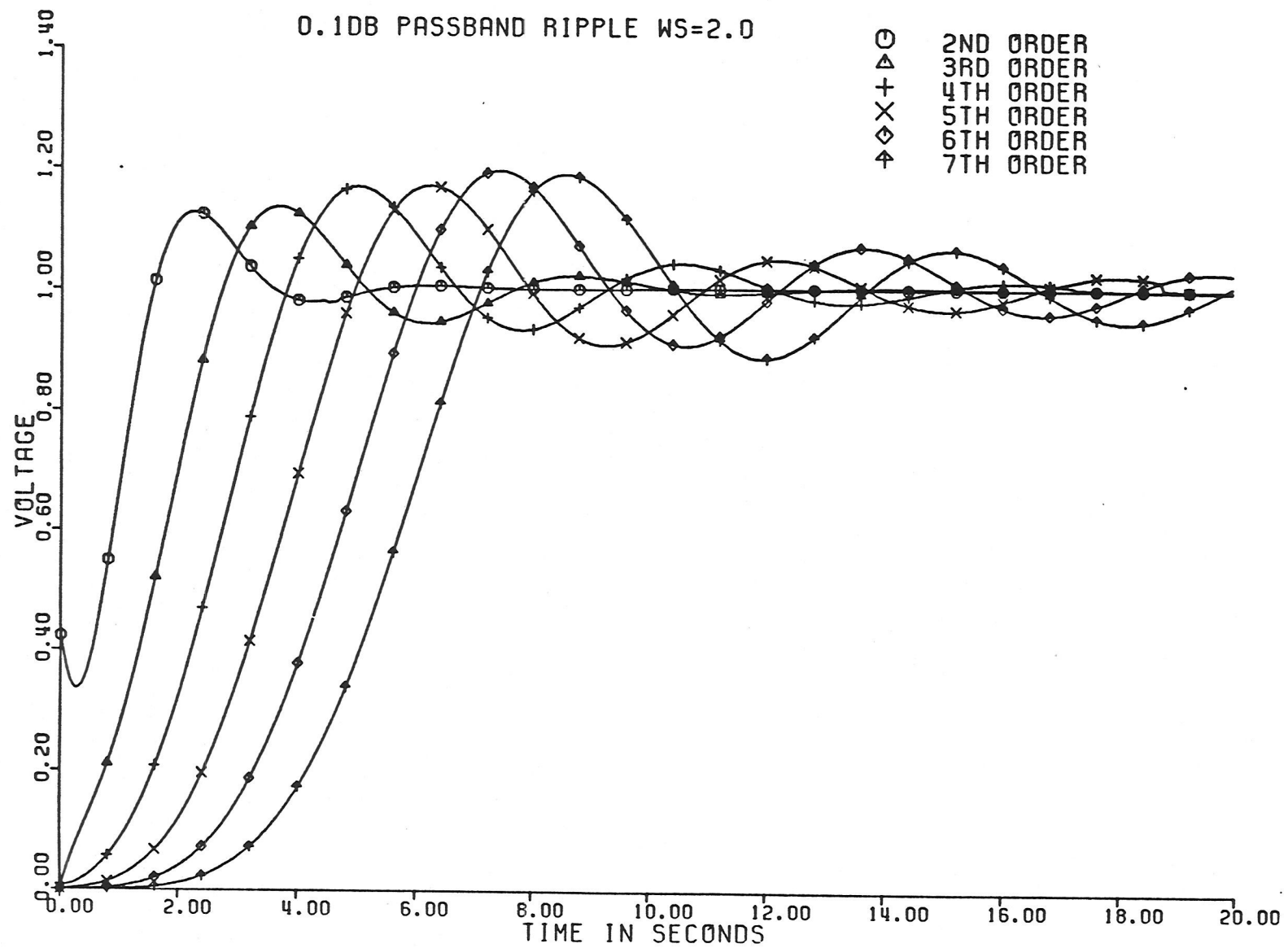


Fig. 14. Unit step response for  $A_p = 0.1$ .

(b)  $\omega_s = 2.0$ .

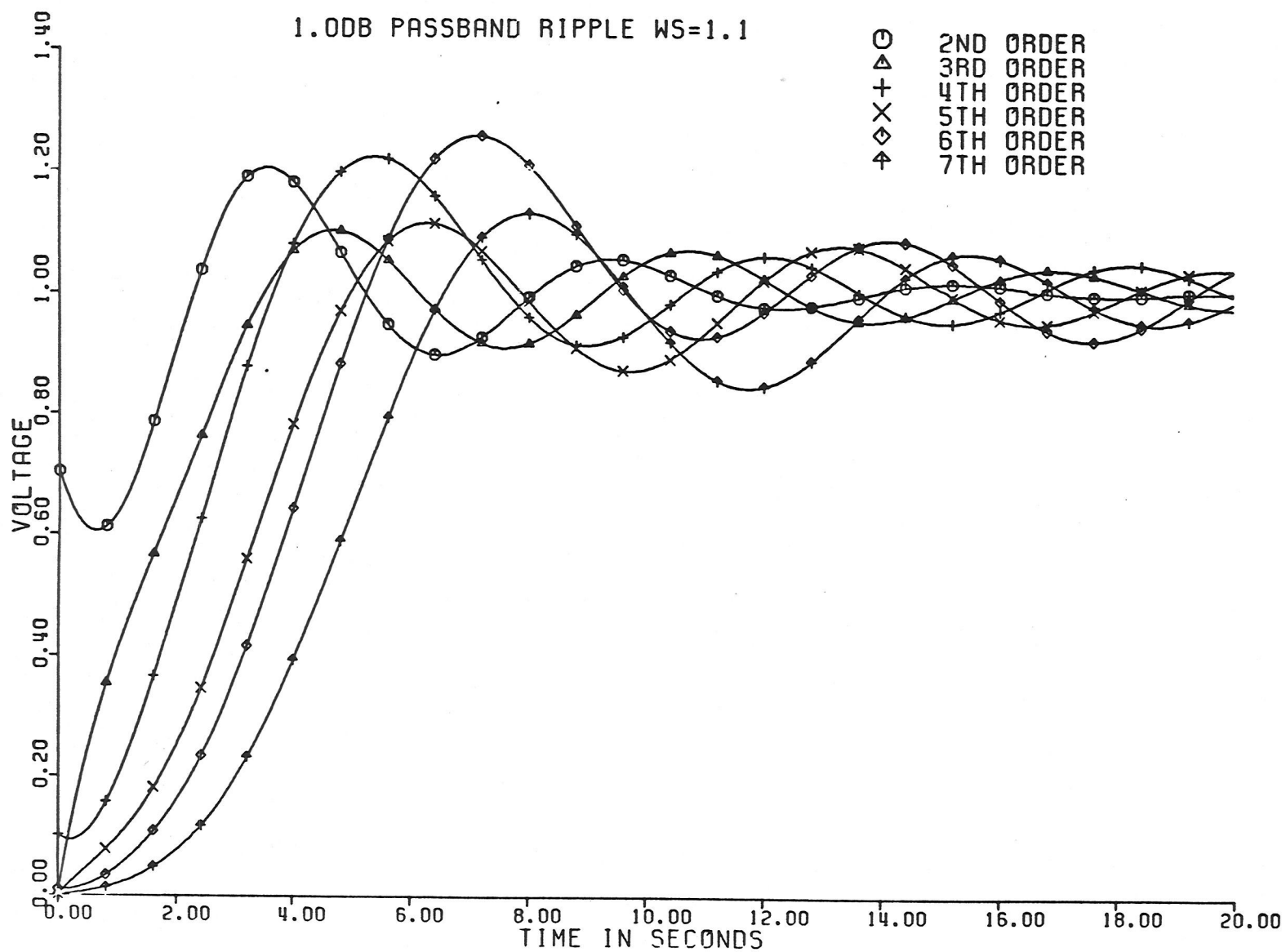


Fig. 15. Unit step response for  $A_p = 1.0$ :

(a)  $\omega_s = 1.1$ .



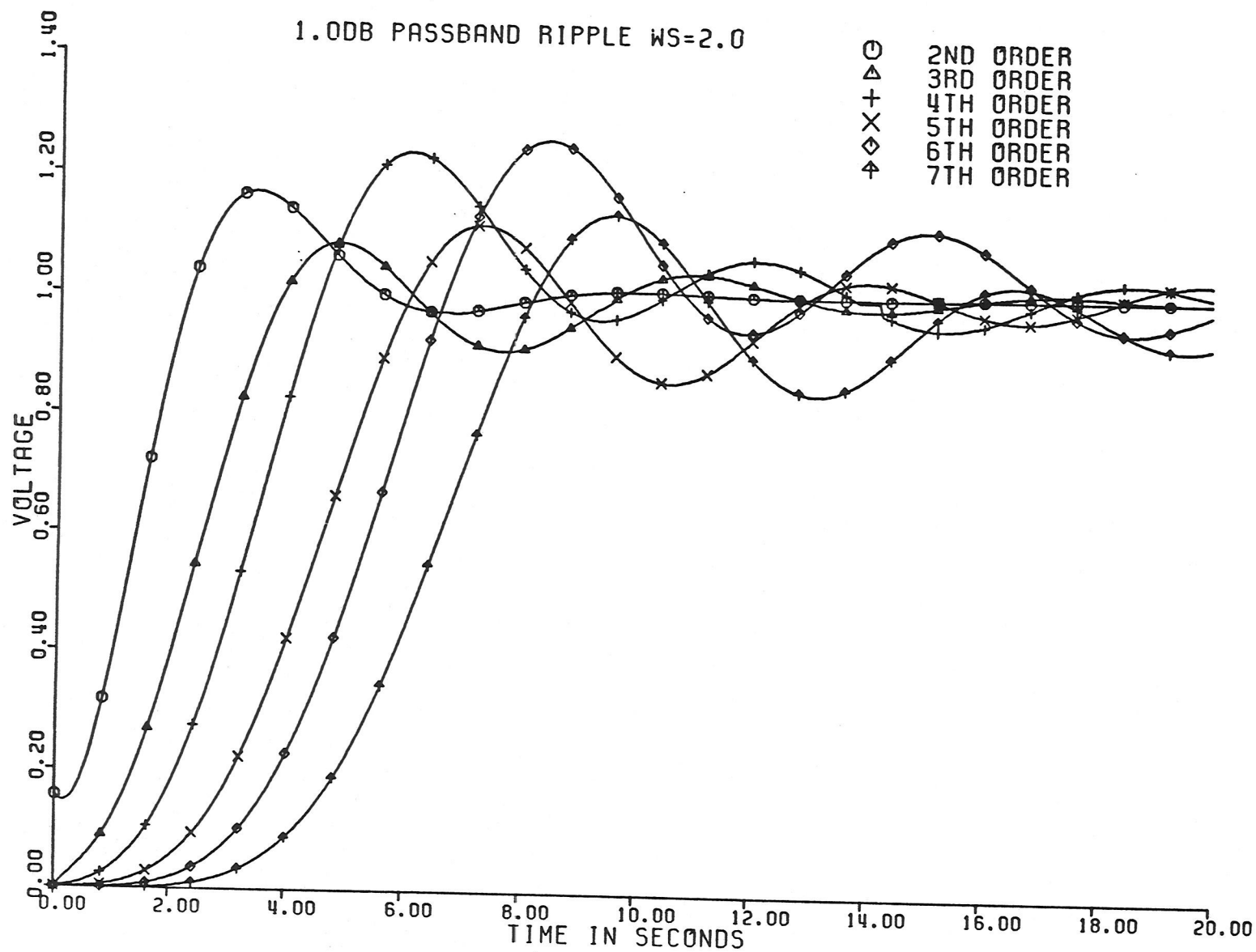


Fig. 15. Unit step response for  $A_p = 1.0$ ;  
(b)  $\omega_s = 2.0$ .

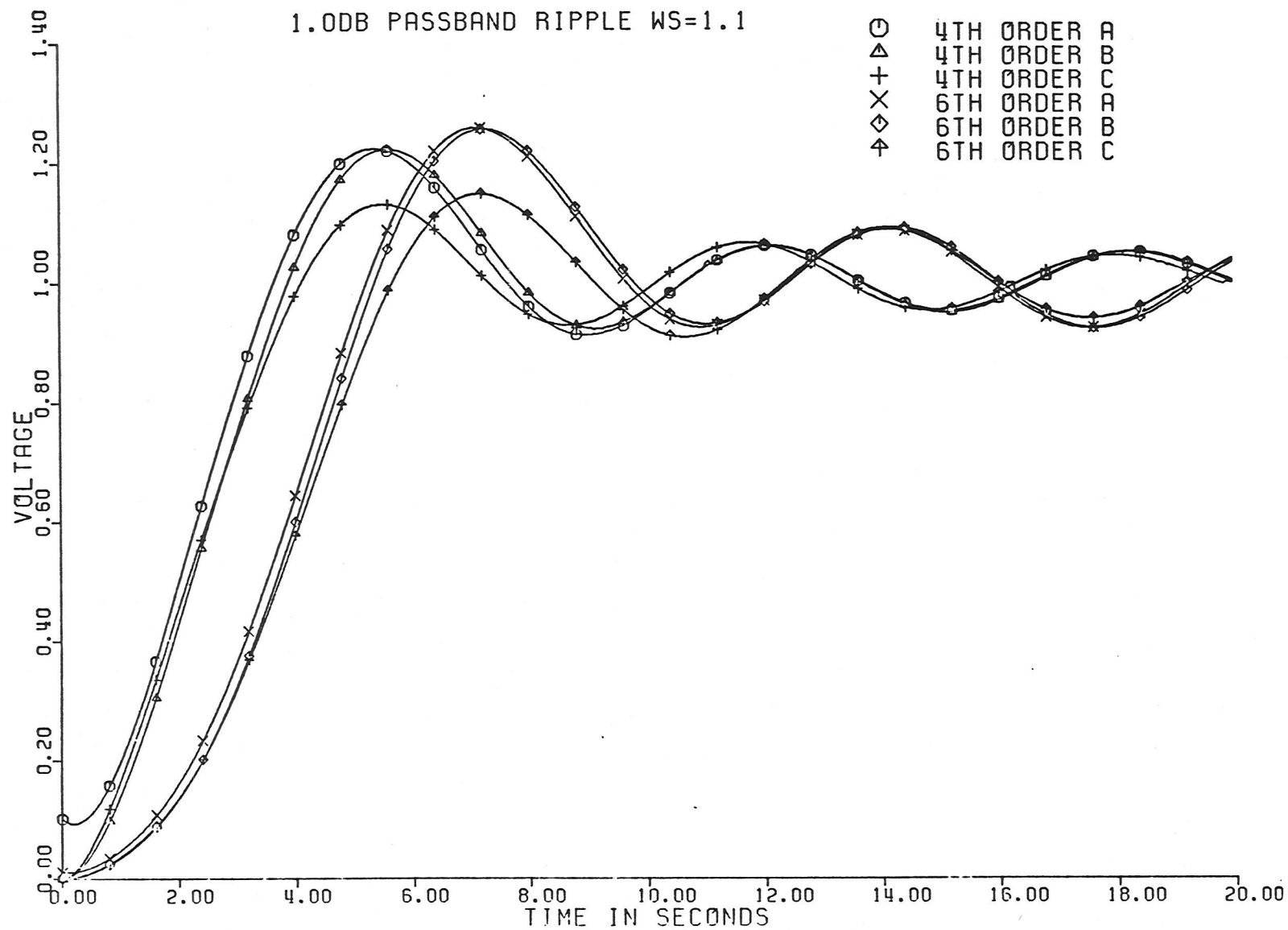


Fig. 16. Unit step responses of Cases A, B, C for  $A_p = 1.0$ :

(a)  $\omega_s = 1.1$ .

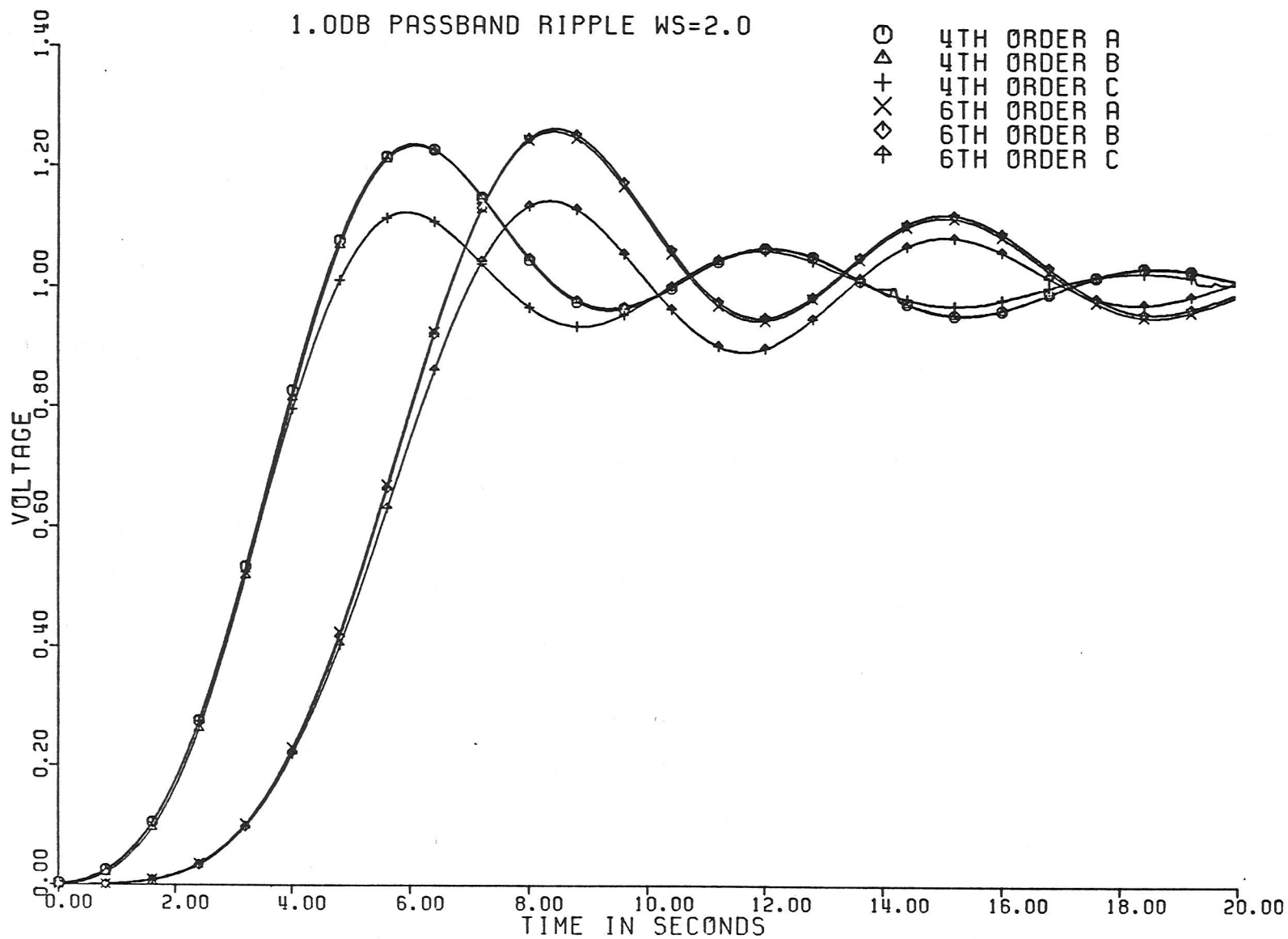


Fig. 16. Unit step responses of Cases A, B, C for  $A_p = 1.0$ :

(b)  $\omega_s = 2.0$ .

The unit step responses are shown in Fig. 14 and Fig. 15 for  $\omega = 1.1, 2.0$  and  $A_p = 0.1, 1.0$ . Cases A, B and C are plotted in Fig. 16. Case A and Case B are almost identical.

#### 4.3 Impulse Responses

The impulse responses are obtained by applying the inverse Laplace transformation to  $H(s)$  of equation (23).

$$h(t) = B_0 \delta(t) + \sum_{i=1}^{n/2} B_i e^{-\frac{a_i}{2}t} \cos(\omega_i t + \beta_i) \quad (28a)$$

n : even

$$h(t) = B_0' e^{-\sigma_0 t} + \sum_{i=1}^{(n-1)/2} B_i' e^{-\frac{a_i}{2}t} \cos(\omega_i t + \beta_i') \quad (28b)$$

n : odd

Characteristics similar to step responses have been observed in the impulse responses. It is worth noting that the impulse  $\delta(t)$  exists in  $h(t)$  when  $n$  is even and for odd  $n$ , the  $\sigma_0$  becomes smaller for increasing  $\omega_s$ . Impulse responses are shown in Fig. 17 and Fig. 18 for  $\omega_s = 1.1, 2.0$  and  $A_p = 0.1, 1.0$ . Cases A, B and C are compared in Fig. 19.

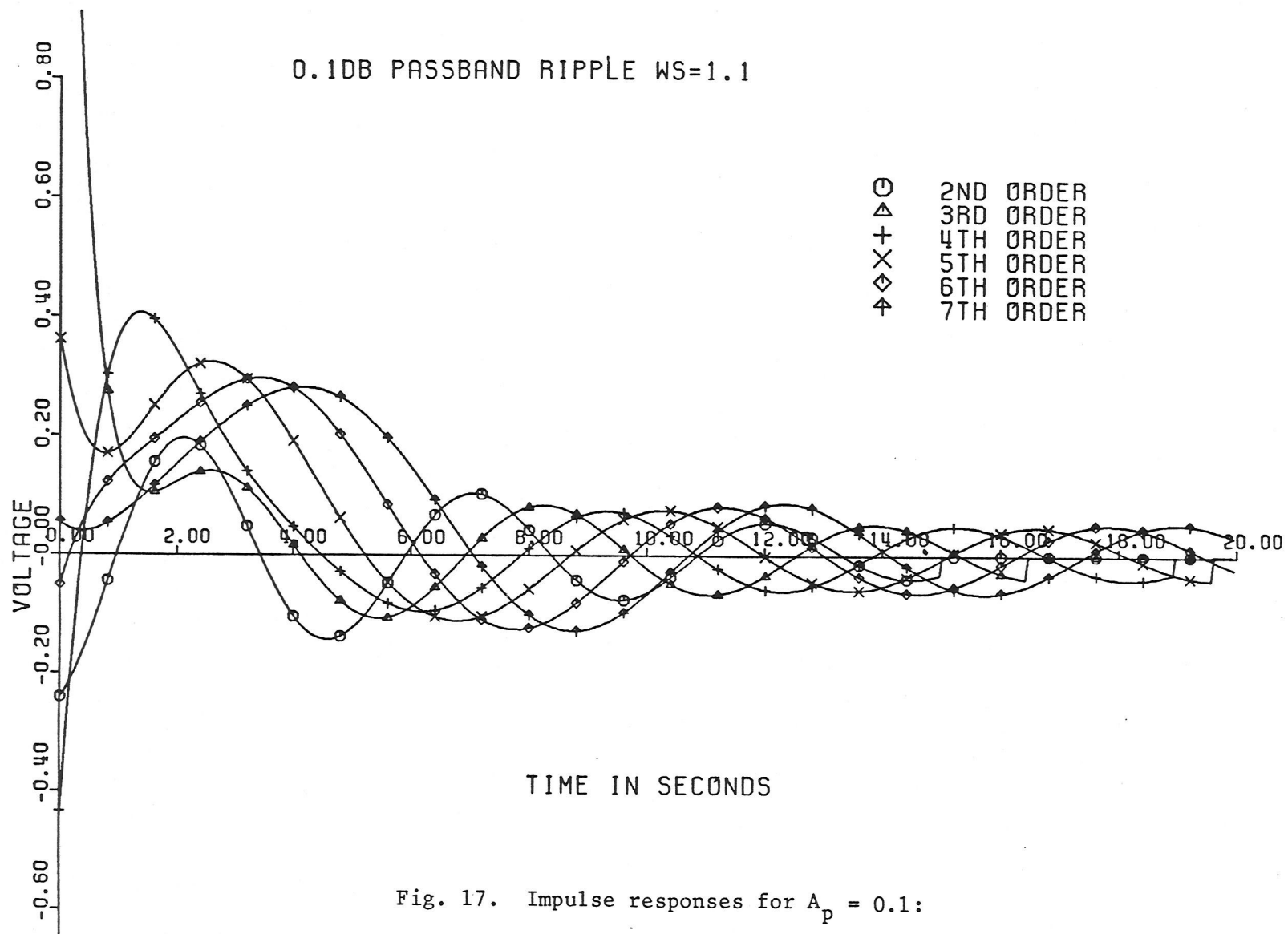
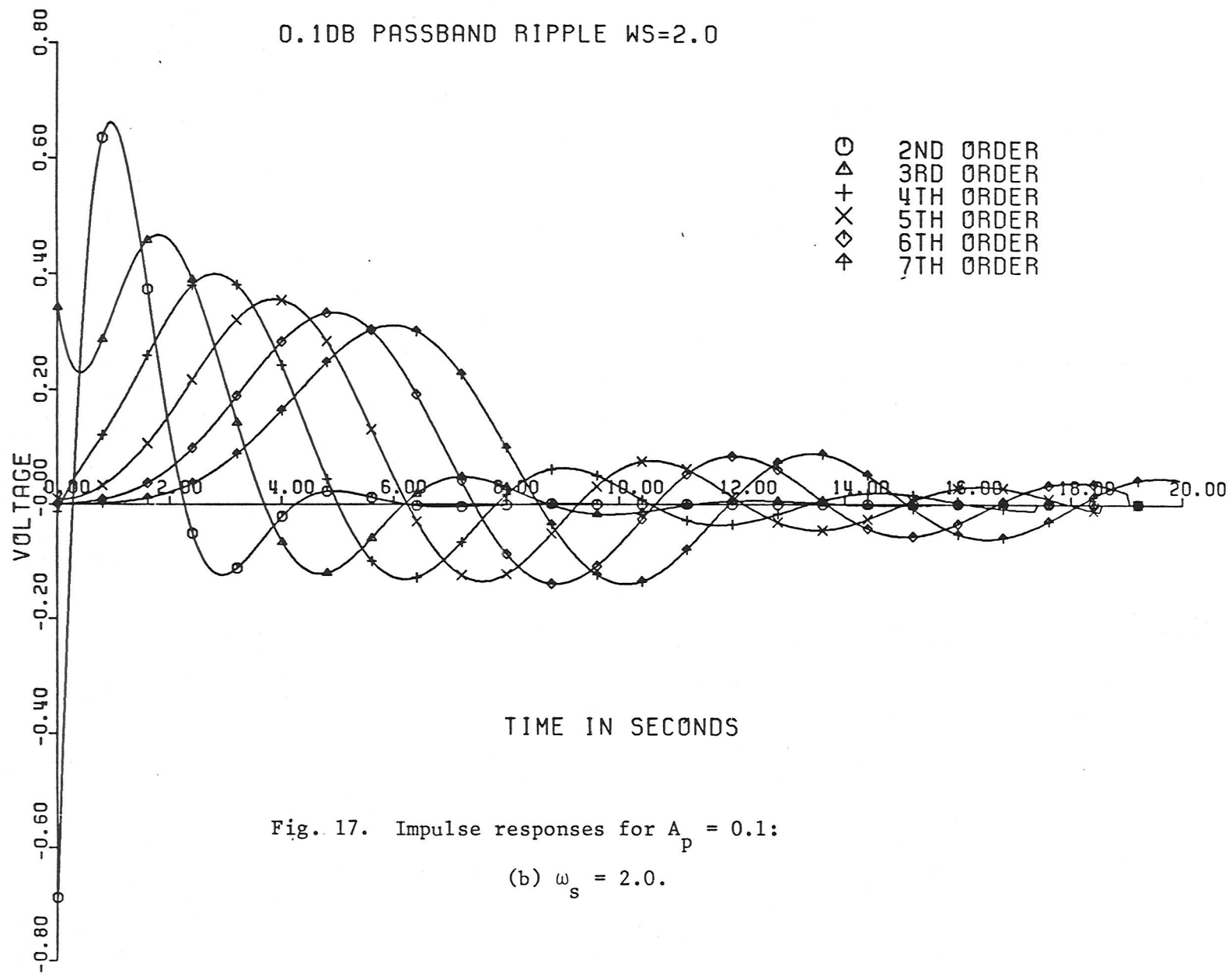
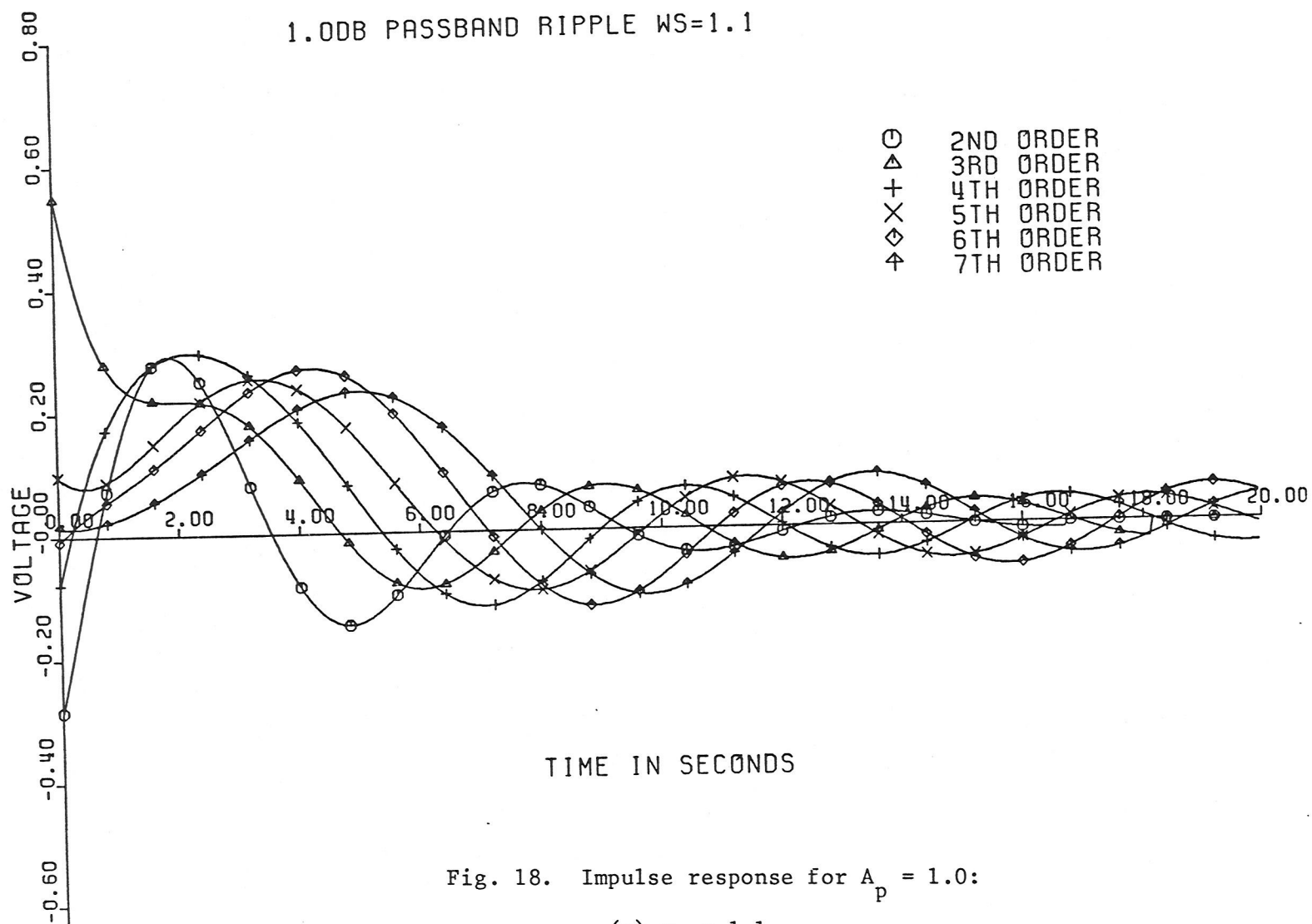


Fig. 17. Impulse responses for  $A_p = 0.1$ :

(a)  $\omega_s = 1.1$ .





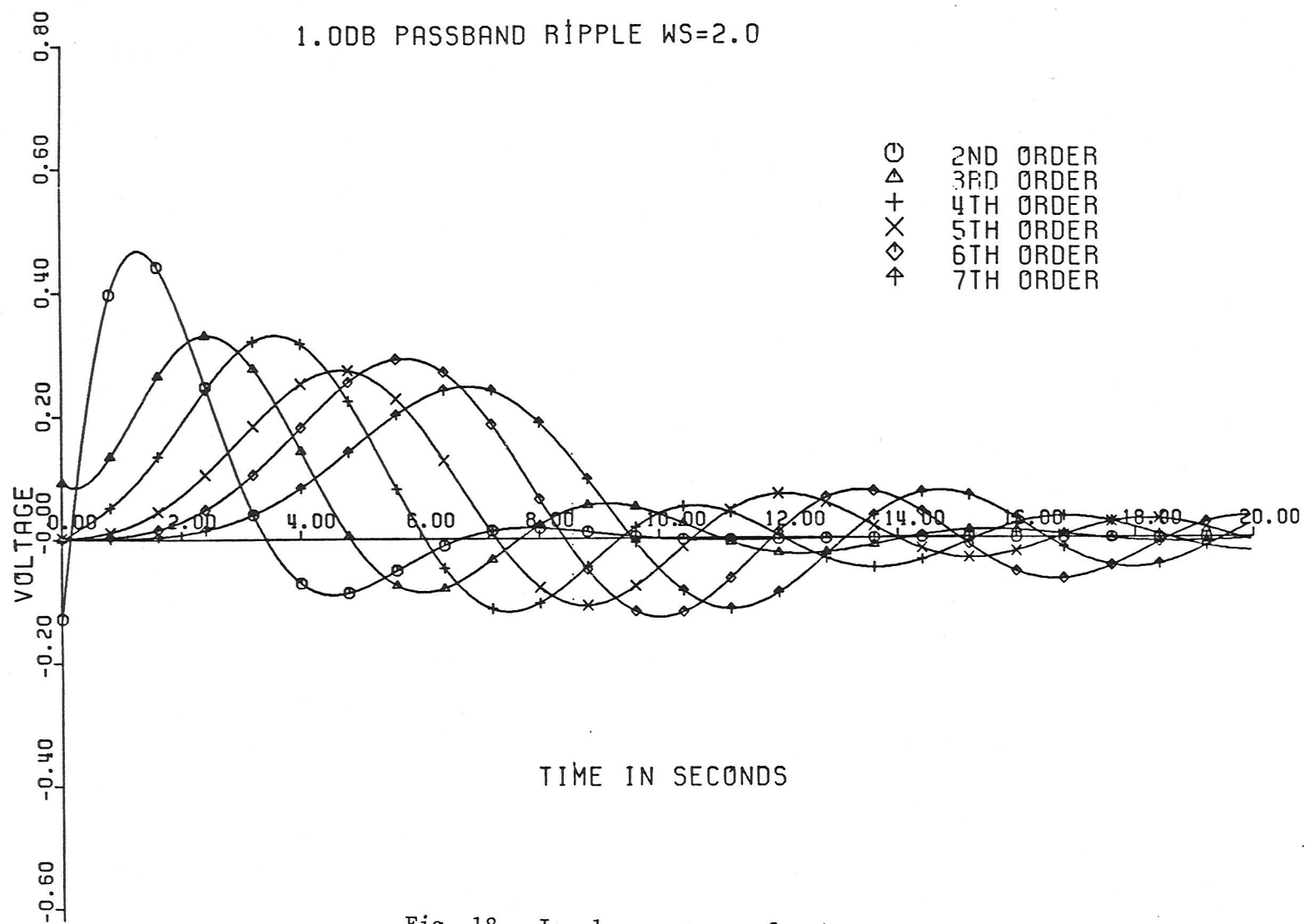
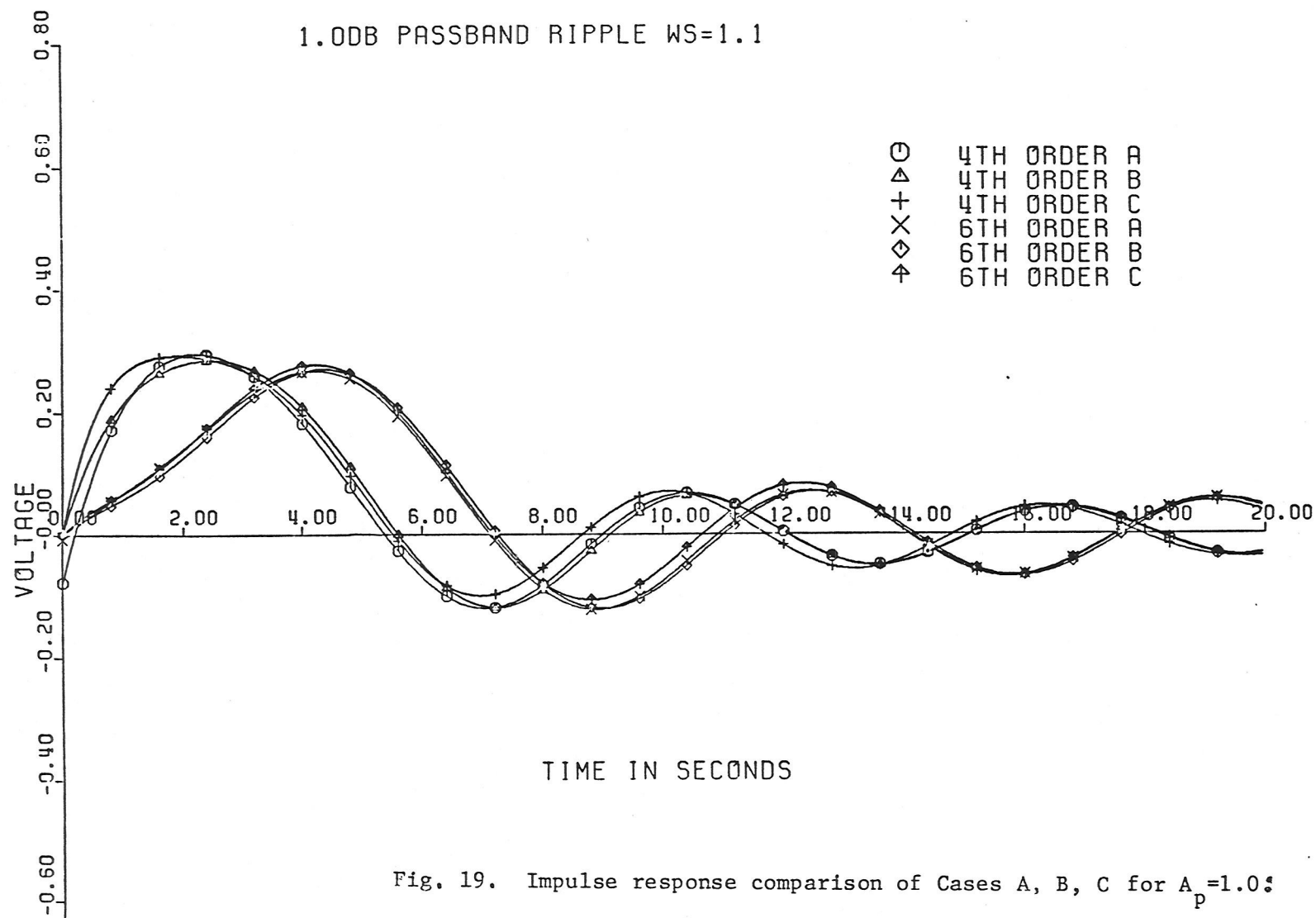


Fig. 18. Impulse response for  $A_p = 1.0$ :

(b)  $\omega_s = 2.0$ .





(a)  $\omega_s = 1.1$ .

1.0DB PASSBAND RIPPLE WS=2.0

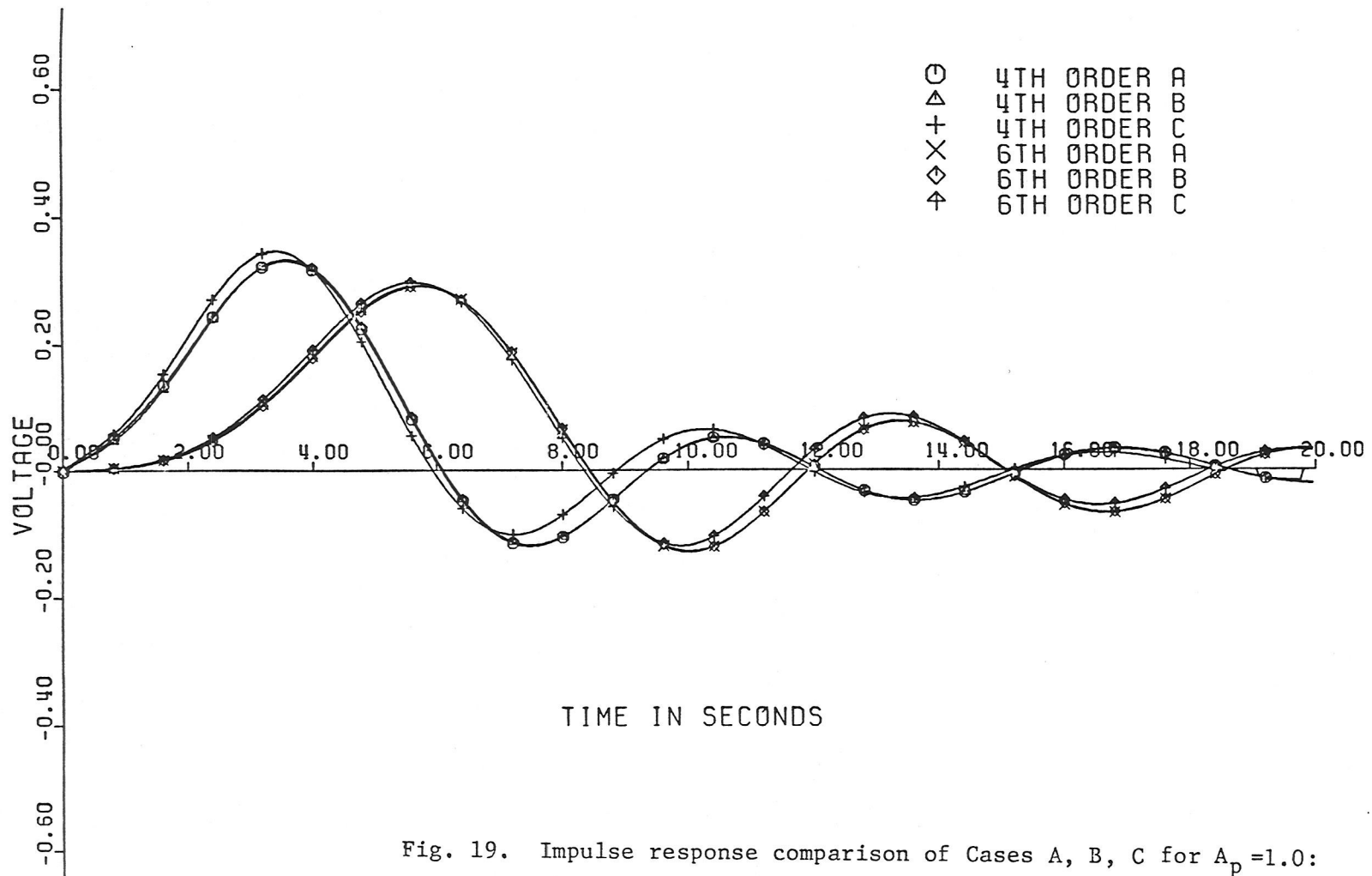


Fig. 19. Impulse response comparison of Cases A, B, C for  $A_p=1.0$ :

(b)  $\omega_s = 2.0$ .

## Chapter V

### CONCLUSION

A simple method of pole-zero pairing has been proposed for the active cascade realization of elliptic functions. The flatness matrix is introduced to advance a theorem which leads to the maximum dynamic range. Secondly, the problem of sequencing the biquads of the low-pass notch type has been solved. It is demonstrated that the generally accepted sequencing techniques do not hold in the case of elliptic transfer functions.

By using the nature of the frequency transformation, the techniques and results obtained for the low-pass case are directly applied to the optimization of other types such as high-pass, band-pass and band-stop elliptic filters.

Two examples are provided to illustrate the proposed methods. The first example is the case in which the pole-zero pairing, biquad sequencing and the gain distribution are all employed to optimize one of the most relevant performance measures, viz. the dynamic range. The second example takes a different approach in which the pole-zero pairing is used for sensitivity improvement of the individual biquads. Subsequently, the sequencing and gain distribution are conducted to enhance the dynamic range as much as possible.

An active notch section proposed by Moore [4] was used in the laboratory experiment (Fig. 4) for the second example. The proposed method may be extended to switched-capacitor realization of elliptic functions using the procedures such as the one advanced by Ericksson [11].

The phase and group-delay have been examined. The time domain characteristics of the elliptic filters have been analyzed and compiled for various stopband frequencies and passband ripples. Case A, B and C have also been compared for  $n=4$  and  $n=6$ . All figures have been plotted by a VERSATEC D1200A plotter using an AMDAHL 5850 computer. In appendices, detailed tables for  $A_p(\text{dB}) = 0.1, 0.2, 0.5, 1.0, 2.0, 3.0$  are included to make them available to active synthesis designers with various  $\omega_s$ .

## REFERENCES

- [1] A.S. Sedra and P.O. Brackett, Filter Theory and Design. Portland OR: Matrix Publishers, Inc., 1978.
- [2] D.E. Johnson, Introduction to Filter Theory. Englewood Cliff NJ: Prentice-Hall, 1976.
- [3] L.P. Huelsman and P.E. Allen, Theory and Design of Active Filters. New York: Mcgraw-Hill, 1980.
- [4] H.P. Moore, D.E. Johnson, and J.R. Johnson, "An active circuit for elliptic-type filters," IEEE Trans. Circuits and Syst., vol. CAS-27, pp. 328-331, Apr. 1980.
- [5] S. Halfin, "An optimization method for cascaded filters," Bell Syst. Tech. J., vol. 44, pp. 185-190, 1970.
- [6] S. Halfin, "Simultaneous determination of ordering and amplifications of cascaded subsystems," J. Optimiz. Theory and Appl., vol. 6, pp. 356-363, Nov. 1970.
- [7] E. Lueder, "A decomposition of a transfer function minimizing distortion and inband losses," Bell Syst. Tech. J., vol. 49, pp. 455-469, 1970.
- [8] G. S. Moschytz, "Second-order pole-zero pair selection for nth order minimum sensitivity networks," IEEE Trans. Circuit Theory, vol. CT-17, pp. 527-534, Nov. 1970.

- [9] E. Lueder, "Optimization of dynamic range and the noise distance of RC-active filters by dynamic programming," Circuit Theory and Application, vol. 3, pp. 365-370, 1975.
- [10] G. Daryanani, Principles of Active Network Synthesis and Design. John Wiley and Sons, 1976.
- [11] Eriksson. S., " Design of parasitics-insensitive bilinear switched-capacitor filters-a flowgraph conversion method." Proc. ISCAS, Rome, Italy, pp. 443-446, 1982.
- [12] A.G.J. Holt, J.P. Gray and J.K. Fidler, "Transient response of elliptic function filters," IEEE Transactions on Circuit Theory, pp. 71-73, March 1978.
- [13] C.S. Lindquist, Active Network Design with Signal Filtering Applications, Long Beach, CA.: Steward and Sons, pp. 235-243, 1977.
- [14] A.B. Williams, Electronic Filter Design Handbook. New York: McGraw-Hill, 1981.
- [15] A.I. Zverev, Handbook of Filter Synthesis. New York: John Wiley, pp. 380-400. 1967.
- [16] R. Saal, Handbook of Filter Design. Berlin: AEG-Telefunken, 1979.
- [17] K.S. Crump, "numerical inversion of Laplace transforms using Fourier series approximation." J. of the Assoc. for Computing, Machinery, vol. 23, no. 1, pp. 89-97, January 1976.

- [18] D.Y. Kim and H.K. Kim, "A new approach to the active realization of elliptic filters," International Journal of Electronics, in print for publication in 1985. It was also presented at the Chicago Int. Symp. on Circuits and Systems, May 1981.
- [19] D.Y. Kim and H.K. Kim, "The phase and time domain behaviors of elliptic filters," 26th Midwest Symp. on Circuits and Systems, pp. 184-187, Aug. 1983.
- [20] S.H. Kim and D.Y. Kim, "The frequency range improvement of the Wien-Bridge Oscillators," 26th Midwest Symp. on Circuits and Systems, pp. 275-277, Aug. 1983.
- [21] M.H. Lee and D.Y. Kim, "Weighted hadamard transformation for S/N ratio enhancement in image transmission," Int. Symp. on Circuits and Systems, pp. 65-68, May 1984.
- [22] D.Y. Kim and H.K. Kim, "Some results in elliptic filter characteristics," IEEE Circuits and Systems Magazine, in print for publication in 1985.
- [23] D.Y. Kim and H.K. Kim, "Phase and group-delay characteristics of elliptic filters," in print for publication at the Kyoto in Japan Int. Symp. on Circuits and Systems, June 1985.

## APPENDIX I

## TABLES OF IMPORTANT PARAMETERS FOR ACTIVE REALIZATIONS

$$H(s) = K \prod_{i=1}^{n/2} \frac{s^2 + c_i}{s^2 + a_i s + b_i} \quad \text{for } n: \text{ even}$$

$$H(s) = \frac{K}{s + \sigma} \prod_{i=1}^{(n-1)/2} \frac{s^2 + c_i}{s^2 + a_i s + b_i} \quad \text{for } n: \text{ odd}$$



| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.1$ |           |           |           |                             |           |            |  |
|--------|------|---------------------------------------|-----------|-----------|-----------|-----------------------------|-----------|------------|--|
| n      | Ws   | As(dB)                                | A1        | B1        | C1        | P1                          | Q1        |            |  |
| 2      | 1.05 | 0.343                                 | 0.1508135 | 1.3990303 | 1.4386640 | -0.0754068 ±j               | 1.1804000 | 7.8428382  |  |
|        | 1.10 | 0.559                                 | 0.2589655 | 1.6258769 | 1.7140833 | -0.1294828 ±j               | 1.2685074 | 4.9238172  |  |
|        | 1.15 | 0.802                                 | 0.3656858 | 1.8221534 | 1.9755745 | -0.1828429 ±j               | 1.3374311 | 3.6913426  |  |
|        | 1.20 | 1.075                                 | 0.4725369 | 1.9986240 | 2.2359899 | -0.2362685 ±j               | 1.3938440 | 2.9917811  |  |
|        | 1.25 | 1.376                                 | 0.5789248 | 2.1585102 | 2.5000000 | -0.2894624 ±j               | 1.4403894 | 2.5377853  |  |
|        | 1.30 | 1.703                                 | 0.6837765 | 2.3031394 | 2.7698611 | -0.3418883 ±j               | 1.4785979 | 2.2194529  |  |
|        | 1.35 | 2.053                                 | 0.7859884 | 2.4333244 | 3.0468391 | -0.3929942 ±j               | 1.5095960 | 1.9846498  |  |
|        | 1.40 | 2.423                                 | 0.8845975 | 2.5498094 | 3.3317143 | -0.4422987 ±j               | 1.5343341 | 1.8051286  |  |
|        | 1.45 | 2.810                                 | 0.9788494 | 2.6534120 | 3.6250000 | -0.4894247 ±j               | 1.5536652 | 1.6641270  |  |
|        | 1.50 | 3.210                                 | 1.0682132 | 2.7450465 | 3.9270510 | -0.5341066 ±j               | 1.5683675 | 1.5510182  |  |
|        | 1.70 | 4.888                                 | 1.3729001 | 3.0119431 | 5.2271136 | -0.6864500 ±j               | 1.5939666 | 1.2641088  |  |
|        | 2.00 | 7.418                                 | 1.6868869 | 3.2140923 | 7.4641016 | -0.8434434 ±j               | 1.5819910 | 1.0627796  |  |
| 3      | 1.05 | 1.748                                 | 0.0897070 | 1.1669690 | 1.2054102 | -0.0448535 ±j<br>-2.8129655 | 1.0793318 | 12.0421358 |  |
|        | 1.10 | 3.374                                 | 0.1708429 | 1.2658398 | 1.3703136 | -0.0854214 ±j<br>-2.2408323 | 1.1218480 | 6.5855565  |  |
|        | 1.15 | 5.051                                 | 0.2460333 | 1.3387389 | 1.5336053 | -0.1230166 ±j<br>-1.9362904 | 1.1504807 | 4.7027738  |  |
|        | 1.20 | 6.691                                 | 0.3135322 | 1.3940819 | 1.6996171 | -0.1567661 ±j<br>-1.7441023 | 1.1702591 | 3.7658411  |  |
|        | 1.25 | 8.257                                 | 0.3731744 | 1.4369652 | 1.8699785 | -0.1865872 ±j<br>-1.6115630 | 1.1841243 | 3.2122642  |  |
|        | 1.30 | 9.736                                 | 0.4255598 | 1.4708184 | 2.0454918 | -0.2127799 ±j<br>-1.5147370 | 1.1939611 | 2.8498298  |  |
|        | 1.35 | 11.129                                | 0.4715398 | 1.4980049 | 2.2266128 | -0.2357699 ±j<br>-1.4410174 | 1.2010068 | 2.5956029  |  |
|        | 1.40 | 12.440                                | 0.5119804 | 1.5201793 | 2.4136247 | -0.2559902 ±j<br>-1.3831048 | 1.2060880 | 2.4082082  |  |
|        | 1.45 | 13.678                                | 0.5476699 | 1.5385189 | 2.6067151 | -0.2738350 ±j<br>-1.3364769 | 1.2097658 | 2.2648139  |  |
|        | 1.50 | 14.848                                | 0.5792925 | 1.5538762 | 2.8060141 | -0.2896462 ±j<br>-1.2981820 | 1.2124279 | 2.1518417  |  |
|        | 1.70 | 18.981                                | 0.6754341 | 1.5959268 | 3.6668482 | -0.3377170 ±j<br>-1.1959479 | 1.2173225 | 1.8703527  |  |
|        | 2.00 | 24.010                                | 0.7637170 | 1.6291078 | 5.1532091 | -0.3818585 ±j<br>-1.1167651 | 1.2179047 | 1.6712540  |  |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.1$ |                        |                        |                         |                                              |                        |                         |
|--------|------|---------------------------------------|------------------------|------------------------|-------------------------|----------------------------------------------|------------------------|-------------------------|
| n      | Wp   | As(dB)                                | A1                     | B1                     | C1                      | P1                                           | Q1                     |                         |
| 4      | 1.05 | 6.397                                 | 1.2371522<br>0.0751961 | 1.6896437<br>1.0954217 | 1.1536336<br>3.3125181  | -0.6185761 ±j<br>-0.0375981 ±j               | 1.1432442<br>1.0459484 | 1.0506896<br>13.9185860 |
|        | 1.10 | 10.721                                | 1.4076325<br>0.1334670 | 1.4488989<br>1.1410789 | 1.2909254<br>4.3499304  | -0.7038163 ±j<br>-0.0667335 ±j               | 0.9764945<br>1.0661264 | 0.8551253<br>8.0035722  |
|        | 1.15 | 14.161                                | 0.1795269<br>1.4483564 | 1.1711529<br>1.2814307 | 1.4297858<br>5.2979222  | -0.0897635 ±j<br>-0.7241782 ±j               | 1.0784690<br>0.8700555 | 6.0280545<br>0.7815776  |
|        | 1.20 | 17.051                                | 0.2168967<br>1.4537055 | 1.1930444<br>1.1653646 | 1.5724303<br>6.2244021  | -0.1084483 ±j<br>-0.7268528 ±j               | 1.0868686<br>0.7981539 | 5.0358806<br>0.7425992  |
|        | 1.25 | 19.566                                | 0.2478803<br>1.4475917 | 1.2098972<br>1.0812014 | 1.7197065<br>7.1532769  | -0.1239401 ±j<br>-0.7237959 ±j               | 1.0929483<br>0.7465393 | 4.4374373<br>0.7183022  |
|        | 1.30 | 21.809                                | 0.2740076<br>1.4377377 | 1.2233502<br>1.0176401 | 1.8720353<br>8.0959007  | -0.1370038 ±j<br>-0.7188689 ±j               | 1.0975337<br>0.7077200 | 4.0365731<br>0.7016450  |
|        | 1.35 | 23.843                                | 0.2963381<br>1.4269898 | 1.2343686<br>0.9680478 | 2.0296574<br>9.0585736  | -0.1481691 ±j<br>-0.7134949 ±j               | 1.1010970<br>0.6774754 | 3.7491683<br>0.6894893  |
|        | 1.40 | 25.711                                | 1.4164597<br>0.3156343 | 0.9283372<br>1.2435689 | 2.1927230<br>10.0451492 | -0.7082299 ±j<br>-0.1578172 ±j               | 0.6532593<br>1.1039305 | 0.6802188<br>3.5330572  |
|        | 1.45 | 27.444                                | 1.4065737<br>0.3324624 | 0.8958663<br>1.2513685 | 2.3613317<br>11.0581496 | -0.7032868 ±j<br>-0.1662312 ±j               | 0.6334461<br>1.1062259 | 0.6729133<br>3.3647290  |
|        | 1.50 | 29.064                                | 1.3974686<br>0.3472533 | 0.8688551<br>1.2580625 | 2.5355530<br>12.0993095 | -0.6987343 ±j<br>-0.1736266 ±j               | 0.6169485<br>1.1081138 | 0.6670089<br>3.2300164  |
|        | 1.70 | 34.691                                | 1.3684817<br>0.3917995 | 0.7951570<br>1.2773866 | 3.2893923<br>16.5660270 | -0.6842408 ±j<br>-0.1958998 ±j               | 0.5718142<br>1.1131082 | 0.6516095<br>2.8846778  |
|        | 2.00 | 41.447                                | 1.3408862<br>0.4325087 | 0.7364029<br>1.2940528 | 4.5932605<br>24.2272012 | -0.6704431 ±j<br>-0.2162544 ±j               | 0.5356388<br>1.1168200 | 0.6399791<br>2.6301536  |
| 5      | 1.05 | 13.841                                | 0.5338036<br>0.0602292 | 1.1032632<br>1.0577721 | 1.1334220<br>1.7737385  | -0.2669018 ±j<br>-0.0301146 ±j<br>-1.1288581 | 1.0158871<br>1.0280395 | 1.9676962<br>17.0761076 |
|        | 1.10 | 20.050                                | 0.6593832<br>0.0990666 | 1.0174748<br>1.0826942 | 1.2593204<br>2.1930925  | -0.3296916 ±j<br>-0.0495333 ±j<br>-0.9321125 | 0.9532986<br>1.0393462 | 1.5297623<br>10.5033017 |
|        | 1.15 | 24.594                                | 0.7214437<br>0.1280050 | 0.9558110<br>1.0993189 | 1.3881033<br>2.5834170  | -0.3607219 ±j<br>-0.0640025 ±j<br>-0.8393853 | 0.9086753<br>1.0465288 | 1.3551381<br>8.1909607  |
|        | 1.20 | 28.303                                | 0.7583106<br>0.1508598 | 0.9100808<br>1.1116471 | 1.5211268<br>2.9683674  | -0.3791553 ±j<br>-0.0754299 ±j<br>-0.7828577 | 0.8753982<br>1.0516451 | 1.2580354<br>6.9889172  |
|        | 1.25 | 31.492                                | 0.7824851<br>0.1695225 | 0.8748385<br>1.1212936 | 1.6589139<br>3.3563960  | -0.3912426 ±j<br>-0.0847613 ±j<br>-0.7440468 | 0.8495691<br>1.0555137 | 1.1953301<br>6.2464357  |
|        | 1.30 | 34.318                                | 0.7993773<br>0.1851072 | 0.8468405<br>1.1290993 | 1.8017262<br>3.7515494  | -0.3996886 ±j<br>-0.0925536 ±j<br>-0.7154823 | 0.8289086<br>1.0585524 | 1.1511953<br>5.7404070  |
|        | 1.35 | 36.874                                | 0.8117251<br>0.1983374 | 0.8240639<br>1.1355652 | 1.9497131<br>4.1560845  | -0.4058625 ±j<br>-0.0991687 ±j<br>-0.6934718 | 0.8119972<br>1.0610046 | 1.1183339<br>5.3728091  |
|        | 1.40 | 39.217                                | 0.8210632<br>0.2097134 | 0.8051821<br>1.1410162 | 2.1029685<br>4.5713865  | -0.4105316 ±j<br>-0.1048567 ±j<br>-0.6759476 | 0.7979009<br>1.0630246 | 1.0928749<br>5.0935390  |
|        | 1.45 | 41.388                                | 0.8283168<br>0.2195971 | 0.7892866<br>1.1456754 | 2.2615546<br>4.9983644  | -0.4141584 ±j<br>-0.1097986 ±j<br>-0.6616480 | 0.7859767<br>1.0647158 | 1.0725583<br>4.8742087  |
|        | 1.50 | 43.415                                | 0.8340749<br>0.2282589 | 0.7757333<br>1.1497029 | 2.4255147<br>5.4376446  | -0.4170375 ±j<br>-0.1141294 ±j<br>-0.6497532 | 0.7757661<br>1.0661507 | 1.0559690<br>4.6974823  |
|        | 1.70 | 50.454                                | 0.8483993<br>0.2542239 | 0.7371098<br>1.1614846 | 3.1356145<br>7.3252003  | -0.4241996 ±j<br>-0.1271120 ±j<br>-0.6171800 | 0.7464345<br>1.0701996 | 1.0119657<br>4.2392622  |
|        | 2.00 | 58.901                                | 0.8581834<br>0.2778251 | 0.7044355<br>1.1718438 | 4.3649509<br>10.5677323 | -0.4290917 ±j<br>-0.1389126 ±j<br>-0.5909334 | 0.7213292<br>1.0735674 | 0.9780038<br>3.8963985  |

| CASE A |        | Passband Ripple: Ap(dB)=0.1 |           |           |               |               |           |            |  |
|--------|--------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|--|
| n      | Ws     | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |  |
| 6      | 1.05   | 22.088                      | 1.2940518 | 0.8136624 | 1.1233258     | -0.6470259 ±j | 0.6285061 | 0.6970605  |  |
|        |        |                             | 0.3030225 | 0.9940022 | 1.4386640     | -0.1515113 ±j | 0.9854170 | 3.2901730  |  |
|        |        |                             | 0.0467711 | 1.0376442 | 6.5287683     | -0.0233855 ±j | 1.0183798 | 21.7794462 |  |
| 1.10   | 29.686 | 1.1995415                   | 0.6276147 | 1.2433620 | -0.5997708 ±j | 0.5175807     | 0.6604368 |            |  |
|        |        |                             | 0.3888995 | 0.9433614 | 1.7140833     | -0.1944498 ±j | 0.9516043 | 2.4974778  |  |
|        |        |                             | 0.0739273 | 1.0537144 | 8.8264550     | -0.0369636 ±j | 1.0258402 | 13.8853520 |  |
| 1.15   | 35.170 | 1.1383264                   | 0.5385703 | 1.3669587 | -0.5691632 ±j | 0.4632748     | 0.6446951 |            |  |
|        |        |                             | 0.4380848 | 0.9069349 | 1.9755745     | -0.2190424 ±j | 0.9267984 | 2.1738517  |  |
|        |        |                             | 0.0937264 | 1.0645973 | 10.9158033    | -0.0468632 ±j | 1.0307285 | 11.0085697 |  |
| 1.20   | 39.630 | 1.0952568                   | 0.4845270 | 1.4950350 | -0.5476284 ±j | 0.4296861     | 0.6355402 |            |  |
|        |        |                             | 0.4708586 | 0.8793391 | 2.2359899     | -0.2354293 ±j | 0.9076960 | 1.9915336  |  |
|        |        |                             | 0.1091892 | 1.0727444 | 12.9526713    | -0.0545946 ±j | 1.0342939 | 9.4856829  |  |
| 1.25   | 43.461 | 1.0630589                   | 0.4477376 | 1.6279471 | -0.5315295 ±j | 0.4064653     | 0.6294401 |            |  |
|        |        |                             | 0.4944813 | 0.8576194 | 2.5000000     | -0.2472406 ±j | 0.8924637 | 1.8728261  |  |
|        |        |                             | 0.1217254 | 1.0791620 | 14.9917591    | -0.0608627 ±j | 1.0370428 | 8.5341839  |  |
| 1.30   | 46.854 | 1.0379663                   | 0.4209084 | 1.7658735 | -0.5189831 ±j | 0.3893134     | 0.6250439 |            |  |
|        |        |                             | 0.5123764 | 0.8400441 | 2.7698611     | -0.2561882 ±j | 0.8800067 | 1.7888005  |  |
|        |        |                             | 0.1321410 | 1.0843814 | 17.0590037    | -0.0660705 ±j | 1.0392382 | 7.8804954  |  |
| 1.35   | 49.921 | 1.0178147                   | 0.4004163 | 1.9089166 | -0.5089074 ±j | 0.3760713     | 0.6217090 |            |  |
|        |        |                             | 0.5264148 | 0.8255203 | 3.0468391     | -0.2632074 ±j | 0.8696218 | 1.7259800  |  |
|        |        |                             | 0.1409492 | 1.0887227 | 19.1687817    | -0.0704746 ±j | 1.0410360 | 7.4028010  |  |
| 1.40   | 52.734 | 1.0012590                   | 0.3842328 | 2.0571405 | -0.5006295 ±j | 0.3655173     | 0.6190857 |            |  |
|        |        |                             | 0.5377196 | 0.8133174 | 3.3317143     | -0.2688598 ±j | 0.8608321 | 1.6771587  |  |
|        |        |                             | 0.1485004 | 1.0923951 | 21.3298812    | -0.0742502 ±j | 1.0425363 | 7.0382111  |  |
| 1.45   | 55.339 | 0.9874124                   | 0.3711241 | 2.2105880 | -0.4937062 ±j | 0.3569009     | 0.6169656 |            |  |
|        |        |                             | 0.5470112 | 0.8029256 | 3.6250000     | -0.2735056 ±j | 0.8532997 | 1.6381039  |  |
|        |        |                             | 0.1550453 | 1.0955433 | 23.5480505    | -0.0775227 ±j | 1.0438072 | 6.7508142  |  |
| 1.50   | 57.772 | 0.9756631                   | 0.3602921 | 2.3692888 | -0.4878315 ±j | 0.3497321     | 0.6152159 |            |  |
|        |        |                             | 0.5547753 | 0.7939763 | 3.9270510     | -0.2773876 ±j | 0.8467777 | 1.6061522  |  |
|        |        |                             | 0.1607698 | 1.0982714 | 25.8272420    | -0.0803849 ±j | 1.0448970 | 6.5185410  |  |
| 1.70   | 66.219 | 0.9424109                   | 0.3310032 | 3.0569811 | -0.4712054 ±j | 0.3301040     | 0.6104861 |            |  |
|        |        |                             | 0.5761225 | 0.7680057 | 5.2271136     | -0.2880612 ±j | 0.8276633 | 1.5211339  |  |
|        |        |                             | 0.1778726 | 1.1062894 | 35.6008780    | -0.0889363 ±j | 1.0480361 | 5.9132385  |  |
| 2.00   | 76.355 | 0.9144698                   | 0.3078514 | 4.2481552 | -0.4572349 ±j | 0.3143051     | 0.6067381 |            |  |
|        |        |                             | 0.5932993 | 0.7454672 | 7.4641016     | -0.2966497 ±j | 0.8108429 | 1.4552594  |  |
|        |        |                             | 0.1933521 | 1.1133872 | 52.3568408    | -0.0966761 ±j | 1.0507335 | 5.4572536  |  |

| CASE A |        | Passband Ripple: Ap(dB)=0.1 |           |           |               |               |           |            |
|--------|--------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws     | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 7      | 1.05   | 30.470                      | 0.7247727 | 0.7573507 | 1.1175213     | -0.3623864 ±j | 0.7912186 | 1.2007336  |
|        |        |                             | 0.1958600 | 0.9690027 | 1.3083409     | -0.0979300 ±j | 0.9794960 | 5.0259332  |
|        |        |                             | 0.0365489 | 1.0263126 | 2.7143721     | -0.0182745 ±j | 1.0129060 | 27.7182018 |
|        |        |                             |           |           |               | -0.6979132    |           |            |
| 1.10   | 39.357 | 0.7452119                   | 0.6384996 | 1.2341277 | -0.3726060 ±j | 0.7068695     | 1.0722610 |            |
|        |        |                             | 0.2582353 | 0.9333386 | 1.5239435     | -0.1291176 ±j | 0.9574274 | 3.7411408  |
|        |        |                             | 0.0565582 | 1.0376826 | 3.5147693     | -0.0282791 ±j | 1.0182745 | 18.0109459 |
|        |        |                             |           |           |               | -0.5996296    |           |            |
| 1.15   | 45.758 | 0.7459005                   | 0.5735305 | 1.3546897 | -0.3729502 ±j | 0.6591196     | 1.0153069 |            |
|        |        |                             | 0.2963281 | 0.9077742 | 1.7321918     | -0.1481640 ±j | 0.9411810 | 3.2152600  |
|        |        |                             | 0.0709754 | 1.0454452 | 4.2484927     | -0.0354877 ±j | 1.0218541 | 14.4059725 |
|        |        |                             |           |           |               | -0.5506092    |           |            |
| 1.20   | 50.963 | 0.7423895                   | 0.5311540 | 1.4798722 | -0.3711947 ±j | 0.6271909     | 0.9816992 |            |
|        |        |                             | 0.3228959 | 0.8882742 | 1.9413408     | -0.1614480 ±j | 0.9285520 | 2.9188447  |
|        |        |                             | 0.0821607 | 1.0512838 | 4.9666973     | -0.0410804 ±j | 1.0244980 | 12.4794606 |
|        |        |                             |           |           |               | -0.5197204    |           |            |
| 1.25   | 55.432 | 0.7379320                   | 0.5009275 | 1.6099341 | -0.3689660 ±j | 0.6039798     | 0.9591159 |            |
|        |        |                             | 0.3427340 | 0.8728061 | 2.1544332     | -0.1713670 ±j | 0.9183896 | 2.7258483  |
|        |        |                             | 0.0911889 | 1.0558981 | 5.6874343     | -0.0455944 ±j | 1.0265570 | 11.2685798 |
|        |        |                             |           |           |               | -0.4980422    |           |            |
| 1.30   | 59.391 | 0.7334671                   | 0.4781411 | 1.7450051 | -0.3667335 ±j | 0.5862146     | 0.9427518 |            |
|        |        |                             | 0.3581982 | 0.8601981 | 2.3729509     | -0.1790991 ±j | 0.9100119 | 2.5892612  |
|        |        |                             | 0.0986655 | 1.0596604 | 6.4192876     | -0.0493328 ±j | 1.0282153 | 10.4332088 |
|        |        |                             |           |           |               | -0.4818348    |           |            |
| 1.35   | 62.970 | 0.7292899                   | 0.4602975 | 1.8851599 | -0.3646449 ±j | 0.5721290     | 0.9302916 |            |
|        |        |                             | 0.3706217 | 0.8497114 | 2.5977295     | -0.1853109 ±j | 0.9029791 | 2.4871665  |
|        |        |                             | 0.1049727 | 1.0627961 | 7.1670237     | -0.0524864 ±j | 1.0295831 | 9.8208371  |
|        |        |                             |           |           |               | -0.4691978    |           |            |
| 1.40   | 66.251 | 0.7254806                   | 0.4459285 | 2.0304452 | -0.3627403 ±j | 0.5606674     | 0.9204640 |            |
|        |        |                             | 0.3808301 | 0.8408500 | 2.8292857     | -0.1904151 ±j | 0.8969906 | 2.4078419  |
|        |        |                             | 0.1103692 | 1.0654530 | 7.9335602     | -0.0551846 ±j | 1.0307316 | 9.3523186  |
|        |        |                             |           |           |               | -0.4590434    |           |            |
| 1.45   | 69.290 | 0.7220415                   | 0.4341057 | 2.1808921 | -0.3610208 ±j | 0.5511531     | 0.9125056 |            |
|        |        |                             | 0.3893678 | 0.8332658 | 3.0679607     | -0.1946839 ±j | 0.8918318 | 2.3444004  |
|        |        |                             | 0.1150390 | 1.0677339 | 8.7208069     | -0.0575195 ±j | 1.0317099 | 8.9822745  |
|        |        |                             |           |           |               | -0.4506960    |           |            |
| 1.50   | 72.129 | 0.7189472                   | 0.4242098 | 2.3365223 | -0.3594736 ±j | 0.5431285     | 0.9059273 |            |
|        |        |                             | 0.3966107 | 0.8267054 | 3.3139902     | -0.1983053 ±j | 0.8873446 | 2.2925086  |
|        |        |                             | 0.1191180 | 1.0697129 | 9.5300781     | -0.0595590 ±j | 1.0325529 | 8.6827249  |
|        |        |                             |           |           |               | -0.4437103    |           |            |
| 1.70   | 81.984 | 0.7093421                   | 0.3968624 | 3.0111362 | -0.3546710 ±j | 0.5206447     | 0.8881049 |            |
|        |        |                             | 0.4170888 | 0.8075087 | 4.3744590     | -0.2085444 ±j | 0.8740812 | 2.1544928  |
|        |        |                             | 0.1312766 | 1.0755421 | 13.0029293    | -0.0656383 ±j | 1.0350042 | 7.8999863  |
|        |        |                             |           |           |               | -0.4243839    |           |            |
| 2.00   | 93.809 | 0.7003389                   | 0.3746156 | 4.1800429 | -0.3501695 ±j | 0.5019930     | 0.8739462 |            |
|        |        |                             | 0.4342505 | 0.7906476 | 6.2017764     | -0.2171253 ±j | 0.8622669 | 2.0476284  |
|        |        |                             | 0.1422479 | 1.0807187 | 18.9610948    | -0.0711239 ±j | 1.0371403 | 7.3082014  |
|        |        |                             |           |           |               | -0.4086024    |           |            |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.1$ |           |           |                |                |           |            |
|--------|---------|---------------------------------------|-----------|-----------|----------------|----------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1             | P1             | Q1        |            |
| 8      | 1.05    | 38.872                                | 1.0368542 | 0.4354101 | 1.1138641      | -0.5184271 ± j | 0.4082198 | 0.6364020  |
|        |         |                                       | 0.4472591 | 0.7840603 | 1.2431181      | -0.2236295 ± j | 0.8567672 | 1.9797738  |
|        |         |                                       | 0.1372550 | 0.9650371 | 1.9061395      | -0.0686275 ± j | 0.9799629 | 7.1572113  |
|        |         |                                       | 0.0290618 | 1.0194208 | 11.0466061     | -0.0145309 ± j | 1.0095591 | 34.7419168 |
| 1.10   | 49.032  | 0.9335258                             | 0.3367666 | 1.2282855 | -0.4667629 ± j | 0.3448174      | 0.6216390 |            |
|        |         |                                       | 0.4928316 | 0.6942689 | 1.4271032      | -0.2464158 ± j | 0.7959574 | 1.6906950  |
|        |         |                                       | 0.1846803 | 0.9378677 | 2.3804113      | -0.0923402 ± j | 0.9640233 | 5.2438492  |
|        |         |                                       | 0.0444102 | 1.0279338 | 15.1062239     | -0.0222051 ± j | 1.0136275 | 22.8296602 |
| 1.15   | 56.348  | 0.8761278                             | 0.2901664 | 1.3469136 | -0.4380639 ± j | 0.3134749      | 0.6148316 |            |
|        |         |                                       | 0.5126347 | 0.6414229 | 1.6072975      | -0.2563174 ± j | 0.7587650 | 1.5622993  |
|        |         |                                       | 0.2146871 | 0.9184804 | 2.8200771      | -0.1073436 ± j | 0.9523433 | 4.4640491  |
|        |         |                                       | 0.0553860 | 1.0337746 | 18.7925269     | -0.0276930 ± j | 1.0163699 | 18.3574655 |
| 1.20   | 62.296  | 0.8380138                             | 0.2619306 | 1.4702527 | -0.4190069 ± j | 0.2938772      | 0.6107197 |            |
|        |         |                                       | 0.5234228 | 0.6054164 | 1.7895085      | -0.2617114 ± j | 0.7327507 | 1.4865327  |
|        |         |                                       | 0.2361306 | 0.9036635 | 3.2528314      | -0.1180653 ± j | 0.9432519 | 4.0257905  |
|        |         |                                       | 0.0638644 | 1.0381803 | 22.3835994     | -0.0319322 ± j | 1.0184109 | 15.9542986 |
| 1.25   | 67.403  | 0.8103889                             | 0.2426986 | 1.5984994 | -0.4051944 ± j | 0.2802072      | 0.6079112 |            |
|        |         |                                       | 0.5299998 | 0.5789572 | 1.9759013      | -0.2649999 ± j | 0.7132547 | 1.4356465  |
|        |         |                                       | 0.2524404 | 0.8918738 | 3.6885364      | -0.1262202 ± j | 0.9359179 | 3.7410448  |
|        |         |                                       | 0.0706874 | 1.0416692 | 25.9769795     | -0.0353437 ± j | 1.0200098 | 14.4385176 |
| 1.30   | 71.928  | 0.7892731                             | 0.2286579 | 1.7317524 | -0.3946366 ± j | 0.2700368      | 0.6058509 |            |
|        |         |                                       | 0.5342972 | 0.5585690 | 2.1675370      | -0.2671486 ± j | 0.6979976 | 1.3987998  |
|        |         |                                       | 0.2653424 | 0.8822335 | 4.1319051      | -0.1326712 ± j | 0.9298558 | 3.5398524  |
|        |         |                                       | 0.0763257 | 1.0445181 | 29.6189023     | -0.0381628 ± j | 1.0213039 | 13.3902106 |
| 1.35   | 76.018  | 0.7725392                             | 0.2179207 | 1.8700686 | -0.3862696 ± j | 0.2621383      | 0.6042668 |            |
|        |         |                                       | 0.5372416 | 0.5423314 | 2.3650162      | -0.2686208 ± j | 0.6856925 | 1.3707642  |
|        |         |                                       | 0.2758335 | 0.8741912 | 4.5855625      | -0.1379167 ± j | 0.9247541 | 3.3896609  |
|        |         |                                       | 0.0810740 | 1.0468953 | 33.3349904     | -0.0405370 ± j | 1.0223757 | 12.6203177 |
| 1.40   | 79.768  | 0.7589238                             | 0.2094313 | 2.0134836 | -0.3794619 ± j | 0.2558123      | 0.6030073 |            |
|        |         |                                       | 0.5393302 | 0.5290782 | 2.5687116      | -0.2696651 ± j | 0.6755434 | 1.3486683  |
|        |         |                                       | 0.2845419 | 0.8673770 | 5.0511190      | -0.1422709 ± j | 0.9203999 | 3.2730888  |
|        |         |                                       | 0.0851311 | 1.0489115 | 37.1409040     | -0.0425656 ± j | 1.0232789 | 12.0304268 |
| 1.45   | 83.242  | 0.7476198                             | 0.2025475 | 2.1620209 | -0.3738099 ± j | 0.2506264      | 0.6019807 |            |
|        |         |                                       | 0.5408517 | 0.5180528 | 2.7788694      | -0.2704259 ± j | 0.6670252 | 1.3307878  |
|        |         |                                       | 0.2918882 | 0.8615306 | 5.5296305      | -0.1459441 ± j | 0.9166411 | 3.1799390  |
|        |         |                                       | 0.0886381 | 1.0506437 | 41.0468858     | -0.0443191 ± j | 1.0240506 | 11.5639750 |
| 1.50   | 86.485  | 0.7380833                             | 0.1968538 | 2.3156973 | -0.3690417 ± j | 0.2462966      | 0.6011273 |            |
|        |         |                                       | 0.5419834 | 0.5087392 | 2.9956604      | -0.2709917 ± j | 0.6597748 | 1.3160175  |
|        |         |                                       | 0.2981673 | 0.8564625 | 6.0218242      | -0.1490836 ± j | 0.9133655 | 3.1038032  |
|        |         |                                       | 0.0916986 | 1.0521477 | 45.0599777     | -0.0458493 ± j | 1.0247173 | 11.1860206 |
| 1.70   | 97.748  | 0.7113421                             | 0.1814302 | 2.9819909 | -0.3556710 ± j | 0.2343678      | 0.5987924 |            |
|        |         |                                       | 0.5444023 | 0.4825898 | 3.9311886      | -0.2722011 ± j | 0.6391372 | 1.2760542  |
|        |         |                                       | 0.3161642 | 0.8415698 | 8.1360237      | -0.1580821 ± j | 0.9036481 | 2.9015656  |
|        |         |                                       | 0.1008063 | 1.0565834 | 62.2665524     | -0.0504032 ± j | 1.0266659 | 10.1968030 |
| 2.00   | 111.263 | 0.6891227                             | 0.1692050 | 4.1367342 | -0.3445613 ± j | 0.2246831      | 0.5969117 |            |
|        |         |                                       | 0.5455491 | 0.4608600 | 5.5450630      | -0.2727745 ± j | 0.6216543 | 1.2443734  |
|        |         |                                       | 0.3315429 | 0.8284074 | 11.7666735     | -0.1657715 ± j | 0.8949454 | 2.7452520  |
|        |         |                                       | 0.1090070 | 1.0605292 | 91.7615329     | -0.0545035 ± j | 1.0283767 | 9.4472869  |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.1$ |           |           |               |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1            | P1            | Q1        |            |
| 9      | 1.05    | 47.276                                | 0.7105134 | 0.5068857 | 1.1114059     | -0.3552567 ±j | 0.6169914 | 1.0020346  |
|        |         |                                       | 0.2991024 | 0.8199459 | 1.2054102     | -0.1495512 ±j | 0.8930735 | 3.0274204  |
|        |         |                                       | 0.1017253 | 0.9669314 | 1.5942707     | -0.0508626 ±j | 0.9820104 | 9.6664915  |
|        |         |                                       | 0.0235444 | 1.0149351 | 3.9936736     | -0.0117722 ±j | 1.0073711 | 42.7889617 |
|        |         |                                       |           |           |               |               |           | -0.5141787 |
| 1.10   | 58.707  | 0.6834614                             | 0.4136007 | 1.2243475 | -0.3417307 ±j | 0.5448126     | 0.9409718 |            |
|        |         |                                       | 0.3462971 | 0.7478414 | 1.3703136     | -0.1731486 ±j | 0.8472668 | 2.4972147  |
|        |         |                                       | 0.1390258 | 0.9453313 | 1.9377187     | -0.0695129 ±j | 0.9697934 | 6.9935346  |
|        |         |                                       | 0.0356876 | 1.0215641 | 5.2992478     | -0.0178438 ±j | 1.0105670 | 28.3214444 |
|        |         |                                       |           |           |               |               |           | -0.4482749 |
| 1.15   | 66.937  | 0.6628505                             | 0.3659231 | 1.3416657 | -0.3314252 ±j | 0.5060439     | 0.9125977 |            |
|        |         |                                       | 0.3705275 | 0.7035213 | 1.5336053     | -0.1852637 ±j | 0.8180456 | 2.2636964  |
|        |         |                                       | 0.1631578 | 0.9299806 | 2.2599957     | -0.0815789 ±j | 0.9608983 | 5.9105667  |
|        |         |                                       | 0.0443266 | 1.0261276 | 6.4899114     | -0.0221633 ±j | 1.0127371 | 22.8526217 |
|        |         |                                       |           |           |               |               |           | -0.4145285 |
| 1.20   | 73.629  | 0.6471966                             | 0.3358266 | 1.4637563 | -0.3235983 ±j | 0.4807398     | 0.8954088 |            |
|        |         |                                       | 0.3856160 | 0.6724942 | 1.6996171     | -0.1928080 ±j | 0.7970692 | 2.1266166  |
|        |         |                                       | 0.1806628 | 0.9182451 | 2.5791043     | -0.0903314 ±j | 0.9539839 | 5.3040863  |
|        |         |                                       | 0.0509798 | 1.0295766 | 7.6523927     | -0.0254899 ±j | 1.0143603 | 19.9035615 |
|        |         |                                       |           |           |               |               |           | -0.3929724 |
| 1.25   | 79.375  | 0.6349287                             | 0.3147842 | 1.5907740 | -0.3174643 ±j | 0.4626019     | 0.8836524 |            |
|        |         |                                       | 0.3959718 | 0.6492537 | 1.8699785     | -0.1979859 ±j | 0.7810604 | 2.0348997  |
|        |         |                                       | 0.1941269 | 0.9088953 | 2.9015215     | -0.0970634 ±j | 0.9484060 | 4.9110144  |
|        |         |                                       | 0.0563231 | 1.0323114 | 8.8171818     | -0.0281615 ±j | 1.0156369 | 18.0392743 |
|        |         |                                       |           |           |               |               |           | -0.3777125 |
| 1.30   | 84.465  | 0.6250504                             | 0.2991359 | 1.7227963 | -0.3125252 ±j | 0.4488473     | 0.8750225 |            |
|        |         |                                       | 0.4035233 | 0.6310858 | 2.0454918     | -0.2017616 ±j | 0.7683606 | 1.9686822  |
|        |         |                                       | 0.2048724 | 0.9012385 | 3.2303598     | -0.1024362 ±j | 0.9437930 | 4.6337914  |
|        |         |                                       | 0.0607317 | 1.0345467 | 9.9987492     | -0.0303658 ±j | 1.0166733 | 16.7478847 |
|        |         |                                       |           |           |               |               |           | -0.3662342 |
| 1.35   | 89.067  | 0.6169231                             | 0.2870033 | 1.8598680 | -0.3084615 ±j | 0.4380122     | 0.8683851 |            |
|        |         |                                       | 0.4092664 | 0.6164517 | 2.2266128     | -0.2046332 ±j | 0.7580085 | 1.9184189  |
|        |         |                                       | 0.2136732 | 0.8948413 | 3.5673591     | -0.1068366 ±j | 0.9399081 | 4.4271378  |
|        |         |                                       | 0.0644400 | 1.0364133 | 11.2051201    | -0.0322200 ±j | 1.0175339 | 15.7983305 |
|        |         |                                       |           |           |               |               |           | -0.3572440 |
| 1.40   | 93.285  | 0.6101198                             | 0.2773069 | 2.0020170 | -0.3050599 ±j | 0.4292381     | 0.8631080 |            |
|        |         |                                       | 0.4137726 | 0.6043974 | 2.4136247     | -0.2068863 ±j | 0.7493968 | 1.8788823  |
|        |         |                                       | 0.2210226 | 0.8894134 | 3.9135894     | -0.1105113 ±j | 0.9365899 | 4.2669260  |
|        |         |                                       | 0.0676055 | 1.0379975 | 12.4412023    | -0.0338028 ±j | 1.0182607 | 15.0700994 |
|        |         |                                       |           |           |               |               |           | -0.3499945 |
| 1.45   | 97.193  | 0.6043442                             | 0.2693763 | 2.1492622 | -0.3021721 ±j | 0.4219814     | 0.8588065 |            |
|        |         |                                       | 0.4173950 | 0.5942933 | 2.6067151     | -0.2086975 ±j | 0.7421177 | 1.8469415  |
|        |         |                                       | 0.2272544 | 0.8847504 | 4.2697534     | -0.1136272 ±j | 0.9337233 | 4.1390251  |
|        |         |                                       | 0.0703396 | 1.0393593 | 13.7102067    | -0.0351698 ±j | 1.0188829 | 14.4938213 |
|        |         |                                       |           |           |               |               |           | -0.3440184 |
| 1.50   | 100.842 | 0.5993831                             | 0.2627701 | 2.3016164 | -0.2996915 ±j | 0.4158787     | 0.8552312 |            |
|        |         |                                       | 0.4203642 | 0.5857034 | 2.8060141     | -0.2101821 ±j | 0.7358851 | 1.8205942  |
|        |         |                                       | 0.2326043 | 0.8807033 | 4.6363361     | -0.1163022 ±j | 0.9312234 | 4.0345678  |
|        |         |                                       | 0.0727240 | 1.0405421 | 15.0143415    | -0.0363620 ±j | 1.0194213 | 14.0265853 |
|        |         |                                       |           |           |               |               |           | -0.3390055 |
| 1.70   | 113.513 | 0.5850488                             | 0.2446596 | 2.9622803 | -0.2925244 ±j | 0.3988598     | 0.8454523 |            |
|        |         |                                       | 0.4282446 | 0.5613150 | 3.6668482     | -0.2141223 ±j | 0.7179601 | 1.7494899  |
|        |         |                                       | 0.2480616 | 0.8687835 | 6.2125942     | -0.1240308 ±j | 0.9237964 | 3.7574763  |
|        |         |                                       | 0.0798115 | 1.0440331 | 20.6082544    | -0.0399058 ±j | 1.0209998 | 12.8024045 |
|        |         |                                       |           |           |               |               |           | -0.3250833 |
| 2.00   | 128.717 | 0.5726761                             | 0.2300769 | 4.1074418 | -0.2863380 ±j | 0.3848213     | 0.8375822 |            |
|        |         |                                       | 0.4342629 | 0.5407386 | 5.1532091     | -0.2171315 ±j | 0.7025614 | 1.6933273  |
|        |         |                                       | 0.2614208 | 0.8582118 | 8.9221914     | -0.1307104 ±j | 0.9171295 | 3.5437019  |
|        |         |                                       | 0.0861831 | 1.0471419 | 30.2010593    | -0.0430916 ±j | 1.0223918 | 11.8735518 |
|        |         |                                       |           |           |               |               |           | -0.3136570 |

| CASE A |         | Passband Ripple: Ap(dB)=0.1 |           |           |               |               |           |            |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 10     | 1.05    | 55.681                      | 0.8444173 | 0.2698548 | 1.1096718     | -0.4222086 ±j | 0.3026461 | 0.6151881  |
|        |         |                             | 0.4926823 | 0.5941999 | 1.1814619     | -0.2463411 ±j | 0.7304217 | 1.5645856  |
|        |         |                             | 0.2126339 | 0.8511860 | 1.4386640     | -0.1063170 ±j | 0.9164512 | 4.3389009  |
|        |         |                             | 0.0785527 | 0.9703031 | 2.5336482     | -0.0392764 ±j | 0.9842563 | 12.5398520 |
|        |         |                             | 0.0194072 | 1.0118536 | 16.8596102    | -0.0097036 ±j | 1.0058626 | 51.8317432 |
| 1.10   | 68.382  | 0.7547385                   | 0.2099361 | 1.2215638 | -0.3773693 ±j | 0.2598625     | 0.6070816 |            |
|        |         |                             | 0.5025003 | 0.5054635 | 1.3338339     | -0.2512502 ±j | 0.6650841 | 1.4148439  |
|        |         |                             | 0.2555688 | 0.7915883 | 1.7140833     | -0.1277844 ±j | 0.8804882 | 3.4813036  |
|        |         |                             | 0.1086680 | 0.9526515 | 3.2619424     | -0.0543340 ±j | 0.9745252 | 8.9818394  |
|        |         |                             | 0.0292527 | 1.0171690 | 23.1838025    | -0.0146264 ±j | 1.0084419 | 34.4770434 |
| 1.15   | 77.527  | 0.7062767                   | 0.1815115 | 1.3379528 | -0.3531383 ±j | 0.2383376     | 0.6032220 |            |
|        |         |                             | 0.5025314 | 0.4572162 | 1.4860346     | -0.2512657 ±j | 0.6277593 | 1.3455430  |
|        |         |                             | 0.2793819 | 0.7539233 | 1.9755745     | -0.1396910 ±j | 0.8569771 | 3.1078873  |
|        |         |                             | 0.1284492 | 0.9401479 | 3.9305495     | -0.0642246 ±j | 0.9674829 | 7.5486042  |
|        |         |                             | 0.0362313 | 1.0208372 | 28.9230322    | -0.0181157 ±j | 1.0102025 | 27.8864958 |
| 1.20   | 84.962  | 0.6744748                   | 0.1642343 | 1.4591581 | -0.3372374 ±j | 0.2247338     | 0.6008502 |            |
|        |         |                             | 0.5004717 | 0.4257019 | 1.6414311     | -0.2502359 ±j | 0.6025644 | 1.3036867  |
|        |         |                             | 0.2950320 | 0.7270787 | 2.2359899     | -0.1475160 ±j | 0.8398320 | 2.8901581  |
|        |         |                             | 0.1429426 | 0.9305912 | 4.5854918     | -0.0714713 ±j | 0.9620203 | 6.7486643  |
|        |         |                             | 0.0415942 | 1.0236134 | 34.5122486    | -0.0207971 ±j | 1.0115240 | 24.3240090 |
| 1.25   | 91.347  | 0.6515794                   | 0.1524388 | 1.5853042 | -0.3257897 ±j | 0.2151740     | 0.5992118 |            |
|        |         |                             | 0.4979529 | 0.4031661 | 1.8012990     | -0.2489764 ±j | 0.5841035 | 1.2751280  |
|        |         |                             | 0.3062333 | 0.7067098 | 2.5000000     | -0.1531167 ±j | 0.8265985 | 2.7451628  |
|        |         |                             | 0.1541733 | 0.9229731 | 5.2430274     | -0.0770867 ±j | 0.9576172 | 6.2313960  |
|        |         |                             | 0.0458946 | 1.0258167 | 40.1039839    | -0.0229473 ±j | 1.0125661 | 22.0685270 |
| 1.30   | 97.002  | 0.6341551                   | 0.1438115 | 1.7164539 | -0.3170776 ±j | 0.2080223     | 0.5980001 |            |
|        |         |                             | 0.4954500 | 0.3861333 | 1.9662686     | -0.2477250 ±j | 0.5698821 | 1.2542058  |
|        |         |                             | 0.3146870 | 0.6906288 | 2.7698611     | -0.1573435 ±j | 0.8160097 | 2.6408488  |
|        |         |                             | 0.1631887 | 0.9167297 | 5.9108926     | -0.0815944 ±j | 0.9539770 | 5.8671955  |
|        |         |                             | 0.0494388 | 1.0276189 | 45.7705353    | -0.0247194 ±j | 1.0134139 | 20.5044300 |
| 1.35   | 102.115 | 0.6203891                   | 0.1372044 | 1.8526432 | -0.3101945 ±j | 0.2024445     | 0.5970627 |            |
|        |         |                             | 0.4931127 | 0.3727633 | 2.1366988     | -0.2465564 ±j | 0.5585457 | 1.2381418  |
|        |         |                             | 0.3213055 | 0.6775736 | 3.0468391     | -0.1606527 ±j | 0.8073192 | 2.5618878  |
|        |         |                             | 0.1706076 | 0.9115092 | 6.5933849     | -0.0853038 ±j | 0.9509114 | 5.5960589  |
|        |         |                             | 0.0524175 | 1.0291246 | 51.5519660    | -0.0262088 ±j | 1.0141192 | 19.3534040 |
| 1.40   | 106.802 | 0.6092140                   | 0.1319743 | 1.9938949 | -0.3046070 ±j | 0.1979618     | 0.5963137 |            |
|        |         |                             | 0.4909810 | 0.3619736 | 2.3128131     | -0.2454905 ±j | 0.5492795 | 1.2253884  |
|        |         |                             | 0.3266300 | 0.6667509 | 3.3317143     | -0.1633150 ±j | 0.8000494 | 2.4999182  |
|        |         |                             | 0.1768274 | 0.9070762 | 7.2931353     | -0.0884137 ±j | 0.9482928 | 5.3860742  |
|        |         |                             | 0.0549584 | 1.0304029 | 57.4727614    | -0.0274792 ±j | 1.0147156 | 18.4701012 |
| 1.45   | 111.144 | 0.5999525                   | 0.1277292 | 2.1402240 | -0.2999763 ±j | 0.1942767     | 0.5957008 |            |
|        |         |                             | 0.4890549 | 0.3530790 | 2.4947597     | -0.2445274 ±j | 0.5415582 | 1.2150058  |
|        |         |                             | 0.3310047 | 0.6576305 | 3.6250000     | -0.1655023 ±j | 0.7938763 | 2.4499481  |
|        |         |                             | 0.1821190 | 0.9032652 | 8.0118665     | -0.0910595 ±j | 0.9460303 | 5.2185810  |
|        |         |                             | 0.0571517 | 1.0315022 | 63.5489356    | -0.0285759 ±j | 1.0152269 | 17.7707415 |
| 1.50   | 115.199 | 0.5921500                   | 0.1242151 | 2.2916411 | -0.2960750 ±j | 0.1911927     | 0.5951897 |            |
|        |         |                             | 0.4873198 | 0.3456214 | 2.6826414     | -0.2436599 ±j | 0.5350245 | 1.2063859  |
|        |         |                             | 0.3346603 | 0.6498420 | 3.9270510     | -0.1673301 ±j | 0.7885700 | 2.4087944  |
|        |         |                             | 0.1866747 | 0.8999552 | 8.7507642     | -0.0933374 ±j | 0.9440568 | 5.0818853  |
|        |         |                             | 0.0590636 | 1.0324572 | 69.7914985    | -0.0295318 ±j | 1.0156698 | 17.2034702 |
| 1.70   | 129.278 | 0.5703208                   | 0.1146818 | 2.9483149 | -0.2851604 ±j | 0.1826618     | 0.5937833 |            |
|        |         |                             | 0.4819191 | 0.3249474 | 3.4947482     | -0.2409596 ±j | 0.5166100 | 1.1828574  |
|        |         |                             | 0.3447202 | 0.6275510 | 5.2271136     | -0.1723601 ±j | 0.7732031 | 2.2980412  |
|        |         |                             | 0.1999062 | 0.8901931 | 11.9220243    | -0.0999531 ±j | 0.9381911 | 4.7197162  |
|        |         |                             | 0.0647416 | 1.0352776 | 96.5555666    | -0.0323708 ±j | 1.0169709 | 15.7161113 |
| 2.00   | 146.170 | 0.5522338                   | 0.1071102 | 4.0866858 | -0.2761169 ±j | 0.1756977     | 0.5926421 |            |
|        |         |                             | 0.4768334 | 0.3080517 | 4.8979715     | -0.2384167 ±j | 0.5012078 | 1.1639790  |
|        |         |                             | 0.3528370 | 0.6085366 | 7.4641016     | -0.1764185 ±j | 0.7598770 | 2.2109008  |
|        |         |                             | 0.2114256 | 0.8815170 | 17.3634536    | -0.1057128 ±j | 0.9329211 | 4.4407652  |
|        |         |                             | 0.0698400 | 1.0377907 | 142.4309671   | -0.0349200 ±j | 1.0181215 | 14.5864825 |

| CASE A |         | Passband Ripple: Ap(dB)=0.1 |           |           |               |               |           |             |  |  |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|-------------|--|--|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | G1        |             |  |  |
| 11     | 1.05    | 64.086                      | 0.6465048 | 0.3541799 | 1.1084015     | -0.3232524 ±j | 0.4996877 | 0.8035348   |  |  |
|        |         |                             | 0.3530542 | 0.6690446 | 1.1652129     | -0.1765271 ±j | 0.7986756 | 2.3157871   |  |  |
|        |         |                             | 0.1584360 | 0.8765242 | 1.3488607     | -0.0792180 ±j | 0.9327104 | 5.9081808   |  |  |
|        |         |                             | 0.0625876 | 0.9737803 | 1.9760810     | -0.0312938 ±j | 0.9863067 | 15.78867452 |  |  |
|        |         |                             | 0.0162442 | 1.0096445 | 5.36021835    | -0.0081221 ±j | 1.0047779 | 61.3564432  |  |  |
|        |         |                             |           |           |               | -0.4098819    |           |             |  |  |
| 1.10   | 78.057  | 0.6036195                   | 0.2850655 | 0.7195217 | -0.3016097 ±j | 0.4404275     | 0.8845229 |             |  |  |
|        |         |                             | 0.3779281 | 0.5868733 | 1.2088558     | -0.1889641 ±j | 0.7424072 | 2.0270473   |  |  |
|        |         |                             | 0.1960877 | 0.8260647 | 1.5834523     | -0.0980439 ±j | 0.9035774 | 4.6330736   |  |  |
|        |         |                             | 0.0874160 | 0.9590637 | 2.4791000     | -0.0437080 ±j | 0.9783421 | 11.2929576  |  |  |
|        |         |                             | 0.0243870 | 1.0140053 | 7.5379407     | -0.0121935 ±j | 1.0082045 | 41.2916632  |  |  |
|        |         |                             |           |           |               | -0.3597738    |           |             |  |  |
| 1.15   | 88.117  | 0.5771859                   | 0.2506304 | 0.7352275 | -0.2885930 ±j | 0.4090776     | 0.8673635 |             |  |  |
|        |         |                             | 0.3879761 | 0.5401039 | 1.4533040     | -0.1935881 ±j | 0.7088529 | 1.8842340   |  |  |
|        |         |                             | 0.2179812 | 0.7937545 | 1.8085704     | -0.1089306 ±j | 0.8842373 | 4.08771831  |  |  |
|        |         |                             | 0.1039032 | 0.9456558 | 2.9446256     | -0.0519515 ±j | 0.9726082 | 9.3740626   |  |  |
|        |         |                             | 0.0301429 | 1.0170203 | 9.2991573     | -0.0150714 ±j | 1.0083616 | 39.4554675  |  |  |
|        |         |                             |           |           |               | -0.3337807    |           |             |  |  |
| 1.20   | 96.295  | 0.5587012                   | 0.2291605 | 0.7455717 | -0.2793506 ±j | 0.3887464     | 0.8568214 |             |  |  |
|        |         |                             | 0.3930905 | 0.5087347 | 1.7601346     | -0.1965453 ±j | 0.6856418 | 1.8144839   |  |  |
|        |         |                             | 0.2328308 | 0.7704363 | 2.0339626     | -0.1164154 ±j | 0.8699907 | 3.7098840   |  |  |
|        |         |                             | 0.1160691 | 0.9407215 | 3.4024453     | -0.0580345 ±j | 0.9681702 | 8.3332990   |  |  |
|        |         |                             | 0.0345590 | 1.0193044 | 11.0152335    | -0.0172735 ±j | 1.0094582 | 29.2140122  |  |  |
|        |         |                             |           |           |               | -0.3172850    |           |             |  |  |
| 1.25   | 103.318 | 0.5448637                   | 0.2142625 | 0.7581287 | -0.2724313 ±j | 0.3742237     | 0.8485426 |             |  |  |
|        |         |                             | 0.3959922 | 0.4858978 | 1.7539211     | -0.1979561 ±j | 0.6683528 | 1.7602969   |  |  |
|        |         |                             | 0.2437136 | 0.7525809 | 2.2634658     | -0.1218555 ±j | 0.8589132 | 3.5535642   |  |  |
|        |         |                             | 0.1255457 | 0.9343875 | 3.8631607     | -0.0627720 ±j | 0.9645968 | 7.6894866   |  |  |
|        |         |                             | 0.0380963 | 1.0211185 | 12.73357378   | -0.0190481 ±j | 1.0103245 | 26.30250157 |  |  |
|        |         |                             |           |           |               | -0.3052095    |           |             |  |  |
| 1.30   | 109.540 | 0.5340465                   | 0.2032405 | 0.7711795 | -0.2670232 ±j | 0.3632342     | 0.8441625 |             |  |  |
|        |         |                             | 0.3977416 | 0.4684099 | 1.91115674    | -0.1988708 ±j | 0.6548742 | 1.7207269   |  |  |
|        |         |                             | 0.2520824 | 0.7383844 | 2.43979196    | -0.1260412 ±j | 0.8499988 | 3.4087782   |  |  |
|        |         |                             | 0.1331840 | 0.9291943 | 4.3316230     | -0.0665520 ±j | 0.9616443 | 7.2377094   |  |  |
|        |         |                             | 0.0410091 | 1.0226029 | 14.4801247    | -0.0205046 ±j | 1.0110304 | 24.1588608  |  |  |
|        |         |                             |           |           |               | -0.2962509    |           |             |  |  |
| 1.35   | 115.163 | 0.5253301                   | 0.1947268 | 0.7847559 | -0.2626550 ±j | 0.3545897     | 0.8400025 |             |  |  |
|        |         |                             | 0.3988339 | 0.4545433 | 2.0745762     | -0.1994170 ±j | 0.6440312 | 1.6904235   |  |  |
|        |         |                             | 0.2587361 | 0.7267940 | 2.7391978     | -0.1293680 ±j | 0.8426493 | 3.2949489   |  |  |
|        |         |                             | 0.1394905 | 0.9248500 | 4.3111267     | -0.0697452 ±j | 0.9591588 | 6.8943150   |  |  |
|        |         |                             | 0.0434556 | 1.0238432 | 16.2605512    | -0.0217278 ±j | 1.0116183 | 23.2841742  |  |  |
|        |         |                             |           |           |               | -0.2892188    |           |             |  |  |
| 1.40   | 120.319 | 0.5181462                   | 0.1879422 | 0.7987927 | -0.2590731 ±j | 0.3475965     | 0.8386809 |             |  |  |
|        |         |                             | 0.3995277 | 0.4432625 | 1.2431285     | -0.1997639 ±j | 0.6351039 | 1.6664166   |  |  |
|        |         |                             | 0.2641585 | 0.7171410 | 2.3878021     | -0.1320793 ±j | 0.8364783 | 3.2058091   |  |  |
|        |         |                             | 0.1447922 | 0.9211593 | 5.3032020     | -0.0723961 ±j | 0.9570361 | 6.6286064   |  |  |
|        |         |                             | 0.0455413 | 1.0248974 | 18.0822213    | -0.0227707 ±j | 1.0121160 | 22.3297471  |  |  |
|        |         |                             |           |           |               | -0.2835386    |           |             |  |  |
| 1.45   | 125.095 | 0.5121203                   | 0.1824057 | 0.8133583 | -0.2560601 ±j | 0.3418171     | 0.8339639 |             |  |  |
|        |         |                             | 0.3999692 | 0.4339018 | 2.4173448     | -0.1999846 ±j | 0.6276209 | 1.6489077   |  |  |
|        |         |                             | 0.2686632 | 0.7089747 | 3.2435289     | -0.1343316 ±j | 0.8312218 | 3.12400595  |  |  |
|        |         |                             | 0.1493131 | 0.9179849 | 5.8087659     | -0.0746566 ±j | 0.9552022 | 6.4168194   |  |  |
|        |         |                             | 0.0473410 | 1.0258036 | 19.9555287    | -0.0236705 ±j | 1.0125430 | 21.38411382 |  |  |
|        |         |                             |           |           |               | -0.2788497    |           |             |  |  |
| 1.50   | 129.556 | 0.5069936                   | 0.1778023 | 0.8284318 | -0.2534968 ±j | 0.3369595     | 0.8316991 |             |  |  |
|        |         |                             | 0.4002456 | 0.4260105 | 2.5973085     | -0.2001228 ±j | 0.6212579 | 1.6007357   |  |  |
|        |         |                             | 0.2724635 | 0.7019778 | 3.5072526     | -0.1362317 ±j | 0.8266914 | 3.0750584   |  |  |
|        |         |                             | 0.1532131 | 0.9152268 | 6.3287388     | -0.0766066 ±j | 0.9536027 | 6.2440792   |  |  |
|        |         |                             | 0.0489091 | 1.0265912 | 21.8787000    | -0.0244546 ±j | 1.0129132 | 20.7161427  |  |  |
|        |         |                             |           |           |               | -0.2749123    |           |             |  |  |
| 1.70   | 145.042 | 0.4924126                   | 0.1652206 | 0.9380530 | -0.2462063 ±j | 0.3234239     | 0.8254730 |             |  |  |
|        |         |                             | 0.4005457 | 0.4039262 | 3.3756369     | -0.2002729 ±j | 0.6031724 | 1.5267150   |  |  |
|        |         |                             | 0.2831058 | 0.6818346 | 4.6433716     | -0.1415529 ±j | 0.8135093 | 2.9166930   |  |  |
|        |         |                             | 0.1645808 | 0.9070854 | 8.5619394     | -0.0822904 ±j | 0.9488486 | 5.7868849   |  |  |
|        |         |                             | 0.0535632 | 1.0289177 | 30.1261720    | -0.0267816 ±j | 1.0140022 | 18.3375496  |  |  |
|        |         |                             |           |           |               | -0.2639560    |           |             |  |  |
| 2.00   | 163.624 | 0.4800719                   | 0.1551291 | 0.9714332 | -0.2400359 ±j | 0.3122689     | 0.8204279 |             |  |  |
|        |         |                             | 0.4002529 | 0.3856476 | 4.7212543     | -0.2001265 ±j | 0.5878750 | 1.5153323   |  |  |
|        |         |                             | 0.2919117 | 0.6645121 | 6.5999975     | -0.1459558 ±j | 0.8020031 | 2.7325437   |  |  |
|        |         |                             | 0.1745277 | 0.8998401 | 12.3963998    | -0.0872638 ±j | 0.9445767 | 5.4352354   |  |  |
|        |         |                             | 0.0577385 | 1.0309918 | 44.2665611    | -0.0288693 ±j | 1.0149672 | 17.5857843  |  |  |
|        |         |                             |           |           |               | -0.2549416    |           |             |  |  |



| CASE A |         | Passband Ripple: Ap(dB)=0.1 |           |           |               |               |           |            |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 12     | 1.05    | 72.491                      | 0.7084965 | 0.1838037 | 1.1074426     | -0.3542483 ±j | 0.2414785 | 0.6051171  |
|        |         |                             | 0.4881750 | 0.4527160 | 1.1536336     | -0.2440875 ±j | 0.6270066 | 1.3782799  |
|        |         |                             | 0.2618955 | 0.7282032 | 1.2918984     | -0.1309477 ±j | 0.8432413 | 3.2583542  |
|        |         |                             | 0.1224767 | 0.8959542 | 1.6991591     | -0.0612384 ±j | 0.9445656 | 7.7283951  |
|        |         |                             | 0.0511250 | 0.9769244 | 3.3125181     | -0.0255625 ±j | 0.9880643 | 19.3329000 |
|        |         |                             | 0.0138010 | 1.0080276 | 23.9660912    | -0.0069005 ±j | 1.0039821 | 72.7486451 |
| 1.10   | 87.732  | 0.6315903                   | 0.1435754 | 1.2179786 | -0.3157951 ±j | 0.2094012     | 0.5999356 |            |
|        |         |                             | 0.4769921 | 0.3763103 | 1.2909254     | -0.2384961 ±j | 0.5651814 | 1.2860618  |
|        |         |                             | 0.2917136 | 0.6535193 | 1.4996665     | -0.1458568 ±j | 0.7951384 | 2.7712292  |
|        |         |                             | 0.1551874 | 0.8531630 | 2.0872157     | -0.0775937 ±j | 0.9204033 | 5.9519548  |
|        |         |                             | 0.0719331 | 0.9644803 | 4.3499304     | -0.0359666 ±j | 0.9814208 | 13.6526715 |
|        |         |                             | 0.0206272 | 1.0116507 | 33.0577896    | -0.0103136 ±j | 1.0057556 | 48.7612336 |
| 1.15   | 98.706  | 0.5903980                   | 0.1244108 | 1.3331670 | -0.2951990 ±j | 0.1930500     | 0.5974259 |            |
|        |         |                             | 0.4668639 | 0.3364143 | 1.4297858     | -0.2334319 ±j | 0.5309650 | 1.2423586  |
|        |         |                             | 0.3061012 | 0.6095271 | 1.7009576     | -0.1530506 ±j | 0.7655734 | 2.5505361  |
|        |         |                             | 0.1748347 | 0.8252160 | 2.4494590     | -0.0874173 ±j | 0.9041981 | 5.1958453  |
|        |         |                             | 0.0858733 | 0.9556924 | 5.2979222     | -0.0429366 ±j | 0.9766519 | 11.3841638 |
|        |         |                             | 0.0254559 | 1.0141731 | 41.3060302    | -0.0127280 ±j | 1.0069812 | 39.5609797 |
| 1.20   | 107.628 | 0.5634735                   | 0.1127324 | 1.4532283 | -0.2817367 ±j | 0.1826386     | 0.5958692 |            |
|        |         |                             | 0.4586902 | 0.3109019 | 1.5724303     | -0.2293451 ±j | 0.5082349 | 1.2156043  |
|        |         |                             | 0.3146823 | 0.5794157 | 1.9034206     | -0.1573411 ±j | 0.7447546 | 2.4189275  |
|        |         |                             | 0.1884468 | 0.8048615 | 2.8072245     | -0.0942234 ±j | 0.8921791 | 4.7607098  |
|        |         |                             | 0.0962145 | 0.9489804 | 6.2244021     | -0.0481072 ±j | 0.9729677 | 10.1248417 |
|        |         |                             | 0.0291566 | 1.0160862 | 49.3373729    | -0.0145783 ±j | 1.0079056 | 34.5723402 |
| 1.25   | 115.290 | 0.5441340                   | 0.1047454 | 1.5782485 | -0.2720670 ±j | 0.1752854     | 0.5947873 |            |
|        |         |                             | 0.4520670 | 0.2929042 | 1.7197065     | -0.2260335 ±j | 0.4917449 | 1.1971815  |
|        |         |                             | 0.3203731 | 0.5571850 | 2.1098820     | -0.1601866 ±j | 0.7290578 | 2.3299342  |
|        |         |                             | 0.1985804 | 0.7891704 | 3.1681544     | -0.0992902 ±j | 0.8827864 | 4.4735167  |
|        |         |                             | 0.1043003 | 0.9436287 | 7.1532769     | -0.0521502 ±j | 0.9700047 | 9.3135420  |
|        |         |                             | 0.0321181 | 1.0176061 | 57.3715316    | -0.0160590 ±j | 1.0086368 | 31.4080028 |
| 1.30   | 122.077 | 0.5294384                   | 0.0988962 | 1.7082709 | -0.2647192 ±j | 0.1697645     | 0.5939836 |            |
|        |         |                             | 0.4466166 | 0.2794310 | 1.8720353     | -0.2233083 ±j | 0.4791288 | 1.1835931  |
|        |         |                             | 0.3244044 | 0.5399830 | 2.3217202     | -0.1622022 ±j | 0.7167102 | 2.2651829  |
|        |         |                             | 0.2064691 | 0.7766295 | 3.5359122     | -0.1032345 ±j | 0.8751983 | 4.2682708  |
|        |         |                             | 0.1108375 | 0.9392397 | 8.0959007     | -0.0554187 ±j | 0.9675580 | 8.7438271  |
|        |         |                             | 0.0345554 | 1.0188506 | 65.5126430    | -0.0172777 ±j | 1.0092334 | 29.2105458 |
| 1.35   | 128.212 | 0.5178406                   | 0.0944122 | 1.8433207 | -0.2589203 ±j | 0.1654464     | 0.5933597 |            |
|        |         |                             | 0.4420622 | 0.2689306 | 2.0296574     | -0.2210311 ±j | 0.4691224 | 1.1731046  |
|        |         |                             | 0.3273939 | 0.5262325 | 2.5397132     | -0.1636969 ±j | 0.7067077 | 2.2157374  |
|        |         |                             | 0.2128037 | 0.7663476 | 3.9125428     | -0.1064019 ±j | 0.8689225 | 4.1137100  |
|        |         |                             | 0.1162475 | 0.9355674 | 9.0585736     | -0.0581238 ±j | 0.9654993 | 8.3205837  |
|        |         |                             | 0.0366012 | 1.0198908 | 73.8184125    | -0.0183006 ±j | 1.0097306 | 27.5918657 |
| 1.40   | 133.836 | 0.5084333                   | 0.0908599 | 1.9834134 | -0.2542166 ±j | 0.1619685     | 0.5928600 |            |
|        |         |                             | 0.4382049 | 0.2605039 | 2.1927230     | -0.2191025 ±j | 0.4609751 | 1.1647423  |
|        |         |                             | 0.3296873 | 0.5149732 | 2.7643424     | -0.1648436 ±j | 0.6984267 | 2.1766577  |
|        |         |                             | 0.2180090 | 0.7577547 | 4.2993023     | -0.1090045 ±j | 0.8636392 | 3.9929128  |
|        |         |                             | 0.1208048 | 0.9324465 | 10.0451492    | -0.0604024 ±j | 0.9637417 | 7.9933281  |
|        |         |                             | 0.0383448 | 1.0207745 | 82.3241078    | -0.0191724 ±j | 1.0101519 | 26.3486301 |
| 1.45   | 139.047 | 0.5006417                   | 0.0879747 | 2.1285596 | -0.2503208 ±j | 0.1591042     | 0.5924502 |            |
|        |         |                             | 0.4349002 | 0.2535883 | 2.3613317     | -0.2174501 ±j | 0.4542068 | 1.1579107  |
|        |         |                             | 0.3314939 | 0.5055804 | 2.9959256     | -0.1657469 ±j | 0.6914538 | 2.1449620  |
|        |         |                             | 0.2223636 | 0.7504641 | 4.6970152     | -0.1111818 ±j | 0.8591290 | 3.8958409  |
|        |         |                             | 0.1246979 | 0.9297612 | 11.0581496    | -0.0623489 ±j | 0.9622234 | 7.7326207  |
|        |         |                             | 0.0398489 | 1.0215350 | 91.0527944    | -0.0199245 ±j | 1.0105137 | 25.3635453 |
| 1.50   | 143.913 | 0.4940809                   | 0.0855850 | 2.2787664 | -0.2470404 ±j | 0.1567036     | 0.5921078 |            |
|        |         |                             | 0.4320404 | 0.2478114 | 2.5355530     | -0.2160202 ±j | 0.4484937 | 1.1522222  |
|        |         |                             | 0.3329476 | 0.4976265 | 3.2346828     | -0.1664738 ±j | 0.6855020 | 2.1187313  |
|        |         |                             | 0.2260596 | 0.7442022 | 5.1062498     | -0.1130298 ±j | 0.8552347 | 3.8161241  |
|        |         |                             | 0.1280605 | 0.9274279 | 12.0993095    | -0.0640302 ±j | 0.9608996 | 7.5201242  |
|        |         |                             | 0.0411588 | 1.0221954 | 100.0203299   | -0.0205794 ±j | 1.0108273 | 24.5642695 |
| 1.70   | 160.807 | 0.4757405                   | 0.0790960 | 2.9302881 | -0.2378702 ±j | 0.1500459     | 0.5911629 |            |
|        |         |                             | 0.4236749 | 0.2318957 | 3.2893923     | -0.2118375 ±j | 0.4324587 | 1.1366154  |
|        |         |                             | 0.3366687 | 0.4751931 | 4.2640673     | -0.1683344 ±j | 0.6684733 | 2.0475394  |
|        |         |                             | 0.2365228 | 0.7260942 | 6.8651328     | -0.1182614 ±j | 0.8438652 | 3.6026617  |
|        |         |                             | 0.1378881 | 0.9205361 | 16.5660270    | -0.0689440 ±j | 0.9569654 | 6.9581475  |
|        |         |                             | 0.0450450 | 1.0241476 | 138.4661013   | -0.0225225 ±j | 1.0117511 | 22.4664788 |
| 2.00   | 181.078 | 0.4605597                   | 0.0739357 | 4.0598914 | -0.2302798 ±j | 0.1445923     | 0.5903931 |            |
|        |         |                             | 0.4163402 | 0.2189945 | 4.5932605     | -0.2081701 ±j | 0.4191177 | 1.1240050  |
|        |         |                             | 0.3393463 | 0.4564290 | 6.0382667     | -0.1696731 ±j | 0.6539419 | 1.9908730  |
|        |         |                             | 0.2453149 | 0.7104258 | 9.8873550     | -0.1226574 ±j | 0.8338951 | 3.4358600  |
|        |         |                             | 0.1465188 | 0.9143973 | 24.2272012    | -0.0732594 ±j | 0.9534308 | 6.5264044  |
|        |         |                             | 0.0485290 | 1.0258886 | 204.3626509   | -0.0242645 ±j | 1.0125709 | 20.8712669 |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.2$ |           |           |           |                             |           |           |  |
|--------|------|---------------------------------------|-----------|-----------|-----------|-----------------------------|-----------|-----------|--|
| n      | Ws   | As(dB)                                | At        | Bt        | Ct        | Pt                          | Qt        |           |  |
| 2      | 1.05 | 0.667                                 | 0.2020056 | 1.3633013 | 1.4386640 | -0.1010028 ±j               | 1.1632282 | 5.7800615 |  |
|        | 1.10 | 1.065                                 | 0.3369623 | 1.5516318 | 1.7140833 | -0.1684811 ±j               | 1.2341985 | 3.6966899 |  |
|        | 1.15 | 1.494                                 | 0.4620370 | 1.7022121 | 1.9755745 | -0.2310185 ±j               | 1.2840726 | 2.8237747 |  |
|        | 1.20 | 1.954                                 | 0.5795678 | 1.8271765 | 2.2359899 | -0.2897839 ±j               | 1.3203037 | 2.3323084 |  |
|        | 1.25 | 2.440                                 | 0.6894256 | 1.9316044 | 2.5000000 | -0.3447128 ±j               | 1.3463943 | 2.0159126 |  |
|        | 1.30 | 2.947                                 | 0.7912308 | 2.0187581 | 2.7698611 | -0.3956154 ±j               | 1.3646415 | 1.7957213 |  |
|        | 1.35 | 3.469                                 | 0.8848026 | 2.0912292 | 3.0468391 | -0.4424013 ±j               | 1.3767753 | 1.6343852 |  |
|        | 1.40 | 4.000                                 | 0.9702261 | 2.1512491 | 3.3317143 | -0.4851130 ±j               | 1.3841656 | 1.5117236 |  |
|        | 1.45 | 4.535                                 | 1.0478103 | 2.2007744 | 3.6250000 | -0.5239052 ±j               | 1.3879113 | 1.4158104 |  |
|        | 1.50 | 5.071                                 | 1.1180197 | 2.2415116 | 3.9270510 | -0.5590098 ±j               | 1.3888915 | 1.3391248 |  |
|        | 1.70 | 7.170                                 | 1.3365637 | 2.3428282 | 5.2271136 | -0.6682818 ±j               | 1.3770358 | 1.1451980 |  |
|        | 2.00 | 10.062                                | 1.5357824 | 2.3982853 | 7.4641016 | -0.7678912 ±j               | 1.3448526 | 1.0083719 |  |
| 3      | 1.05 | 3.016                                 | 0.1109607 | 1.1393749 | 1.2054102 | -0.0554803 ±j<br>-2.0254788 | 1.0659722 | 9.6197616 |  |
|        | 1.10 | 5.285                                 | 0.1963898 | 1.2073755 | 1.3703136 | -0.0981949 ±j<br>-1.6516436 | 1.0944100 | 5.5950273 |  |
|        | 1.15 | 7.364                                 | 0.2675138 | 1.2517954 | 1.5336053 | -0.1337569 ±j<br>-1.4558064 | 1.1108125 | 4.1823503 |  |
|        | 1.20 | 9.254                                 | 0.3268265 | 1.2827631 | 1.6996171 | -0.1634132 ±j<br>-1.3325527 | 1.1207405 | 3.4654210 |  |
|        | 1.25 | 10.977                                | 0.3766229 | 1.3053106 | 1.8699785 | -0.1883115 ±j<br>-1.2472408 | 1.1268759 | 3.0335431 |  |
|        | 1.30 | 12.557                                | 0.4188005 | 1.3222844 | 2.0454918 | -0.2094002 ±j<br>-1.1845191 | 1.1306794 | 2.7457136 |  |
|        | 1.35 | 14.017                                | 0.4548520 | 1.3354102 | 2.2266128 | -0.2274260 ±j<br>-1.1364187 | 1.1329994 | 2.5406054 |  |
|        | 1.40 | 15.374                                | 0.4859358 | 1.3457881 | 2.4136247 | -0.2429679 ±j<br>-1.0983578 | 1.1343521 | 2.3873134 |  |
|        | 1.45 | 16.643                                | 0.5129516 | 1.3541478 | 2.6067151 | -0.2564758 ±j<br>-1.0675024 | 1.1350630 | 2.2685933 |  |
|        | 1.50 | 17.836                                | 0.5366031 | 1.3609897 | 2.8060141 | -0.2683015 ±j<br>-1.0420002 | 1.1353431 | 2.1740737 |  |
|        | 1.70 | 22.014                                | 0.6071465 | 1.3789452 | 3.6668482 | -0.3035732 ±j<br>-0.9730806 | 1.1343670 | 1.9341049 |  |
|        | 2.00 | 27.062                                | 0.6705048 | 1.3922124 | 5.1532091 | -0.3352524 ±j<br>-0.9187064 | 1.1312905 | 1.7597494 |  |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.2$ |                        |                        |                         |                                              |                        |                         |  |
|--------|------|---------------------------------------|------------------------|------------------------|-------------------------|----------------------------------------------|------------------------|-------------------------|--|
| n      | Ws   | As(dB)                                | At                     | Bl                     | Cl                      | P1                                           | Q1                     |                         |  |
| 4      | 1.05 | 8.922                                 | 1.1653819<br>0.0813902 | 1.3071479<br>1.0709816 | 1.1536336<br>3.3125181  | -0.5826910 ±j<br>-0.0406951 ±j               | 0.9836763<br>1.0340820 | 0.9810566<br>12.7150717 |  |
|        | 1.10 | 13.591                                | 0.1345593<br>1.2445370 | 1.0991172<br>1.0934245 | 1.2909254<br>4.3499304  | -0.0672796 ±j<br>-0.6222685 ±j               | 1.0462269<br>0.8403609 | 7.7912720<br>0.8402076  |  |
|        | 1.15 | 17.137                                | 1.2527579<br>0.1743017 | 0.9652245<br>1.1166191 | 1.4297858<br>5.2979222  | -0.6263790 ±j<br>-0.0871508 ±j               | 0.7568844<br>1.0531020 | 0.7842364<br>6.0624890  |  |
|        | 1.20 | 20.068                                | 1.2453409<br>0.2056167 | 0.8802298<br>1.1289366 | 1.5724303<br>6.2244021  | -0.6226704 ±j<br>-0.1028084 ±j               | 0.7017915<br>1.0575287 | 0.7533725<br>5.1674513  |  |
|        | 1.25 | 22.602                                | 1.2341596<br>0.2311018 | 0.8196465<br>1.1381935 | 1.7197065<br>7.1532769  | -0.6170798 ±j<br>-0.1155509 ±j               | 0.6624644<br>1.0605854 | 0.7335707<br>4.6164131  |  |
|        | 1.30 | 24.855                                | 1.2225970<br>0.2523116 | 0.7742234<br>1.1454461 | 1.8720353<br>8.0959007  | -0.6112985 ±j<br>-0.1261558 ±j               | 0.6328804<br>1.0627939 | 0.7196972<br>4.2417990  |  |
|        | 1.35 | 26.894                                | 1.2117075<br>0.2702604 | 0.7388884<br>1.1512967 | 2.0296574<br>9.0585736  | -0.6058538 ±j<br>-0.1351302 ±j               | 0.6097783<br>1.0644419 | 0.7094007<br>3.9701899  |  |
|        | 1.40 | 28.766                                | 1.2017872<br>0.2856497 | 0.7106213<br>1.1561204 | 2.1927230<br>10.0451492 | -0.6008936 ±j<br>-0.1428249 ±j               | 0.5912260<br>1.0657023 | 0.7014416<br>3.7641567  |  |
|        | 1.45 | 30.501                                | 1.1928641<br>0.2989861 | 0.6875066<br>1.1601657 | 2.3613317<br>11.0581496 | -0.5964321 ±j<br>-0.1494931 ±j               | 0.5759995<br>1.0666853 | 0.6951003<br>3.6025413  |  |
|        | 1.50 | 32.122                                | 1.1848720<br>0.3106469 | 0.6682680<br>1.1636055 | 2.5355530<br>12.0993095 | -0.5924360 ±j<br>-0.1553235 ±j               | 0.5632829<br>1.0674643 | 0.6899282<br>3.4724486  |  |
|        | 1.70 | 37.751                                | 1.1603284<br>0.3454480 | 0.6156716<br>1.1733675 | 3.2893923<br>16.5660270 | -0.5801642 ±j<br>-0.1727240 ±j               | 0.5282813<br>1.0693614 | 0.6762288<br>3.1356990  |  |
|        | 2.00 | 44.508                                | 1.1377183<br>0.3768736 | 0.5735633<br>1.1815840 | 4.5932605<br>24.2272012 | -0.5688592 ±j<br>-0.1884368 ±j               | 0.4999625<br>1.0705492 | 0.6656653<br>2.8842742  |  |
| 5      | 1.05 | 16.810                                | 0.5029009<br>0.0595351 | 0.9850014<br>1.0400487 | 1.1334220<br>1.7737385  | -0.2514505 ±j<br>-0.0297676 ±j<br>-0.9040464 | 0.9600906<br>1.0193932 | 1.9734948<br>17.1298508 |  |
|        | 1.10 | 23.089                                | 0.5956337<br>0.0937296 | 0.8962457<br>1.0552471 | 1.2593204<br>2.1930925  | -0.2978168 ±j<br>-0.0468648 ±j<br>-0.7632858 | 0.8986383<br>1.0261826 | 1.5894039<br>10.9597385 |  |
|        | 1.15 | 27.647                                | 0.6403261<br>0.1185123 | 0.8379995<br>1.0650595 | 1.3881033<br>2.5834170  | -0.3201631 ±j<br>-0.0592561 ±j<br>-0.6947204 | 0.8576101<br>1.0303146 | 1.4296201<br>8.7081052  |  |
|        | 1.20 | 31.360                                | 0.6666117<br>0.1377817 | 0.7963163<br>1.0721864 | 1.5211268<br>2.9683674  | -0.3333058 ±j<br>-0.0688908 ±j<br>-0.6521454 | 0.8277823<br>1.0331701 | 1.3386588<br>7.5152535  |  |
|        | 1.25 | 34.551                                | 0.6837572<br>0.1533507 | 0.7647968<br>1.0776791 | 1.6589139<br>3.3563960  | -0.3418786 ±j<br>-0.0766753 ±j<br>-0.6225620 | 0.8049322<br>1.0352778 | 1.2790017<br>6.7695387  |  |
|        | 1.30 | 37.378                                | 0.6956990<br>0.1662502 | 0.7400470<br>1.0820718 | 1.8017262<br>3.7515494  | -0.3478495 ±j<br>-0.0831251 ±j<br>-0.6006035 | 0.7867959<br>1.0369002 | 1.2365404<br>6.2569965  |  |
|        | 1.35 | 39.934                                | 0.7044088<br>0.1771341 | 0.7200700<br>1.0856762 | 1.9497131<br>4.1560845  | -0.3522044 ±j<br>-0.0885670 ±j<br>-0.5835759 | 0.7720247<br>1.0381869 | 1.2046547<br>5.8823117  |  |
|        | 1.40 | 42.277                                | 0.7109849<br>0.1864467 | 0.7036010<br>1.0886912 | 2.1029685<br>4.5713865  | -0.3554925 ±j<br>-0.0932234 ±j<br>-0.5699521 | 0.7597540<br>1.0392308 | 1.1797850<br>5.5962569  |  |
|        | 1.45 | 44.448                                | 0.7160864<br>0.1945049 | 0.6897940<br>1.0912514 | 2.2615546<br>4.9983644  | -0.3580432 ±j<br>-0.0972525 ±j<br>-0.5587914 | 0.7493991<br>1.0400930 | 1.1598299<br>5.3707115  |  |
|        | 1.50 | 46.476                                | 0.7201317<br>0.2015428 | 0.6780586<br>1.0934521 | 2.4255147<br>5.4376446  | -0.3600658 ±j<br>-0.1007714 ±j<br>-0.5494777 | 0.7405479<br>1.0408156 | 1.1434619<br>5.1883888  |  |
|        | 1.70 | 53.515                                | 0.7301754<br>0.2225134 | 0.6447779<br>1.0998248 | 3.1356145<br>7.3252003  | -0.3650877 ±j<br>-0.1112567 ±j<br>-0.5238348 | 0.7151845<br>1.0428072 | 1.0997092<br>4.7130881  |  |
|        | 2.00 | 61.961                                | 0.7370134<br>0.2414211 | 0.6167785<br>1.1053496 | 4.3649509<br>10.5677323 | -0.3685067 ±j<br>-0.1207105 ±j<br>-0.5030269 | 0.6935282<br>1.0444035 | 1.0655879<br>4.3548649  |  |

| CASE A |        | Passband Ripple: Ap(dB)=0.2 |           |           |               |               |           |            |
|--------|--------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws     | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 6      | 1.05   | 25.135                      | 1.1013283 | 0.6206474 | 1.1233258     | -0.5506641 ±j | 0.5633972 | 0.7153288  |
|        |        |                             | 0.2800231 | 0.9395398 | 1.4386640     | -0.1400115 ±j | 0.9591333 | 3.4614958  |
|        |        |                             | 0.0441377 | 1.0251104 | 6.5287683     | -0.0220688 ±j | 1.0122368 | 22.9390604 |
| 1.10   | 32.745 | 1.0189911                   | 0.4850118 | 1.2433620 | -0.5094956 ±j | 0.4747905     | 0.6834484 |            |
|        |        |                             | 0.3496553 | 0.8841675 | 1.7140833     | -0.1748276 ±j | 0.9239063 | 2.6892252  |
|        |        |                             | 0.0678520 | 1.0348943 | 8.8264550     | -0.0339260 ±j | 1.0167317 | 14.9928998 |
| 1.15   | 38.230 | 0.9677970                   | 0.4194502 | 1.3669587 | -0.4838985 ±j | 0.4304560     | 0.6692000 |            |
|        |        |                             | 0.3889889 | 0.8466895 | 1.9755745     | -0.1944944 ±j | 0.8993672 | 2.3655106  |
|        |        |                             | 0.0848342 | 1.0413658 | 10.9158033    | -0.0424171 ±j | 1.0195914 | 12.0290322 |
| 1.20   | 42.691 | 0.9321584                   | 0.3793494 | 1.4950350 | -0.4660792 ±j | 0.4026408     | 0.6607391 |            |
|        |        |                             | 0.4150414 | 0.8190761 | 2.2359899     | -0.2075207 ±j | 0.8809150 | 2.1805733  |
|        |        |                             | 0.0979578 | 1.0461393 | 12.9526713    | -0.0489789 ±j | 1.0216361 | 10.4413251 |
| 1.25   | 46.521 | 0.9056239                   | 0.3518934 | 1.6279471 | -0.4528119 ±j | 0.3832163     | 0.6550247 |            |
|        |        |                             | 0.4337613 | 0.7976970 | 2.5000000     | -0.2168807 ±j | 0.8664062 | 2.0590560  |
|        |        |                             | 0.1085202 | 1.0498597 | 14.9917591    | -0.0542601 ±j | 1.0231889 | 9.4418085  |
| 1.30   | 49.915 | 0.8849819                   | 0.3317820 | 1.7658735 | -0.4424910 ±j | 0.3687598     | 0.6508667 |            |
|        |        |                             | 0.4479183 | 0.7805859 | 2.7698611     | -0.2239592 ±j | 0.8546509 | 1.9724752  |
|        |        |                             | 0.1172478 | 1.0528610 | 17.0590037    | -0.0586239 ±j | 1.0244141 | 8.7514642  |
| 1.35   | 52.982 | 0.8684183                   | 0.3163673 | 1.9089166 | -0.4342092 ±j | 0.3575328     | 0.6476894 |            |
|        |        |                             | 0.4590137 | 0.7665563 | 3.0468391     | -0.2295069 ±j | 0.8449159 | 1.9074201  |
|        |        |                             | 0.1245970 | 1.0553411 | 19.1687817    | -0.0622985 ±j | 1.0254073 | 8.2449638  |
| 1.40   | 55.794 | 0.8548153                   | 0.3041592 | 2.0571405 | -0.4274076 ±j | 0.3485425     | 0.6451760 |            |
|        |        |                             | 0.4679441 | 0.7548380 | 3.3317143     | -0.2339721 ±j | 0.8367168 | 1.8566621  |
|        |        |                             | 0.1308756 | 1.0574280 | 21.3298812    | -0.0654378 ±j | 1.0262290 | 7.8571802  |
| 1.45   | 58.400 | 0.8434395                   | 0.2942473 | 2.2105880 | -0.4217198 ±j | 0.3411741     | 0.6431353 |            |
|        |        |                             | 0.4752825 | 0.7449046 | 3.6250000     | -0.2376413 ±j | 0.8297176 | 1.8159275  |
|        |        |                             | 0.1363019 | 1.0592091 | 23.5480505    | -0.0681509 ±j | 1.0269199 | 7.5507318  |
| 1.50   | 60.832 | 0.8337867                   | 0.2860410 | 2.3692888 | -0.4168933 ±j | 0.3350238     | 0.6414446 |            |
|        |        |                             | 0.4814142 | 0.7363815 | 3.9270510     | -0.2407071 ±j | 0.8236757 | 1.7825125  |
|        |        |                             | 0.1410364 | 1.0607467 | 25.8272420    | -0.0705182 ±j | 1.0275086 | 7.3025492  |
| 1.70   | 69.280 | 0.8064610                   | 0.2637757 | 3.0569811 | -0.4032305 ±j | 0.3180894     | 0.6368454 |            |
|        |        |                             | 0.4982773 | 0.7117966 | 5.2271136     | -0.2491387 ±j | 0.8060562 | 1.6931945  |
|        |        |                             | 0.1551209 | 1.0652350 | 35.6008780    | -0.0775605 ±j | 1.0291839 | 6.6535336  |
| 2.00   | 79.415 | 0.7834842                   | 0.2460937 | 4.2481552 | -0.3917421 ±j | 0.3043549     | 0.6331696 |            |
|        |        |                             | 0.5118594 | 0.6906194 | 7.4641016     | -0.2559297 ±j | 0.7906449 | 1.6235613  |
|        |        |                             | 0.1677945 | 1.0691712 | 52.3568408    | -0.0838973 ±j | 1.0305981 | 6.1623425  |

| CASE A |        | Passband Ripple: $A_p(\text{dB})=0.2$ |           |           |               |               |           |            |
|--------|--------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws     | As(dB)                                | A1        | B1        | C1            | P1            | Q1        |            |
| 7      | 1.05   | 33.529                                | 0.6349609 | 0.6633564 | 1.1175213     | -0.3174804 ±j | 0.7500417 | 1.2827041  |
|        |        |                                       | 0.1782958 | 0.9388053 | 1.3083409     | -0.0891479 ±j | 0.9648098 | 5.4343397  |
|        |        |                                       | 0.0336272 | 1.0171337 | 2.7143721     | -0.0168136 ±j | 1.0083903 | 29.9915269 |
|        |        |                                       |           |           |               | -0.5834090    |           |            |
| 1.10   | 42.418 | 0.6461581                             | 0.5595693 | 1.2341277 | -0.3230791 ±j | 0.6746771     | 1.1576789 |            |
|        |        |                                       | 0.2305992 | 0.8990045 | 1.5239435     | -0.1152996 ±j | 0.9411220 | 4.1117158  |
|        |        |                                       | 0.0510451 | 1.0240416 | 3.5147693     | -0.0255225 ±j | 1.0116275 | 19.8246277 |
|        |        |                                       |           |           |               | -0.5060399    |           |            |
| 1.15   | 48.819 | 0.6444190                             | 0.5033594 | 1.3546897 | -0.3222095 ±j | 0.6320921     | 1.1009581 |            |
|        |        |                                       | 0.2622015 | 0.8717200 | 1.7321918     | -0.1311008 ±j | 0.9244093 | 3.5608469  |
|        |        |                                       | 0.0634332 | 1.0286745 | 4.2484927     | -0.0317166 ±j | 1.0137399 | 15.9890288 |
|        |        |                                       |           |           |               | -0.4667845    |           |            |
| 1.20   | 54.023 | 0.6402852                             | 0.4667977 | 1.4798722 | -0.3201426 ±j | 0.6035780     | 1.0670651 |            |
|        |        |                                       | 0.2841262 | 0.8513598 | 1.9413408     | -0.1420631 ±j | 0.9116896 | 3.2474708  |
|        |        |                                       | 0.0729703 | 1.0321211 | 4.9666973     | -0.0364851 ±j | 1.0152782 | 13.9225629 |
|        |        |                                       |           |           |               | -0.4418302    |           |            |
| 1.25   | 58.493 | 0.6358444                             | 0.4407442 | 1.6099341 | -0.3179222 ±j | 0.5828119     | 1.0441009 |            |
|        |        |                                       | 0.3004461 | 0.8354266 | 2.1544332     | -0.1502230 ±j | 0.9015873 | 3.0421989  |
|        |        |                                       | 0.0806267 | 1.0348237 | 5.6874343     | -0.0403134 ±j | 1.0164637 | 12.6169397 |
|        |        |                                       |           |           |               | -0.4242190    |           |            |
| 1.30   | 62.452 | 0.6316468                             | 0.4211094 | 1.7450051 | -0.3158234 ±j | 0.5668906     | 1.0273612 |            |
|        |        |                                       | 0.3131419 | 0.8225601 | 2.3729509     | -0.1565710 ±j | 0.8933340 | 2.8962939  |
|        |        |                                       | 0.0869418 | 1.0370142 | 6.4192876     | -0.0434709 ±j | 1.0174107 | 11.7128789 |
|        |        |                                       |           |           |               | -0.4110009    |           |            |
| 1.35   | 66.030 | 0.6278330                             | 0.4057339 | 1.8851599 | -0.3139165 ±j | 0.5542475     | 1.0145570 |            |
|        |        |                                       | 0.3233272 | 0.8119313 | 2.5977295     | -0.1616636 ±j | 0.8864515 | 2.7868742  |
|        |        |                                       | 0.0922522 | 1.0388312 | 7.1670237     | -0.0461261 ±j | 1.0181864 | 11.0483122 |
|        |        |                                       |           |           |               | -0.4006646    |           |            |
| 1.40   | 69.311 | 0.6244157                             | 0.3933506 | 2.0304452 | -0.3122078 ±j | 0.5439457     | 1.0044218 |            |
|        |        |                                       | 0.3316883 | 0.8029971 | 2.8292857     | -0.1658441 ±j | 0.8806207 | 2.7016363  |
|        |        |                                       | 0.0967840 | 1.0403649 | 7.9335602     | -0.0483920 ±j | 1.0188342 | 10.5387542 |
|        |        |                                       |           |           |               | -0.3923402    |           |            |
| 1.45   | 72.351 | 0.6213662                             | 0.3831598 | 2.1808921 | -0.3106831 ±j | 0.5353838     | 0.9961904 |            |
|        |        |                                       | 0.3386758 | 0.7953824 | 3.0679607     | -0.1693379 ±j | 0.8756181 | 2.633209   |
|        |        |                                       | 0.1006972 | 1.0416773 | 8.7208069     | -0.0503486 ±j | 1.0193833 | 10.1355908 |
|        |        |                                       |           |           |               | -0.3854849    |           |            |
| 1.50   | 75.189 | 0.6186448                             | 0.3746279 | 2.3365223 | -0.3093224 ±j | 0.5281549     | 0.9893699 |            |
|        |        |                                       | 0.3446006 | 0.7888179 | 3.3139902     | -0.1723003 ±j | 0.8712809 | 2.5773441  |
|        |        |                                       | 0.1041092 | 1.0428128 | 9.5300781     | -0.0520546 ±j | 1.0198545 | 9.8087599  |
|        |        |                                       |           |           |               | -0.3797393    |           |            |
| 1.70   | 85.044 | 0.6102960                             | 0.3510381 | 3.0111362 | -0.3051480 ±j | 0.5078610     | 0.9708153 |            |
|        |        |                                       | 0.3613387 | 0.7697181 | 4.3744590     | -0.1806694 ±j | 0.8585317 | 2.4280149  |
|        |        |                                       | 0.1142466 | 1.0461414 | 13.0029293    | -0.0571233 ±j | 1.0212141 | 8.9526528  |
|        |        |                                       |           |           |               | -0.3638043    |           |            |
| 2.00   | 96.869 | 0.6025643                             | 0.3318307 | 4.1800429 | -0.3012822 ±j | 0.4909784     | 0.9559934 |            |
|        |        |                                       | 0.3753557 | 0.7530633 | 6.2017764     | -0.1876778 ±j | 0.8472546 | 2.3119198  |
|        |        |                                       | 0.1233541 | 1.0490774 | 18.9610948    | -0.0616771 ±j | 1.0223861 | 8.3032878  |
|        |        |                                       |           |           |               | -0.3507498    |           |            |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.2$ |           |           |            |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1         | P1            | Q1        |            |
| 8      | 1.05    | 41.932                                | 0.8825054 | 0.3407799 | 1.1138641  | -0.4412527 ±j | 0.3821988 | 0.6614844  |
|        |         |                                       | 0.3949525 | 0.7316060 | 1.2431181  | -0.1974763 ±j | 0.8322314 | 2.1656773  |
|        |         |                                       | 0.1236089 | 0.9462598 | 1.9061395  | -0.0618045 ±j | 0.9707935 | 7.8696497  |
|        |         |                                       | 0.0263295 | 1.0124386 | 11.0466061 | -0.0131648 ±j | 1.0061139 | 38.2156644 |
| 1.10   | 52.093  |                                       | 0.7967319 | 0.2661672 | 1.2282855  | -0.3983659 ±j | 0.3278289 | 0.6475377  |
|        |         |                                       | 0.4305238 | 0.6462959 | 1.4271032  | -0.2152619 ±j | 0.7745697 | 1.8673191  |
|        |         |                                       | 0.1639635 | 0.9157396 | 2.3804113  | -0.0819818 ±j | 0.9534246 | 5.8363147  |
|        |         |                                       | 0.0396677 | 1.0176011 | 15.1062239 | -0.0198339 ±j | 1.0085672 | 25.4302926 |
| 1.15   | 59.408  |                                       | 0.7490566 | 0.2305174 | 1.3469136  | -0.3745283 ±j | 0.3004097 | 0.6409693  |
|        |         |                                       | 0.4458270 | 0.5967810 | 1.6072975  | -0.2229135 ±j | 0.7396557 | 1.7327710  |
|        |         |                                       | 0.1892782 | 0.8946921 | 2.8200771  | -0.0946391 ±j | 0.9411353 | 4.9973103  |
|        |         |                                       | 0.0491122 | 1.0210944 | 18.7925269 | -0.0245561 ±j | 1.0101937 | 20.5751862 |
| 1.20   | 65.357  |                                       | 0.7173504 | 0.2087770 | 1.4702527  | -0.3586752 ±j | 0.2830709 | 0.6369569  |
|        |         |                                       | 0.4541020 | 0.5632485 | 1.7895085  | -0.2270510 ±j | 0.7153295 | 1.6527099  |
|        |         |                                       | 0.2072865 | 0.8788853 | 3.2528314  | -0.1036433 ±j | 0.9317421 | 4.2126710  |
|        |         |                                       | 0.0563645 | 1.0237072 | 22.3835994 | -0.0281823 ±j | 1.0113916 | 17.9507250 |
| 1.25   | 70.464  |                                       | 0.6943384 | 0.1939052 | 1.5984994  | -0.3471692 ±j | 0.2708852 | 0.6341961  |
|        |         |                                       | 0.4591118 | 0.5386903 | 1.9759013  | -0.2295559 ±j | 0.6971330 | 1.5986417  |
|        |         |                                       | 0.2209445 | 0.8664462 | 3.6885364  | -0.1104723 ±j | 0.9242522 | 4.2129618  |
|        |         |                                       | 0.0621768 | 1.0257638 | 25.9769795 | -0.0310884 ±j | 1.0123227 | 16.2890213 |
| 1.30   | 74.989  |                                       | 0.6767287 | 0.1830137 | 1.7317524  | -0.3383644 ±j | 0.2617695 | 0.6321602  |
|        |         |                                       | 0.4623617 | 0.5198068 | 2.1675370  | -0.2311809 ±j | 0.6829072 | 1.5593338  |
|        |         |                                       | 0.2317276 | 0.8563534 | 4.1319051  | -0.1158638 ±j | 0.9181116 | 3.9934546  |
|        |         |                                       | 0.0669649 | 1.0274356 | 29.6189023 | -0.0334824 ±j | 1.0130718 | 15.1366653 |
| 1.35   | 79.079  |                                       | 0.6627602 | 0.1746647 | 1.8700686  | -0.3313801 ±j | 0.2546605 | 0.6305887  |
|        |         |                                       | 0.4645715 | 0.5047889 | 2.3650162  | -0.2322857 ±j | 0.6714404 | 1.5293341  |
|        |         |                                       | 0.2404831 | 0.8479821 | 4.5855625  | -0.1202416 ±j | 0.9129754 | 3.8292057  |
|        |         |                                       | 0.0709873 | 1.0288256 | 33.3349904 | -0.0354936 ±j | 1.0136892 | 14.2886223 |
| 1.40   | 82.828  |                                       | 0.6513860 | 0.1680510 | 2.0134836  | -0.3256930 ±j | 0.2489480 | 0.6293354  |
|        |         |                                       | 0.4661260 | 0.4925437 | 2.5687116  | -0.2330630 ±j | 0.6619859 | 1.5056326  |
|        |         |                                       | 0.2477430 | 0.8409209 | 5.0511190  | -0.1238715 ±j | 0.9086126 | 3.7014861  |
|        |         |                                       | 0.0744174 | 1.0300011 | 37.1409040 | -0.0372087 ±j | 1.0142074 | 13.6378073 |
| 1.45   | 86.302  |                                       | 0.6419366 | 0.1626799 | 2.1620209  | -0.3209683 ±j | 0.2442524 | 0.6283112  |
|        |         |                                       | 0.4672481 | 0.4823643 | 2.7788694  | -0.2336240 ±j | 0.6540521 | 1.4864149  |
|        |         |                                       | 0.2538623 | 0.8348844 | 5.5296305  | -0.1269312 ±j | 0.9048607 | 3.5992744  |
|        |         |                                       | 0.0773774 | 1.0310085 | 41.0468858 | -0.0386887 ±j | 1.0146485 | 13.1225136 |
| 1.50   | 89.546  |                                       | 0.6339601 | 0.1582316 | 2.3156973  | -0.3169800 ±j | 0.2403233 | 0.6274581  |
|        |         |                                       | 0.4680743 | 0.4737703 | 2.9956604  | -0.2340371 ±j | 0.6472997 | 1.4705140  |
|        |         |                                       | 0.2590890 | 0.8296667 | 6.0218242  | -0.1295445 ±j | 0.9016013 | 3.5156273  |
|        |         |                                       | 0.0799569 | 1.0318814 | 45.0599777 | -0.0399785 ±j | 1.0150286 | 12.7045368 |
| 1.70   | 100.809 |                                       | 0.6115710 | 0.1461553 | 2.9819909  | -0.3057855 ±j | 0.2294571 | 0.6251157  |
|        |         |                                       | 0.4697926 | 0.4496615 | 3.9311886  | -0.2348963 ±j | 0.6280806 | 1.4273704  |
|        |         |                                       | 0.2740534 | 0.8144114 | 8.1360237  | -0.1370267 ±j | 0.8919838 | 3.2929617  |
|        |         |                                       | 0.0876142 | 1.0344462 | 62.2665524 | -0.0438071 ±j | 1.0161334 | 11.6085919 |
| 2.00   | 114.323 |                                       | 0.5929421 | 0.1365551 | 4.1367342  | -0.2964711 ±j | 0.2205901 | 0.6232203  |
|        |         |                                       | 0.4705353 | 0.4296460 | 5.5450630  | -0.2352676 ±j | 0.6117966 | 1.3930387  |
|        |         |                                       | 0.2868241 | 0.8010156 | 11.7666735 | -0.1434120 ±j | 0.8834300 | 3.1203612  |
|        |         |                                       | 0.0944853 | 1.0367161 | 91.7615329 | -0.0472426 ±j | 1.0170960 | 10.7762027 |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.2$ |           |           |            |              |              |            |  |
|--------|---------|---------------------------------------|-----------|-----------|------------|--------------|--------------|------------|--|
| n      | Ws      | As(dB)                                | A1        | B1        | C1         | P1           |              | Q1         |  |
| 9      | 1.05    | 50.337                                | 0.6136141 | 0.4452282 | 1.1114059  | -0.3068070   | ±j 0.5925349 | 1.0874168  |  |
|        |         |                                       | 0.2643454 | 0.7878444 | 1.2054102  | -0.1321727   | ±j 0.8777099 | 3.3577502  |  |
|        |         |                                       | 0.0909014 | 0.9542903 | 1.5942707  | -0.0454507   | ±j 0.9758199 | 10.7465614 |  |
|        |         |                                       | 0.0211157 | 1.0094522 | 3.9936736  | -0.0105578   | ±j 1.0046595 | 47.5814755 |  |
|        |         |                                       |           |           |            | -0.4363395   |              |            |  |
| 1.10   | 61.768  | 0.5888637                             | 0.3644960 | 1.2243475 | -0.2944318 | ±j 0.5270729 | 1.0252543    |            |  |
|        |         |                                       | 0.3031554 | 0.7165911 | 1.3703136  | -0.1515777   | ±j 0.8328357 | 2.7923540  |  |
|        |         |                                       | 0.1228712 | 0.9299938 | 1.9377187  | -0.0614356   | ±j 0.9624030 | 7.8485569  |  |
|        |         |                                       | 0.0316578 | 1.0134662 | 5.2992478  | -0.0158289   | ±j 1.0065862 | 31.7997861 |  |
|        |         |                                       |           |           |            | -0.3823859   |              |            |  |
| 1.15   | 69.998  | 0.5708054                             | 0.3231846 | 1.3416657 | -0.2854027 | ±j 0.4916604 | 0.9959493    |            |  |
|        |         |                                       | 0.3229960 | 0.6733991 | 1.5336053  | -0.1614980   | ±j 0.8045605 | 2.5406166  |  |
|        |         |                                       | 0.1434099 | 0.9131847 | 2.259957   | -0.0717050   | ±j 0.9529130 | 6.6634652  |  |
|        |         |                                       | 0.0390995 | 1.0161992 | 6.4899114  | -0.0195498   | ±j 1.0078775 | 25.7820948 |  |
|        |         |                                       |           |           |            | -0.3544921   |              |            |  |
| 1.20   | 76.690  | 0.5572682                             | 0.2970684 | 1.4637563 | -0.2786341 | ±j 0.4684350 | 0.9780564    |            |  |
|        |         |                                       | 0.3353313 | 0.6433629 | 1.6996171  | -0.1676656   | ±j 0.7843794 | 2.3919601  |  |
|        |         |                                       | 0.1582512 | 0.9005147 | 2.5791043  | -0.0791256   | ±j 0.9456500 | 5.9965095  |  |
|        |         |                                       | 0.0448039 | 1.0182510 | 7.6523927  | -0.0224019   | ±j 1.0088355 | 22.5222594 |  |
|        |         |                                       |           |           |            | -0.3365856   |              |            |  |
| 1.25   | 82.436  | 0.5467240                             | 0.2787856 | 1.5907740 | -0.2733620 | ±j 0.4517287 | 0.9657551    |            |  |
|        |         |                                       | 0.3437917 | 0.6209541 | 1.8699785  | -0.1718959   | ±j 0.7690292 | 2.2921040  |  |
|        |         |                                       | 0.1696379 | 0.8905116 | 2.9015215  | -0.0848189   | ±j 0.9398496 | 5.5628458  |  |
|        |         |                                       | 0.0493700 | 1.0198701 | 8.8171818  | -0.0246850   | ±j 1.0095845 | 20.4554472 |  |
|        |         |                                       |           |           |            | -0.3238692   |              |            |  |
| 1.30   | 87.526  | 0.5382631                             | 0.2651752 | 1.7227963 | -0.2691315 | ±j 0.4390256 | 0.9566914    |            |  |
|        |         |                                       | 0.3499596 | 0.6034827 | 2.0454918  | -0.1749798   | ±j 0.7568783 | 2.2198035  |  |
|        |         |                                       | 0.1787093 | 0.8823724 | 3.2303598  | -0.0893546   | ±j 0.9350873 | 5.2562846  |  |
|        |         |                                       | 0.0531282 | 1.0211888 | 9.9987492  | -0.0265641   | ±j 1.0101897 | 19.0207699 |  |
|        |         |                                       |           |           |            | -0.3142828   |              |            |  |
| 1.35   | 92.127  | 0.5313171                             | 0.2546134 | 1.8598680 | -0.2656586 | ±j 0.4289975 | 0.9497008    |            |  |
|        |         |                                       | 0.3546502 | 0.5894363 | 2.2266128  | -0.1773251   | ±j 0.7469887 | 2.1648021  |  |
|        |         |                                       | 0.1861291 | 0.8756051 | 3.5673591  | -0.0930646   | ±j 0.9310983 | 5.0273577  |  |
|        |         |                                       | 0.0562832 | 1.0222869 | 11.2051201 | -0.0281416   | ±j 1.0106904 | 17.9641894 |  |
|        |         |                                       |           |           |            | -0.3067618   |              |            |  |
| 1.40   | 96.346  | 0.5255115                             | 0.2461661 | 2.0020170 | -0.2627557 | ±j 0.4208628 | 0.9441303    |            |  |
|        |         |                                       | 0.3583309 | 0.5778825 | 2.4136247  | -0.1791655   | ±j 0.7387707 | 2.1214631  |  |
|        |         |                                       | 0.1923190 | 0.8698849 | 3.9135894  | -0.0961595   | ±j 0.9277059 | 4.8496306  |  |
|        |         |                                       | 0.0589721 | 1.0232167 | 12.4412023 | -0.0294861   | ±j 1.0111119 | 17.1528731 |  |
|        |         |                                       |           |           |            | -0.3006892   |              |            |  |
| 1.45   | 100.253 | 0.5205879                             | 0.2392528 | 2.1492622 | -0.2602940 | ±j 0.4141254 | 0.9395814    |            |  |
|        |         |                                       | 0.3612901 | 0.5682083 | 2.6067151  | -0.1806451   | ±j 0.7318304 | 2.0864007  |  |
|        |         |                                       | 0.1975633 | 0.8649858 | 4.2697534  | -0.0987816   | ±j 0.9247854 | 4.7075862  |  |
|        |         |                                       | 0.0612915 | 1.0240144 | 13.7102067 | -0.0306458   | ±j 1.0114718 | 16.5102036 |  |
|        |         |                                       |           |           |            | -0.2956781   |              |            |  |
| 1.50   | 103.903 | 0.5163621                             | 0.2334910 | 2.3016164 | -0.2581810 | ±j 0.4084526 | 0.9357949    |            |  |
|        |         |                                       | 0.3637161 | 0.5599912 | 2.8060141  | -0.1818580   | ±j 0.7258918 | 2.0574443  |  |
|        |         |                                       | 0.2020624 | 0.8607445 | 4.6363361  | -0.1010312   | ±j 0.9222457 | 4.5914689  |  |
|        |         |                                       | 0.0633120 | 1.0247061 | 15.0143415 | -0.0316560   | ±j 1.0117826 | 15.9887085 |  |
|        |         |                                       |           |           |            | -0.2914711   |              |            |  |
| 1.70   | 116.574 | 0.5041664                             | 0.2176797 | 2.9622803 | -0.2520832 | ±j 0.3925987 | 0.9254118    |            |  |
|        |         |                                       | 0.3701577 | 0.5366938 | 3.6668482  | -0.1850788   | ±j 0.7088297 | 1.9791401  |  |
|        |         |                                       | 0.2150468 | 0.8483065 | 6.2125942  | -0.1075234   | ±j 0.9147378 | 4.2829531  |  |
|        |         |                                       | 0.0693058 | 1.0267419 | 20.6082544 | -0.0346529   | ±j 1.0126900 | 14.6204579 |  |
|        |         |                                       |           |           |            | -0.2797703   |              |            |  |
| 2.00   | 131.777 | 0.4936527                             | 0.2049309 | 4.1074418 | -0.2468264 | ±j 0.3794834 | 0.9170271    |            |  |
|        |         |                                       | 0.3750815 | 0.5170713 | 5.1532091  | -0.1875408   | ±j 0.6941900 | 1.9171212  |  |
|        |         |                                       | 0.2262528 | 0.8373373 | 8.9221914  | -0.1131264   | ±j 0.9080417 | 4.0444198  |  |
|        |         |                                       | 0.0746795 | 1.0285475 | 30.2010593 | -0.0373397   | ±j 1.0134857 | 13.5803507 |  |
|        |         |                                       |           |           |            | -0.2701489   |              |            |  |

| CASE A |         | Passband Ripple: Ap(dB)=0.2 |           |           |               |               |           |            |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 10     | 1.05    | 58.742                      | 0.7219023 | 0.2143304 | 1.1096718     | -0.3609512 ±j | 0.2899045 | 0.6413032  |
|        |         |                             | 0.4286979 | 0.5530684 | 1.1814619     | -0.2143489 ±j | 0.7121256 | 1.7347548  |
|        |         |                             | 0.1876661 | 0.8301441 | 1.4386640     | -0.0938331 ±j | 0.9062778 | 4.8550185  |
|        |         |                             | 0.0697921 | 0.9612792 | 2.5336482     | -0.0348961 ±j | 0.9798273 | 14.0481224 |
|        |         |                             | 0.0172839 | 1.0074563 | 16.8596102    | -0.0086419 ±j | 1.0036741 | 58.0721057 |
| 1.10   | 71.443  | 0.6468828                   | 0.1678608 | 1.2215638 | -0.3234414 ±j | 0.2514885     | 0.6333577 |            |
|        |         |                             | 0.4353334 | 0.4706465 | 1.3338339     | -0.2176667 ±j | 0.6505903 | 1.5758882  |
|        |         |                             | 0.2237432 | 0.7700839 | 1.7140833     | -0.1118716 ±j | 0.8703842 | 3.9221043  |
|        |         |                             | 0.0957040 | 0.9414361 | 3.2619424     | -0.0478520 ±j | 0.9690956 | 10.1383078 |
|        |         |                             | 0.0258247 | 1.0106505 | 23.1838025    | -0.0129123 ±j | 1.0052282 | 38.9283110 |
| 1.15   | 80.588  | 0.6062003                   | 0.1456323 | 1.3379528 | -0.3031002 ±j | 0.2318676     | 0.6295245 |            |
|        |         |                             | 0.4346591 | 0.4259971 | 1.4860346     | -0.2173296 ±j | 0.6154389 | 1.5016010  |
|        |         |                             | 0.2436755 | 0.7326024 | 1.9755745     | -0.1218378 ±j | 0.8472060 | 3.5125478  |
|        |         |                             | 0.1126258 | 0.9276810 | 3.9305495     | -0.0563129 ±j | 0.9615143 | 8.5518799  |
|        |         |                             | 0.0318411 | 1.0128493 | 28.9230322    | -0.0159205 ±j | 1.0062782 | 31.6071020 |
| 1.20   | 88.023  | 0.5794448                   | 0.1320597 | 1.4591581 | -0.2897224 ±j | 0.2193640     | 0.6271522 |            |
|        |         |                             | 0.4325331 | 0.3968678 | 1.6414311     | -0.2162665 ±j | 0.5916896 | 1.4564770  |
|        |         |                             | 0.2567541 | 0.7060577 | 2.2359899     | -0.1283771 ±j | 0.8304077 | 3.2726736  |
|        |         |                             | 0.1249837 | 0.9172891 | 4.5854918     | -0.0624918 ±j | 0.9557112 | 7.6630169  |
|        |         |                             | 0.0364470 | 1.0145044 | 34.5122486    | -0.0182235 ±j | 1.0070612 | 27.6354006 |
| 1.25   | 94.407  | 0.5601532                   | 0.1227656 | 1.5853042 | -0.2800766 ±j | 0.2105295     | 0.6255059 |            |
|        |         |                             | 0.4301619 | 0.3760473 | 1.8012990     | -0.2150810 ±j | 0.5742713 | 1.4255724  |
|        |         |                             | 0.2661077 | 0.6859953 | 2.5000000     | -0.1330538 ±j | 0.8174913 | 3.1124558  |
|        |         |                             | 0.1345390 | 0.9090675 | 5.2430274     | -0.0672695 ±j | 0.9510743 | 7.0867969  |
|        |         |                             | 0.0401306 | 1.0158129 | 40.1039839    | -0.0200653 ±j | 1.0076757 | 25.1149040 |
| 1.30   | 100.063 | 0.5454550                   | 0.1159532 | 1.7164539 | -0.2727275 ±j | 0.2038944     | 0.6242844 |            |
|        |         |                             | 0.4278811 | 0.3603137 | 1.9662686     | -0.2139405 ±j | 0.5608415 | 1.4028697  |
|        |         |                             | 0.2731641 | 0.6701988 | 2.7698611     | -0.1365820 ±j | 0.8071828 | 2.9969415  |
|        |         |                             | 0.1421975 | 0.9023659 | 5.9108926     | -0.0710987 ±j | 0.9472649 | 6.6803546  |
|        |         |                             | 0.0431604 | 1.0168800 | 45.7705353    | -0.0215802 ±j | 1.0081738 | 23.3641421 |
| 1.35   | 105.176 | 0.5338324                   | 0.1107275 | 1.8526432 | -0.2669162 ±j | 0.1987040     | 0.6233369 |            |
|        |         |                             | 0.4257860 | 0.3479641 | 2.1366988     | -0.2128930 ±j | 0.5501278 | 1.3854022  |
|        |         |                             | 0.2786876 | 0.6573998 | 3.0468391     | -0.1393438 ±j | 0.7987384 | 2.9093578  |
|        |         |                             | 0.1484922 | 0.8967850 | 6.5933849     | -0.0742461 ±j | 0.9440723 | 6.3773538  |
|        |         |                             | 0.0457026 | 1.0177696 | 51.5519660    | -0.0228513 ±j | 1.0085868 | 22.0741371 |
| 1.40   | 109.863 | 0.5243908                   | 0.1065856 | 1.9938949 | -0.2621954 ±j | 0.1945229     | 0.6225786 |            |
|        |         |                             | 0.4238941 | 0.3379976 | 2.3128131     | -0.2119470 ±j | 0.5413650 | 1.3715116  |
|        |         |                             | 0.2831309 | 0.6468053 | 3.3317143     | -0.1415655 ±j | 0.7916846 | 2.8405308  |
|        |         |                             | 0.1537647 | 0.8920613 | 7.2931353     | -0.0768824 ±j | 0.9413556 | 6.1424360  |
|        |         |                             | 0.0478684 | 1.0185234 | 57.4727614    | -0.0239342 ±j | 1.0089354 | 21.0831923 |
| 1.45   | 114.205 | 0.5165615                   | 0.1032202 | 2.1402240 | -0.2582807 ±j | 0.1910792     | 0.6219570 |            |
|        |         |                             | 0.4221959 | 0.3297812 | 2.4947597     | -0.2110979 ±j | 0.5340589 | 1.3601881  |
|        |         |                             | 0.2867816 | 0.6378878 | 3.6250000     | -0.1433908 ±j | 0.7857015 | 2.7849719  |
|        |         |                             | 0.1582470 | 0.8880107 | 8.0118665     | -0.0791235 ±j | 0.9390156 | 5.9548896  |
|        |         |                             | 0.0497360 | 1.0191707 | 63.5489356    | -0.0248680 ±j | 1.0092335 | 20.2979852 |
| 1.50   | 118.260 | 0.5099624                   | 0.1004319 | 2.2916411 | -0.2549812 ±j | 0.1881927     | 0.6214379 |            |
|        |         |                             | 0.4206734 | 0.3228918 | 2.6826414     | -0.2103367 ±j | 0.5278734 | 1.3507764  |
|        |         |                             | 0.2898324 | 0.6302798 | 3.9270510     | -0.1449162 ±j | 0.7805633 | 2.7391747  |
|        |         |                             | 0.1621036 | 0.8845004 | 8.7507642     | -0.0810518 ±j | 0.9369797 | 5.8017157  |
|        |         |                             | 0.0513624 | 1.0197323 | 69.7914985    | -0.0256812 ±j | 1.0094913 | 19.6606575 |
| 1.70   | 132.338 | 0.4914846                   | 0.0928565 | 2.9483149 | -0.2457423 ±j | 0.1801867     | 0.6200065 |            |
|        |         |                             | 0.4159663 | 0.3037897 | 3.4947482     | -0.2079832 ±j | 0.5104240 | 1.3250380  |
|        |         |                             | 0.2982294 | 0.6085397 | 5.2271136     | -0.1491147 ±j | 0.7657052 | 2.6157365  |
|        |         |                             | 0.1732924 | 0.8741858 | 11.9220243    | -0.0866462 ±j | 0.9309555 | 5.3953831  |
|        |         |                             | 0.0561847 | 1.0213867 | 96.5555666    | -0.0280923 ±j | 1.0102463 | 17.9877734 |
| 2.00   | 149.231 | 0.4761575                   | 0.0868281 | 4.0866858 | -0.2380787 ±j | 0.1736278     | 0.6188417 |            |
|        |         |                             | 0.4115649 | 0.2881735 | 4.8979715     | -0.2057824 ±j | 0.4958095 | 1.3043337  |
|        |         |                             | 0.3050075 | 0.5900320 | 7.4641016     | -0.1525037 ±j | 0.7528443 | 2.5184150  |
|        |         |                             | 0.1830201 | 0.8650632 | 17.3634536    | -0.0915100 ±j | 0.9255750 | 5.0818889  |
|        |         |                             | 0.0605051 | 1.0228563 | 142.4309671   | -0.0302526 ±j | 1.0109110 | 16.7153370 |



| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.2$ |           |           |               |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | $A_s(\text{dB})$                      | A1        | B1        | C1            | P1            | Q1        |            |
| 11     | 1.05    | 67.147                                | 0.5568385 | 0.3126345 | 1.1084015     | -0.2784193 ±j | 0.4848889 | 1.0041284  |
|        |         |                                       | 0.3082142 | 0.6408206 | 1.1652129     | -0.1541071 ±j | 0.7855390 | 2.5972610  |
|        |         |                                       | 0.1395598 | 0.8616680 | 1.3488607     | -0.0697799 ±j | 0.9256342 | 6.6513477  |
|        |         |                                       | 0.0553658 | 0.9670438 | 1.9760810     | -0.0276829 ±j | 0.9829941 | 17.7615844 |
|        |         |                                       | 0.0143924 | 1.0060089 | 5.6021835     | -0.0071962 ±j | 1.0029741 | 69.6895457 |
|        |         |                                       |           |           | -0.3502609    |               |           |            |
| 1.10   | 81.118  | 0.5198380                             | 0.2524791 | 1.2195217 | -0.2599190 ±j | 0.4300247     | 0.9665953 |            |
|        |         |                                       | 0.3283331 | 0.5616672 | 1.3088558     | -0.1641666 ±j | 0.7312432 | 2.2825739  |
|        |         |                                       | 0.1715504 | 0.8105909 | 1.5834523     | -0.0857752 ±j | 0.8962329 | 5.2481845  |
|        |         |                                       | 0.0767767 | 0.9505196 | 2.4791006     | -0.0383884 ±j | 0.9741899 | 12.6984527 |
|        |         |                                       | 0.0214536 | 1.0086441 | 7.5378437     | -0.0107268 ±j | 1.0042555 | 46.8133180 |
|        |         |                                       |           |           | -0.3084519    |               |           |            |
| 1.15   | 91.177  | 0.4971963                             | 0.2224135 | 1.3352275 | -0.2485981 ±j | 0.4007648     | 0.9485334 |            |
|        |         |                                       | 0.3363895 | 0.5168635 | 1.4533340     | -0.1681947 ±j | 0.6989807 | 2.1372019  |
|        |         |                                       | 0.1900847 | 0.7780525 | 1.8085794     | -0.0950424 ±j | 0.8769375 | 4.6404198  |
|        |         |                                       | 0.0909254 | 0.9390507 | 2.9446236     | -0.0454627 ±j | 0.9679792 | 10.6575976 |
|        |         |                                       | 0.0264191 | 1.0104525 | 9.2991673     | -0.0132095 ±j | 1.0051259 | 38.0487809 |
|        |         |                                       |           |           | -0.2866383    |               |           |            |
| 1.20   | 99.356  | 0.4813997                             | 0.2036293 | 1.4557817 | -0.2406998 ±j | 0.3816973     | 0.9373770 |            |
|        |         |                                       | 0.3404542 | 0.4868871 | 1.6013465     | -0.1702271 ±j | 0.6766904 | 2.0495354  |
|        |         |                                       | 0.2026347 | 0.7547044 | 2.0339626     | -0.1013174 ±j | 0.8628089 | 4.2872083  |
|        |         |                                       | 0.1013367 | 0.9303726 | 3.4024453     | -0.0506683 ±j | 0.9632265 | 9.5183510  |
|        |         |                                       | 0.0302167 | 1.0118163 | 11.0168385    | -0.0151084 ±j | 1.0057774 | 33.2891827 |
|        |         |                                       |           |           | -0.2725682    |               |           |            |
| 1.25   | 106.379 | 0.4695865                             | 0.1905756 | 1.5812870 | -0.2347932 ±j | 0.3680322     | 0.9296469 |            |
|        |         |                                       | 0.3427368 | 0.4650932 | 1.7539211     | -0.1713684 ±j | 0.6600955 | 1.9897992  |
|        |         |                                       | 0.2118236 | 0.7368911 | 2.2631658     | -0.1059118 ±j | 0.8518649 | 4.0525397  |
|        |         |                                       | 0.1094314 | 0.9234973 | 3.8631607     | -0.0547157 ±j | 0.9594287 | 8.7816483  |
|        |         |                                       | 0.0332520 | 1.0128961 | 12.7367378    | -0.0166260 ±j | 1.0062900 | 30.2666663 |
|        |         |                                       |           |           | -0.2625459    |               |           |            |
| 1.30   | 112.600 | 0.4603565                             | 0.1809073 | 1.7117951 | -0.2301783 ±j | 0.3576664     | 0.9239186 |            |
|        |         |                                       | 0.3440956 | 0.4484174 | 1.9115674     | -0.1720478 ±j | 0.6471607 | 1.9460864  |
|        |         |                                       | 0.2188858 | 0.7227639 | 2.4979196     | -0.1094429 ±j | 0.8430814 | 3.8840136  |
|        |         |                                       | 0.1159469 | 0.9178860 | 4.3318290     | -0.0578735 ±j | 0.9563081 | 8.2629493  |
|        |         |                                       | 0.0357473 | 1.0137775 | 14.4806247    | -0.0178736 ±j | 1.0067065 | 28.1662054 |
|        |         |                                       |           |           | -0.2549742    |               |           |            |
| 1.35   | 118.224 | 0.4529213                             | 0.1734327 | 1.8473359 | -0.2264607 ±j | 0.3494971     | 0.9194809 |            |
|        |         |                                       | 0.3449301 | 0.4352021 | 2.0745762     | -0.1724650 ±j | 0.6367557 | 1.9125571  |
|        |         |                                       | 0.2244985 | 0.7112518 | 2.7391978     | -0.1122493 ±j | 0.8358540 | 3.7566279  |
|        |         |                                       | 0.1213208 | 0.9132082 | 4.8112671     | -0.0606604 ±j | 0.9536921 | 7.8767987  |
|        |         |                                       | 0.0378402 | 1.0145128 | 16.2605612    | -0.0189201 ±j | 1.0070526 | 26.6179759 |
|        |         |                                       |           |           | -0.2490243    |               |           |            |
| 1.40   | 123.380 | 0.4467943                             | 0.1674719 | 1.9879279 | -0.2233971 ±j | 0.3428784     | 0.9159322 |            |
|        |         |                                       | 0.3454484 | 0.4244552 | 2.2431285     | -0.1727242 ±j | 0.6281891 | 1.8859612  |
|        |         |                                       | 0.2290716 | 0.7016778 | 2.9876021     | -0.1145358 ±j | 0.8297947 | 3.6567700  |
|        |         |                                       | 0.1258347 | 0.9092451 | 5.3032020     | -0.0629174 ±j | 0.9514655 | 7.5777456  |
|        |         |                                       | 0.0396227 | 1.0151364 | 18.0839213    | -0.0198114 ±j | 1.0073450 | 25.4283388 |
|        |         |                                       |           |           | -0.2442143    |               |           |            |
| 1.45   | 128.156 | 0.4416554                             | 0.1626047 | 2.1335836 | -0.2208277 ±j | 0.3374016     | 0.9130258 |            |
|        |         |                                       | 0.3457678 | 0.4155399 | 2.4173448     | -0.1728839 ±j | 0.6210081 | 1.8643261  |
|        |         |                                       | 0.2328700 | 0.6935877 | 3.2435289     | -0.1164350 ±j | 0.8246397 | 3.5763262  |
|        |         |                                       | 0.1296813 | 0.9058440 | 5.8087659     | -0.0648406 ±j | 0.9495471 | 7.3392120  |
|        |         |                                       | 0.0411593 | 1.0156720 | 19.9555287    | -0.0205797 ±j | 1.0075954 | 24.4854779 |
|        |         |                                       |           |           | -0.2402410    |               |           |            |
| 1.50   | 132.616 | 0.4372836                             | 0.1585559 | 2.2843118 | -0.2186418 ±j | 0.3327937     | 0.9106007 |            |
|        |         |                                       | 0.3459581 | 0.4080256 | 2.5973085     | -0.1729790 ±j | 0.6149015 | 1.8463763  |
|        |         |                                       | 0.2360742 | 0.6866627 | 3.5072526     | -0.1180371 ±j | 0.8202012 | 3.5101299  |
|        |         |                                       | 0.1329977 | 0.9028944 | 6.3287388     | -0.0664988 ±j | 0.9478778 | 7.1445420  |
|        |         |                                       | 0.0424972 | 1.0161369 | 21.8787000    | -0.0212486 ±j | 1.0078122 | 23.7200496 |
|        |         |                                       |           |           | -0.2369026    |               |           |            |
| 1.70   | 148.103 | 0.4248499                             | 0.1474801 | 2.9380530 | -0.2124250 ±j | 0.3199308     | 0.9039225 |            |
|        |         |                                       | 0.3460998 | 0.3870026 | 3.3756369     | -0.1730499 ±j | 0.5975419 | 1.7974449  |
|        |         |                                       | 0.2450461 | 0.6667577 | 4.6433716     | -0.1225230 ±j | 0.8073078 | 3.3322397  |
|        |         |                                       | 0.1426549 | 0.8942156 | 8.5619394     | -0.0713275 ±j | 0.9429358 | 6.6287903  |
|        |         |                                       | 0.0464626 | 1.0175077 | 30.1261720    | -0.0232313 ±j | 1.0084483 | 21.7102682 |
|        |         |                                       |           |           | -0.2276045    |               |           |            |
| 2.00   | 166.685 | 0.4143261                             | 0.1385860 | 4.0714332 | -0.2071631 ±j | 0.3093048     | 0.8984985 |            |
|        |         |                                       | 0.3457700 | 0.3696078 | 4.7212543     | -0.1728850 ±j | 0.5828538 | 1.7582605  |
|        |         |                                       | 0.2524695 | 0.6496747 | 6.5999975     | -0.1262348 ±j | 0.7960776 | 3.1925595  |
|        |         |                                       | 0.1510943 | 0.8865246 | 12.3963998    | -0.0755472 ±j | 0.9385186 | 6.2315664  |
|        |         |                                       | 0.0500135 | 1.0187265 | 44.2665611    | -0.0250068 ±j | 1.0090100 | 20.1809351 |
|        |         |                                       |           |           | -0.2189450    |               |           |            |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.2$ |           |           |             |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|-------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1          | P1            | Q1        |            |
| 12     | 1.05    | 75.552                                | 0.6076828 | 0.1472220 | 1.1074426   | -0.3038414 ±j | 0.2343125 | 0.6314069  |
|        |         |                                       | 0.4226013 | 0.4217078 | 1.1536336   | -0.2113006 ±j | 0.6140520 | 1.5366503  |
|        |         |                                       | 0.2288951 | 0.7082443 | 1.2918984   | -0.1144475 ±j | 0.8337542 | 3.6766740  |
|        |         |                                       | 0.1076763 | 0.8854379 | 1.6991591   | -0.0538382 ±j | 0.9394356 | 8.7389425  |
|        |         |                                       | 0.0450616 | 0.9717329 | 3.3125181   | -0.0225308 ±j | 0.9855076 | 21.8759396 |
|        |         |                                       | 0.0121641 | 1.0049633 | 23.9660912  | -0.0060820 ±j | 1.0024601 | 82.4131517 |
| 1.10   | 90.793  | 90.793                                | 0.5428171 | 0.1155504 | 1.2179786   | -0.2714086 ±j | 0.2046651 | 0.6262276  |
|        |         |                                       | 0.4122090 | 0.3509975 | 1.2909254   | -0.2061045 ±j | 0.5554443 | 1.4372572  |
|        |         |                                       | 0.2537609 | 0.6348474 | 1.4996665   | -0.1268805 ±j | 0.7866059 | 3.1398573  |
|        |         |                                       | 0.1356430 | 0.8416100 | 2.0872157   | -0.0678215 ±j | 0.9148827 | 6.7632889  |
|        |         |                                       | 0.0630414 | 0.9577587 | 4.3499304   | -0.0315207 ±j | 0.9781437 | 15.5239577 |
|        |         |                                       | 0.0180976 | 1.0071621 | 33.0577896  | -0.0090488 ±j | 1.0035339 | 55.4533300 |
| 1.15   | 101.767 | 101.767                               | 0.5079590 | 0.1003699 | 1.3331670   | -0.2539795 ±j | 0.1893787 | 0.6236961  |
|        |         |                                       | 0.4032468 | 0.3140833 | 1.4297858   | -0.2016234 ±j | 0.5229066 | 1.3897976  |
|        |         |                                       | 0.2657305 | 0.5918777 | 1.7009576   | -0.1328653 ±j | 0.7577760 | 2.8951732  |
|        |         |                                       | 0.1523863 | 0.8132620 | 2.4494590   | -0.0761932 ±j | 0.8985859 | 5.9179220  |
|        |         |                                       | 0.0750297 | 0.9480499 | 5.2979222   | -0.0375149 ±j | 0.9729555 | 12.9772404 |
|        |         |                                       | 0.0222658 | 1.0086762 | 41.3060302  | -0.0111329 ±j | 1.0042670 | 45.1063028 |
| 1.20   | 110.689 | 110.689                               | 0.4851318 | 0.0910889 | 1.4532283   | -0.2425659 ±j | 0.1795847 | 0.6221183  |
|        |         |                                       | 0.3961073 | 0.2904700 | 1.5724303   | -0.1980536 ±j | 0.5012432 | 1.3606232  |
|        |         |                                       | 0.2728619 | 0.5625510 | 1.9034206   | -0.1364310 ±j | 0.7375213 | 2.7487678  |
|        |         |                                       | 0.1639674 | 0.7927212 | 2.8072245   | -0.0819837 ±j | 0.8865663 | 5.4300368  |
|        |         |                                       | 0.0839012 | 0.9406954 | 6.2244021   | -0.0419506 ±j | 0.9689869 | 11.5599589 |
|        |         |                                       | 0.0254514 | 1.0098198 | 49.3373729  | -0.0127257 ±j | 1.0048173 | 39.4830377 |
| 1.25   | 118.350 | 118.350                               | 0.4687148 | 0.0847278 | 1.5782485   | -0.2343574 ±j | 0.1726396 | 0.6210182  |
|        |         |                                       | 0.3903563 | 0.2738055 | 1.7197065   | -0.1951781 ±j | 0.4855008 | 1.3404788  |
|        |         |                                       | 0.2775885 | 0.5409364 | 2.1098820   | -0.1387942 ±j | 0.7222691 | 2.6495476  |
|        |         |                                       | 0.1725802 | 0.7769384 | 3.1681544   | -0.0862901 ±j | 0.8772072 | 5.1074274  |
|        |         |                                       | 0.0908271 | 0.9348628 | 7.1532769   | -0.0454135 ±j | 0.9658159 | 10.6453158 |
|        |         |                                       | 0.0279962 | 1.0107262 | 57.3715316  | -0.0139981 ±j | 1.0052513 | 35.9102435 |
| 1.30   | 125.137 | 125.137                               | 0.4562285 | 0.0800621 | 1.7082709   | -0.2281142 ±j | 0.1674097 | 0.6201991  |
|        |         |                                       | 0.3856396 | 0.2613258 | 1.8720353   | -0.1928198 ±j | 0.4734410 | 1.3255911  |
|        |         |                                       | 0.2809353 | 0.5242298 | 2.3217202   | -0.1404677 ±j | 0.7102807 | 2.5772379  |
|        |         |                                       | 0.1792808 | 0.7643534 | 3.5359122   | -0.0896404 ±j | 0.8696655 | 4.8765561  |
|        |         |                                       | 0.0964192 | 0.9300985 | 8.0959007   | -0.0482096 ±j | 0.9632104 | 10.0023266 |
|        |         |                                       | 0.0300873 | 1.0114665 | 65.5126430  | -0.0150437 ±j | 1.0056044 | 33.4266068 |
| 1.35   | 131.272 | 131.272                               | 0.4463674 | 0.0764812 | 1.8433207   | -0.2231837 ±j | 0.1633103 | 0.6195623  |
|        |         |                                       | 0.3817067 | 0.2515966 | 2.0296574   | -0.1908533 ±j | 0.4638659 | 1.3140825  |
|        |         |                                       | 0.2834165 | 0.5108857 | 2.5397132   | -0.1417082 ±j | 0.7005744 | 2.5219520  |
|        |         |                                       | 0.1846589 | 0.7540533 | 3.9125428   | -0.0923295 ±j | 0.8634400 | 4.7025212  |
|        |         |                                       | 0.1010440 | 0.9261232 | 9.0585736   | -0.0505220 ±j | 0.9610259 | 9.5240966  |
|        |         |                                       | 0.0318411 | 1.0120851 | 73.8184125  | -0.0159205 ±j | 1.0058984 | 31.5951803 |
| 1.40   | 136.897 | 136.897                               | 0.4383644 | 0.0736417 | 1.9834134   | -0.2191822 ±j | 0.1600028 | 0.6190515  |
|        |         |                                       | 0.3783808 | 0.2437866 | 2.1927230   | -0.1891904 ±j | 0.4560631 | 1.3048959  |
|        |         |                                       | 0.2853195 | 0.4999656 | 2.7643424   | -0.1426598 ±j | 0.6925416 | 2.4782129  |
|        |         |                                       | 0.1890769 | 0.7454569 | 4.2993023   | -0.0945384 ±j | 0.8582071 | 4.5663882  |
|        |         |                                       | 0.1049355 | 0.9227538 | 10.0451492  | -0.0524677 ±j | 0.9591668 | 9.1542036  |
|        |         |                                       | 0.0333339 | 1.0126088 | 82.3241078  | -0.0166669 ±j | 1.0061466 | 30.1880422 |
| 1.45   | 142.107 | 142.107                               | 0.4317330 | 0.0713338 | 2.1285596   | -0.2158665 ±j | 0.1572751 | 0.6186321  |
|        |         |                                       | 0.3755342 | 0.2373755 | 2.3613317   | -0.1877671 ±j | 0.4495765 | 1.2973836  |
|        |         |                                       | 0.2868183 | 0.4908598 | 2.9959256   | -0.1434092 ±j | 0.6857795 | 2.4427096  |
|        |         |                                       | 0.1927719 | 0.7381711 | 4.6970152   | -0.0963860 ±j | 0.8537452 | 4.4569195  |
|        |         |                                       | 0.1082580 | 0.9198602 | 11.0581496  | -0.0541290 ±j | 0.9575648 | 8.8593305  |
|        |         |                                       | 0.0346207 | 1.0130593 | 91.0527944  | -0.0173103 ±j | 1.0063596 | 29.0724527 |
| 1.50   | 146.973 | 146.973                               | 0.4261470 | 0.0694211 | 2.2787664   | -0.2130735 ±j | 0.1549863 | 0.6182814  |
|        |         |                                       | 0.3730730 | 0.2320188 | 2.5355530   | -0.1865365 ±j | 0.4440978 | 1.2911233  |
|        |         |                                       | 0.2880242 | 0.4831515 | 3.2346828   | -0.1440121 ±j | 0.6800089 | 2.4133081  |
|        |         |                                       | 0.1959074 | 0.7319189 | 5.1062498   | -0.0979537 ±j | 0.8498964 | 4.3669740  |
|        |         |                                       | 0.1111269 | 0.9173494 | 12.0993095  | -0.0555635 ±j | 0.9561705 | 8.6188241  |
|        |         |                                       | 0.0357409 | 1.0134505 | 100.0203299 | -0.0178705 ±j | 1.0065442 | 28.1666641 |
| 1.70   | 163.868 | 163.868                               | 0.4105217 | 0.0642217 | 2.9302881   | -0.2052609 ±j | 0.1486261 | 0.6173122  |
|        |         |                                       | 0.3658822 | 0.2172549 | 3.2893923   | -0.1829411 ±j | 0.4287044 | 1.2739242  |
|        |         |                                       | 0.2911099 | 0.4614231 | 4.2640673   | -0.1455550 ±j | 0.6635035 | 2.3334185  |
|        |         |                                       | 0.2047815 | 0.7138661 | 6.8651328   | -0.1023908 ±j | 0.8386789 | 4.1258896  |
|        |         |                                       | 0.1195039 | 0.9099543 | 16.5660270  | -0.0597520 ±j | 0.9520420 | 7.9822935  |
|        |         |                                       | 0.0390602 | 1.0146047 | 138.4661013 | -0.0195301 ±j | 1.0070865 | 25.7877661 |
| 2.00   | 184.139 | 184.139                               | 0.3975774 | 0.0600812 | 4.0598914   | -0.1987887 ±j | 0.1434026 | 0.6165209  |
|        |         |                                       | 0.3595859 | 0.2052805 | 4.5932605   | -0.1797929 ±j | 0.4158785 | 1.2600018  |
|        |         |                                       | 0.2933293 | 0.4432607 | 6.0382667   | -0.1466646 ±j | 0.6494230 | 2.2697301  |
|        |         |                                       | 0.2122362 | 0.6982760 | 9.8873550   | -0.1061181 ±j | 0.8288637 | 3.9372599  |
|        |         |                                       | 0.1268519 | 0.9033918 | 24.2272012  | -0.0634259 ±j | 0.9483506 | 7.4927486  |
|        |         |                                       | 0.0420313 | 1.0156315 | 204.3626509 | -0.0210157 ±j | 1.0075663 | 23.9770072 |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.5$ |           |           |           |                                  |           |           |
|--------|------|---------------------------------------|-----------|-----------|-----------|----------------------------------|-----------|-----------|
| n      | Ws   | As (dB)                               | A1        | B1        | C1        | P1                               | Q1        |           |
| 2      | 1.05 | 1.553                                 | 0.2751653 | 1.2743412 | 1.4386640 | -0.1375827 $\pm j$               | 1.1204518 | 4.1025056 |
|        | 1.10 | 2.354                                 | 0.4298725 | 1.3846530 | 1.7140833 | -0.2149362 $\pm j$               | 1.1569163 | 2.7373531 |
|        | 1.15 | 3.144                                 | 0.5557066 | 1.4570556 | 1.9755745 | -0.2778533 $\pm j$               | 1.1746715 | 2.1721633 |
|        | 1.20 | 3.929                                 | 0.6609881 | 1.5067570 | 2.2359899 | -0.3304940 $\pm j$               | 1.1821720 | 1.8570688 |
|        | 1.25 | 4.702                                 | 0.7498065 | 1.5412040 | 2.5000000 | -0.3749032 $\pm j$               | 1.1834912 | 1.6556970 |
|        | 1.30 | 5.459                                 | 0.8250785 | 1.5650010 | 2.7698611 | -0.4125393 $\pm j$               | 1.1810217 | 1.5162193 |
|        | 1.35 | 6.197                                 | 0.8891361 | 1.5812422 | 3.0468391 | -0.4445680 $\pm j$               | 1.1762659 | 1.4142656 |
|        | 1.40 | 6.914                                 | 0.9438940 | 1.5920793 | 3.3317143 | -0.4719470 $\pm j$               | 1.1701903 | 1.3367775 |
|        | 1.45 | 7.609                                 | 0.9909287 | 1.5990339 | 3.6250000 | -0.4954643 $\pm j$               | 1.1634212 | 1.2761051 |
|        | 1.50 | 8.282                                 | 1.0315340 | 1.6031929 | 3.9270510 | -0.5157670 $\pm j$               | 1.1563638 | 1.2274656 |
|        | 1.70 | 10.758                                | 1.1481760 | 1.6046247 | 5.2271136 | -0.5740880 $\pm j$               | 1.1291801 | 1.1032610 |
|        | 2.00 | 13.922                                | 1.2450405 | 1.5917857 | 7.4641016 | -0.6225203 $\pm j$               | 1.0973852 | 1.0133484 |
| 3      | 1.05 | 5.558                                 | 0.1302092 | 1.0865090 | 1.2054102 | -0.0651046 $\pm j$<br>-1.3200497 | 1.0403223 | 8.0052535 |
|        | 1.10 | 8.546                                 | 0.2078707 | 1.1142212 | 1.3703136 | -0.1039353 $\pm j$<br>-1.112862  | 1.0504374 | 5.0779974 |
|        | 1.15 | 10.976                                | 0.2651435 | 1.1284575 | 1.5336053 | -0.1325717 $\pm j$<br>-1.0036471 | 1.0539840 | 4.0064660 |
|        | 1.20 | 13.057                                | 0.3096018 | 1.1366169 | 1.6996171 | -0.1548009 $\pm j$<br>-0.9346435 | 1.0548240 | 3.4435281 |
|        | 1.25 | 14.890                                | 0.3452464 | 1.1415701 | 1.8699785 | -0.1726232 $\pm j$<br>-0.8863206 | 1.0544057 | 3.0947256 |
|        | 1.30 | 16.538                                | 0.3745004 | 1.1446754 | 2.0454918 | -0.1872502 $\pm j$<br>-0.8503815 | 1.0533816 | 2.8568593 |
|        | 1.35 | 18.041                                | 0.3989459 | 1.1466520 | 2.2266128 | -0.1994729 $\pm j$<br>-0.8225280 | 1.0520753 | 2.6841194 |
|        | 1.40 | 19.427                                | 0.4196700 | 1.1479101 | 2.4136247 | -0.2098350 $\pm j$<br>-0.8002799 | 1.0506567 | 2.5529718 |
|        | 1.45 | 20.716                                | 0.4374495 | 1.1486971 | 2.6067151 | -0.2187248 $\pm j$<br>-0.7820935 | 1.0492171 | 2.4500492 |
|        | 1.50 | 21.923                                | 0.4528564 | 1.1491683 | 2.8060141 | -0.2264282 $\pm j$<br>-0.7669521 | 1.0478066 | 2.3671802 |
|        | 1.70 | 26.128                                | 0.4980586 | 1.1494746 | 3.6668482 | -0.2490293 $\pm j$<br>-0.7254805 | 1.0428130 | 2.1526292 |
|        | 2.00 | 31.188                                | 0.5378717 | 1.1484897 | 5.1532091 | -0.2689359 $\pm j$<br>-0.6921248 | 1.0373829 | 1.9924381 |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.5$ |                        |                        |                         |                                              |                        |                         |
|--------|------|---------------------------------------|------------------------|------------------------|-------------------------|----------------------------------------------|------------------------|-------------------------|
| n      | Ws   | As(dB)                                | A1                     | B1                     | C1                      | P1                                           | Q1                     |                         |
| 4      | 1.05 | 12.698                                | 0.9789281<br>0.0810475 | 0.9056314<br>1.0360359 | 1.1536336<br>3.3125181  | -0.4894640 ±j<br>-0.0405237 ±j               | 0.8161228<br>1.0170515 | 0.9721314<br>12.5587861 |
|        | 1.10 | 17.604                                | 0.9950829<br>0.1244823 | 0.7495833<br>1.0455664 | 1.2909254<br>4.3499304  | -0.4975415 ±j<br>-0.0622411 ±j               | 0.7085449<br>1.0206333 | 0.8700629<br>8.2142578  |
|        | 1.15 | 21.216                                | 0.9858050<br>0.1552819 | 0.6639312<br>1.0505862 | 1.4297858<br>5.2979222  | -0.4929025 ±j<br>-0.0776410 ±j               | 0.6488285<br>1.0220363 | 0.8265527<br>6.6007751  |
|        | 1.20 | 24.173                                | 0.9733269<br>0.1788745 | 0.6085473<br>1.0536989 | 1.5724303<br>6.2244021  | -0.4866635 ±j<br>-0.0894373 ±j               | 0.6096770<br>1.0225947 | 0.8014722<br>5.7386499  |
|        | 1.25 | 26.719                                | 0.9614118<br>0.1977243 | 0.5694076<br>1.0558008 | 1.7197065<br>7.1532769  | -0.4807059 ±j<br>-0.0988621 ±j               | 0.5816609<br>1.0227547 | 0.7848780<br>5.1967405  |
|        | 1.30 | 28.977                                | 0.9507868<br>0.2132051 | 0.5401428<br>1.0572991 | 1.8720353<br>8.0959007  | -0.4753934 ±j<br>-0.1066026 ±j               | 0.5604855<br>1.0227096 | 0.7729852<br>4.8228225  |
|        | 1.35 | 31.020                                | 0.9414821<br>0.2261740 | 0.5173859<br>1.0584088 | 2.0296574<br>9.0585736  | -0.4707410 ±j<br>-0.1130870 ±j               | 0.5438647<br>1.0225557 | 0.7640033<br>4.5486650  |
|        | 1.40 | 32.894                                | 0.9333588<br>0.2372050 | 0.4991687<br>1.0592545 | 2.1927230<br>10.0451492 | -0.4666794 ±j<br>-0.1186025 ±j               | 0.5304517<br>1.0223444 | 0.7569636<br>4.3388668  |
|        | 1.45 | 34.630                                | 0.9262511<br>0.2467023 | 0.4842553<br>1.0599140 | 2.3613317<br>11.0581496 | -0.4631256 ±j<br>-0.1233512 ±j               | 0.5193939<br>1.0221049 | 0.7512915<br>4.1731315  |
|        | 1.50 | 36.251                                | 0.9200056<br>0.2549615 | 0.4718265<br>1.0604377 | 2.5355530<br>12.0993095 | -0.4600028 ±j<br>-0.1274808 ±j               | 0.5101215<br>1.0218544 | 0.7466219<br>4.0389446  |
|        | 1.70 | 41.882                                | 0.9013251<br>0.2793793 | 0.4377449<br>1.0617292 | 3.2893923<br>16.5660270 | -0.4506625 ±j<br>-0.1396896 ±j               | 0.4844049<br>1.0208898 | 0.7340558<br>3.6881847  |
|        | 2.00 | 48.639                                | 0.8845576<br>0.3011558 | 0.4103174<br>1.0625759 | 4.5932605<br>24.2272012 | -0.4422788 ±j<br>-0.1505779 ±j               | 0.4633648<br>1.0197560 | 0.7241589<br>3.4228574  |
| 5      | 1.05 | 20.886                                | 0.4323114<br>0.0541969 | 0.8511782<br>1.0177650 | 1.1334220<br>1.7737385  | -0.2161557 ±j<br>-0.0270984 ±j<br>-0.6644197 | 0.8969141<br>1.0084794 | 2.1340941<br>18.6144237 |
|        | 1.10 | 27.207                                | 0.4923042<br>0.0816412 | 0.7655330<br>1.0225812 | 1.2593204<br>2.1930925  | -0.2461521 ±j<br>-0.0408206 ±j<br>-0.5731073 | 0.8396083<br>1.0104033 | 1.7772496<br>12.3862383 |
|        | 1.15 | 31.774                                | 0.5205828<br>0.1009685 | 0.7130476<br>1.0253399 | 1.3881033<br>2.5834170  | -0.2602914 ±j<br>-0.0504842 ±j<br>-0.5270727 | 0.8033032<br>1.0113314 | 1.6220695<br>10.0287785 |
|        | 1.20 | 35.490                                | 0.5370560<br>0.1157494 | 0.6765517<br>1.0271815 | 1.5211268<br>2.9683674  | -0.2685280 ±j<br>-0.0578747 ±j<br>-0.4979450 | 0.7774602<br>1.0118459 | 1.5315492<br>8.7559841  |
|        | 1.25 | 38.681                                | 0.5477411<br>0.1275571 | 0.6493882<br>1.0285103 | 1.6589139<br>3.3563960  | -0.2738706 ±j<br>-0.0637785 ±j<br>-0.4774571 | 0.7578806<br>1.0121475 | 1.4712174<br>7.9505983  |
|        | 1.30 | 41.509                                | 0.5551546<br>0.1372581 | 0.6282699<br>1.0295169 | 1.8017262<br>3.7515494  | -0.2775773 ±j<br>-0.0686291 ±j<br>-0.4621179 | 0.7424424<br>1.0123275 | 1.4277732<br>7.3922847  |
|        | 1.35 | 44.065                                | 0.5605455<br>0.1453898 | 0.6113391<br>1.0303058 | 1.9497131<br>4.1560845  | -0.2802728 ±j<br>-0.0726949 ±j<br>-0.4501460 | 0.7299221<br>1.0124333 | 1.3948586<br>6.9815086  |
|        | 1.40 | 46.409                                | 0.5646057<br>0.1523107 | 0.5974490<br>1.0309401 | 2.1029685<br>4.5713865  | -0.2823029 ±j<br>-0.0761554 ±j<br>-0.4405189 | 0.7195513<br>1.0124922 | 1.3690053<br>6.6663205  |
|        | 1.45 | 48.580                                | 0.5677486<br>0.1582734 | 0.5858462<br>1.0314603 | 2.2615546<br>4.9983644  | -0.2838743 ±j<br>-0.0791367 ±j<br>-0.4326005 | 0.7108176<br>1.0125205 | 1.3481424<br>6.4167974  |
|        | 1.50 | 50.607                                | 0.5702359<br>0.1634621 | 0.5760120<br>1.0318940 | 2.4255147<br>5.4376446  | -0.2851179 ±j<br>-0.0817310 ±j<br>-0.4259707 | 0.7033632<br>1.0125285 | 1.3309484<br>6.2144193  |
|        | 1.70 | 57.646                                | 0.5763869<br>0.1788227 | 0.5482434<br>1.0330788 | 3.1356145<br>7.3252003  | -0.2881934 ±j<br>-0.0894114 ±j<br>-0.4076153 | 0.6820469<br>1.0124645 | 1.2846139<br>5.6838677  |
|        | 2.00 | 66.093                                | 0.5805440<br>0.1928524 | 0.5249972<br>1.0340194 | 4.3649509<br>10.5677323 | -0.2902720 ±j<br>-0.0962762 ±j<br>-0.3926121 | 0.6638821<br>1.0122995 | 1.2480827<br>5.2809921  |

| CASE A |        | Passband Ripple: $A_p(\text{dB})=0.5$ |           |           |                    |                    |           |            |
|--------|--------|---------------------------------------|-----------|-----------|--------------------|--------------------|-----------|------------|
| n      | Ws     | As(dB)                                | Ai        | Bi        | CI                 | Pi                 | Qi        |            |
| 6      | 1.05   | 29.259                                | 0.8574618 | 0.4343528 | 1.1233258          | -0.4287309 $\pm j$ | 0.5005423 | 0.7686109  |
|        |        |                                       | 0.2377049 | 0.8773089 | 1.4386640          | -0.1188524 $\pm j$ | 0.9290764 | 3.9403805  |
|        |        |                                       | 0.0383979 | 1.0101218 | 6.5287683          | -0.0191989 $\pm j$ | 1.0048648 | 26.1745879 |
| 1.10   | 36.875 | 0.7930367                             | 0.3443244 | 1.2433620 | -0.3965183 $\pm j$ | 0.4325478          | 0.7399300 |            |
|        |        |                                       | 0.2887569 | 0.8185801 | 1.7140833          | -0.1443784 $\pm j$ | 0.8931601 | 3.1332733  |
|        |        |                                       | 0.0573585 | 1.0131039 | 8.8264550          | -0.0286792 $\pm j$ | 1.0061220 | 17.5480776 |
| 1.15   | 42.361 | 0.7541545                             | 0.3002543 | 1.3669587 | -0.3770772 $\pm j$ | 0.3975765          | 0.7265815 |            |
|        |        |                                       | 0.3172080 | 0.7808035 | 1.9755745          | -0.1586040 $\pm j$ | 0.8692803 | 2.7856513  |
|        |        |                                       | 0.0706764 | 1.0149068 | 10.9158033         | -0.0353382 $\pm j$ | 1.0068059 | 14.2540540 |
| 1.20   | 46.822 | 0.7273031                             | 0.2730620 | 1.4950350 | -0.3636516 $\pm j$ | 0.3752593          | 0.7184808 |            |
|        |        |                                       | 0.3359443 | 0.7536447 | 2.2359899          | -0.1679721 $\pm j$ | 0.8517218 | 2.5841400  |
|        |        |                                       | 0.0808512 | 1.0161593 | 12.9526713         | -0.0404256 $\pm j$ | 1.0072364 | 12.4679353 |
| 1.25   | 50.652 | 0.7073715                             | 0.2543262 | 1.6279471 | -0.3536858 $\pm j$ | 0.3594893          | 0.7129317 |            |
|        |        |                                       | 0.3493681 | 0.7329275 | 2.5000000          | -0.1746841 $\pm j$ | 0.8381008 | 2.4504578  |
|        |        |                                       | 0.0889753 | 1.0170926 | 14.9917591         | -0.0444877 $\pm j$ | 1.0075284 | 11.3347140 |
| 1.30   | 54.046 | 0.6918858                             | 0.2405366 | 1.7658735 | -0.3459429 $\pm j$ | 0.3476494          | 0.7088529 |            |
|        |        |                                       | 0.3595044 | 0.7165121 | 2.7698611          | -0.1797522 $\pm j$ | 0.8271646 | 2.3545483  |
|        |        |                                       | 0.0956485 | 1.0178191 | 17.0590037         | -0.0478243 $\pm j$ | 1.0077360 | 10.5476827 |
| 1.35   | 57.113 | 0.6794661                             | 0.2299275 | 1.9089166 | -0.3397331 $\pm j$ | 0.3383917          | 0.7057123 |            |
|        |        |                                       | 0.3674422 | 0.7031503 | 3.0468391          | -0.1837211 $\pm j$ | 0.8181668 | 2.2821022  |
|        |        |                                       | 0.1012416 | 1.0184021 | 19.1687817         | -0.0506208 $\pm j$ | 1.0078887 | 9.9678342  |
| 1.40   | 59.926 | 0.6692679                             | 0.2214999 | 2.0571405 | -0.3346339 $\pm j$ | 0.3309381          | 0.7032128 |            |
|        |        |                                       | 0.3738287 | 0.6920512 | 3.3317143          | -0.1869143 $\pm j$ | 0.8106258 | 2.2253407  |
|        |        |                                       | 0.1060018 | 1.0188808 | 21.3298812         | -0.0530009 $\pm j$ | 1.0080038 | 9.5224434  |
| 1.45   | 62.531 | 0.6607392                             | 0.2146403 | 2.2105880 | -0.3303696 $\pm j$ | 0.3248019          | 0.7011736 |            |
|        |        |                                       | 0.3790760 | 0.6826832 | 3.6250000          | -0.1895380 $\pm j$ | 0.8042130 | 2.1796325  |
|        |        |                                       | 0.1101030 | 1.0192808 | 23.5480505         | -0.0550515 $\pm j$ | 1.0080923 | 9.1695430  |
| 1.50   | 64.964 | 0.6535014                             | 0.2089491 | 2.3692888 | -0.3267507 $\pm j$ | 0.3196609          | 0.6994775 |            |
|        |        |                                       | 0.3834606 | 0.6746729 | 3.9270510          | -0.1917303 $\pm j$ | 0.7986942 | 2.1420315  |
|        |        |                                       | 0.1136720 | 1.0196198 | 25.8272420         | -0.0568360 $\pm j$ | 1.0081614 | 8.8831194  |
| 1.70   | 73.411 | 0.6330041                             | 0.1934516 | 3.0569811 | -0.3165021 $\pm j$ | 0.3054146          | 0.6948318 |            |
|        |        |                                       | 0.3955242 | 0.6516993 | 5.2271136          | -0.1977621 $\pm j$ | 0.7826809 | 2.0410355  |
|        |        |                                       | 0.1242396 | 1.0205768 | 35.6008780         | -0.0621198 $\pm j$ | 1.0083243 | 8.1313508  |
| 2.00   | 83.547 | 0.6157543                             | 0.1810832 | 4.2481552 | -0.3078771 $\pm j$ | 0.2937598          | 0.6910852 |            |
|        |        |                                       | 0.4052524 | 0.6320508 | 7.4641016          | -0.2026262 $\pm j$ | 0.7687609 | 1.9617805  |
|        |        |                                       | 0.1336886 | 1.0213764 | 52.3568408         | -0.0668443 $\pm j$ | 1.0084187 | 7.5595953  |

| CASE A |         | Passband Ripple: Ap(dB)=0.5 |           |           |            |               |           |            |  |
|--------|---------|-----------------------------|-----------|-----------|------------|---------------|-----------|------------|--|
| n      | Ws      | As(dB)                      | At        | B1        | C1         | P1            | Q1        |            |  |
| 7      | 1.05    | 37.659                      | 0.5099994 | 0.5644559 | 1.1175213  | -0.2549997 ±j | 0.7067044 | 1.4731444  |  |
|        |         |                             | 0.1493484 | 0.9043740 | 1.3083409  | -0.0746742 ±j | 0.9480495 | 6.3675653  |  |
|        |         |                             | 0.0285154 | 1.0064253 | 2.7143721  | -0.0142577 ±j | 1.0031062 | 35.1812870 |  |
|        |         |                             |           |           |            | -0.4470368    |           |            |  |
| 1.10   | 46.549  |                             | 0.5139227 | 0.4767487 | 1.2341277  | -0.2569614 ±j | 0.6408741 | 1.3435287  |  |
|        |         |                             | 0.1893422 | 0.8607015 | 1.5239435  | -0.0946711 ±j | 0.9228970 | 4.8998053  |  |
|        |         |                             | 0.0424181 | 1.0084755 | 3.5147693  | -0.0212090 ±j | 1.0040048 | 23.6745358 |  |
|        |         |                             |           |           |            | -0.3915074    |           |            |  |
| 1.15   | 52.950  |                             | 0.5107672 | 0.4296201 | 1.3546897  | -0.2553836 ±j | 0.6036550 | 1.2832737  |  |
|        |         |                             | 0.2132389 | 0.8319049 | 1.7321918  | -0.1066194 ±j | 0.9058351 | 4.2773076  |  |
|        |         |                             | 0.0521674 | 1.0097580 | 4.2484927  | -0.0260837 ±j | 1.0045286 | 19.2623675 |  |
|        |         |                             |           |           |            | -0.3628301    |           |            |  |
| 1.20   | 58.155  |                             | 0.5066558 | 0.3990333 | 1.4798722  | -0.2533279 ±j | 0.5786694 | 1.2467850  |  |
|        |         |                             | 0.2297269 | 0.8108393 | 1.9413408  | -0.1148634 ±j | 0.8931101 | 3.9197251  |  |
|        |         |                             | 0.0596098 | 1.0106704 | 4.9666973  | -0.0298049 ±j | 1.0048791 | 16.8650425 |  |
|        |         |                             |           |           |            | -0.3444321    |           |            |  |
| 1.25   | 62.624  |                             | 0.5026902 | 0.3772522 | 1.6099341  | -0.2513451 ±j | 0.5604265 | 1.2218431  |  |
|        |         |                             | 0.2419602 | 0.7945590 | 2.1544332  | -0.1209801 ±j | 0.8831324 | 3.6839960  |  |
|        |         |                             | 0.0655495 | 1.0113629 | 5.6874343  | -0.0327747 ±j | 1.0051312 | 15.3420763 |  |
|        |         |                             |           |           |            | -0.3313720    |           |            |  |
| 1.30   | 66.583  |                             | 0.4991075 | 0.3608389 | 1.7450051  | -0.2495538 ±j | 0.5464081 | 1.2035456  |  |
|        |         |                             | 0.2514571 | 0.7815262 | 2.3729509  | -0.1257285 ±j | 0.8750534 | 3.5156683  |  |
|        |         |                             | 0.0704270 | 1.0119100 | 6.4192876  | -0.0352135 ±j | 1.0053208 | 14.2834091 |  |
|        |         |                             |           |           |            | -0.3215293    |           |            |  |
| 1.35   | 70.162  |                             | 0.4959319 | 0.3479843 | 1.8851599  | -0.2479660 ±j | 0.5352543 | 1.1894817  |  |
|        |         |                             | 0.2590652 | 0.7708293 | 2.5977295  | -0.1295326 ±j | 0.8683609 | 3.3889882  |  |
|        |         |                             | 0.0745142 | 1.0123546 | 7.1670237  | -0.0372571 ±j | 1.0054683 | 13.5029053 |  |
|        |         |                             |           |           |            | -0.3138089    |           |            |  |
| 1.40   | 73.443  |                             | 0.4931302 | 0.3376290 | 2.0304452  | -0.2465651 ±j | 0.5261508 | 1.1783064  |  |
|        |         |                             | 0.2653043 | 0.7618824 | 2.8292857  | -0.1326521 ±j | 0.8627200 | 3.2900292  |  |
|        |         |                             | 0.0779924 | 1.0127236 | 7.9335602  | -0.0389962 ±j | 1.0055859 | 12.9030720 |  |
|        |         |                             |           |           |            | -0.3075764    |           |            |  |
| 1.45   | 76.482  |                             | 0.4906564 | 0.3291047 | 2.1808921  | -0.2453282 ±j | 0.5185737 | 1.1692021  |  |
|        |         |                             | 0.2705146 | 0.7542871 | 3.0679607  | -0.1352573 ±j | 0.8579001 | 3.2105367  |  |
|        |         |                             | 0.0809888 | 1.0130348 | 8.7208069  | -0.0404944 ±j | 1.0056814 | 12.4275993 |  |
|        |         |                             |           |           |            | -0.3024340    |           |            |  |
| 1.50   | 79.321  |                             | 0.4884655 | 0.3219660 | 2.3365223  | -0.2442328 ±j | 0.5121683 | 1.1616387  |  |
|        |         |                             | 0.2749300 | 0.7477605 | 3.3139902  | -0.1374650 ±j | 0.8537352 | 3.1452787  |  |
|        |         |                             | 0.0835962 | 1.0133008 | 9.5300781  | -0.0417981 ±j | 1.0057603 | 12.0415579 |  |
|        |         |                             |           |           |            | -0.2981173    |           |            |  |
| 1.70   | 89.176  |                             | 0.4818188 | 0.3022159 | 3.0111362  | -0.2409094 ±j | 0.4941443 | 1.1409720  |  |
|        |         |                             | 0.2873943 | 0.7288744 | 4.3744590  | -0.1436972 ±j | 0.8415613 | 2.9706273  |  |
|        |         |                             | 0.0913159 | 1.0140632 | 13.0029293 | -0.0456580 ±j | 1.0059714 | 11.0277269 |  |
|        |         |                             |           |           |            | -0.2861135    |           |            |  |
| 2.00   | 101.001 |                             | 0.4757354 | 0.2861183 | 4.1800429  | -0.2378677 ±j | 0.4791005 | 1.1243651  |  |
|        |         |                             | 0.2978244 | 0.7125206 | 6.2017764  | -0.1489122 ±j | 0.8308705 | 2.8342521  |  |
|        |         |                             | 0.0982182 | 1.0147148 | 18.9610948 | -0.0491091 ±j | 1.0061327 | 10.2560499 |  |
|        |         |                             |           |           |            | -0.2762455    |           |            |  |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.5$ |           |           |            |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|------------|---------------|-----------|------------|
| n      | Ws      | As (dB)                               | A1        | B1        | C1         | P1            | Q1        |            |
| 8      | 1.05    | 46.063                                | 0.6886088 | 0.2452244 | 1.1138641  | -0.3443044 ±j | 0.3559198 | 0.7191331  |
|        |         |                                       | 0.3203041 | 0.6744903 | 1.2431181  | -0.1601521 ±j | 0.8055071 | 2.5640431  |
|        |         |                                       | 0.1024606 | 0.9249474 | 1.9061395  | -0.0512303 ±j | 0.9603764 | 9.3864553  |
|        |         |                                       | 0.0219745 | 1.0044115 | 11.0466061 | -0.0109872 ±j | 1.0021431 | 45.6076447 |
| 1.10   | 56.224  | 56.224                                | 0.6235898 | 0.1935285 | 1.2282855  | -0.3117949 ±j | 0.3103424 | 0.7054616  |
|        |         |                                       | 0.3453350 | 0.5945194 | 1.4271032  | -0.1726675 ±j | 0.7514688 | 2.2327622  |
|        |         |                                       | 0.1338770 | 0.8910324 | 2.3804113  | -0.0669385 ±j | 0.9415687 | 7.0508400  |
|        |         |                                       | 0.0326098 | 1.0059148 | 15.1062239 | -0.0163049 ±j | 1.0028205 | 30.7561410 |
| 1.15   | 63.540  | 63.540                                | 0.5873960 | 0.1685247 | 1.3469136  | -0.2936980 ±j | 0.2868208 | 0.6988770  |
|        |         |                                       | 0.3559766 | 0.5487270 | 1.6072975  | -0.1779883 ±j | 0.7190599 | 2.0809264  |
|        |         |                                       | 0.1534043 | 0.8683429 | 2.8200771  | -0.0767021 ±j | 0.9286871 | 6.0744663  |
|        |         |                                       | 0.0400595 | 1.0068774 | 18.7925269 | -0.0200298 ±j | 1.0032329 | 25.0485423 |
| 1.20   | 69.488  | 69.488                                | 0.5632799 | 0.1531707 | 1.4702527  | -0.2816400 ±j | 0.2717529 | 0.6948061  |
|        |         |                                       | 0.3616765 | 0.5178995 | 1.7895085  | -0.1808382 ±j | 0.6965609 | 1.9897682  |
|        |         |                                       | 0.1672285 | 0.8515736 | 3.2528314  | -0.0836143 ±j | 0.9190116 | 5.5182426  |
|        |         |                                       | 0.0457431 | 1.0075729 | 22.3835994 | -0.0228716 ±j | 1.0035187 | 21.9438220 |
| 1.25   | 74.595  | 74.595                                | 0.5457493 | 0.1426190 | 1.5984994  | -0.2728746 ±j | 0.2610716 | 0.6919831  |
|        |         |                                       | 0.3650951 | 0.4953972 | 1.9759013  | -0.1825475 ±j | 0.6797599 | 1.9278392  |
|        |         |                                       | 0.1776812 | 0.8385124 | 3.6885364  | -0.0888406 ±j | 0.9113834 | 5.1536301  |
|        |         |                                       | 0.0502776 | 1.0081069 | 25.9769795 | -0.0251388 ±j | 1.0037305 | 19.9700363 |
| 1.30   | 79.120  | 79.120                                | 0.5323171 | 0.1348652 | 1.7317524  | -0.2661585 ±j | 0.2530313 | 0.6898896  |
|        |         |                                       | 0.3672908 | 0.4781305 | 2.1675370  | -0.1836454 ±j | 0.6666370 | 1.8826221  |
|        |         |                                       | 0.1859164 | 0.8279918 | 4.1319051  | -0.0929582 ±j | 0.9051799 | 4.8943543  |
|        |         |                                       | 0.0540002 | 1.0085327 | 29.6189023 | -0.0270001 ±j | 1.0038943 | 18.5972919 |
| 1.35   | 83.210  | 83.210                                | 0.5216512 | 0.1289062 | 1.8700686  | -0.2608256 ±j | 0.2467311 | 0.6882667  |
|        |         |                                       | 0.3687676 | 0.4644177 | 2.3650162  | -0.1843838 ±j | 0.6560643 | 1.8479984  |
|        |         |                                       | 0.1925929 | 0.8193132 | 4.5855625  | -0.0962964 ±j | 0.9000223 | 4.6998582  |
|        |         |                                       | 0.0571191 | 1.0088814 | 33.3349904 | -0.0285596 ±j | 1.0040248 | 17.5848456 |
| 1.40   | 86.960  | 86.960                                | 0.5129587 | 0.1241761 | 2.0134836  | -0.2564794 ±j | 0.2416494 | 0.6869682  |
|        |         |                                       | 0.3697941 | 0.4532477 | 2.5687116  | -0.1848970 ±j | 0.6473491 | 1.8205721  |
|        |         |                                       | 0.1981225 | 0.8120240 | 5.0511190  | -0.0990612 ±j | 0.8956623 | 4.5483162  |
|        |         |                                       | 0.0597730 | 1.0091726 | 37.1409040 | -0.0298865 ±j | 1.0041312 | 16.8065266 |
| 1.45   | 90.434  | 90.434                                | 0.5057320 | 0.1203283 | 2.1620209  | -0.2528660 ±j | 0.2374596 | 0.6859042  |
|        |         |                                       | 0.3705249 | 0.4439691 | 2.7788694  | -0.1852625 ±j | 0.6400366 | 1.7982867  |
|        |         |                                       | 0.2027791 | 0.8058139 | 5.5296305  | -0.1013896 ±j | 0.8919272 | 4.4268429  |
|        |         |                                       | 0.0620590 | 1.0094196 | 41.0468858 | -0.0310295 ±j | 1.0042195 | 16.1894236 |
| 1.50   | 93.677  | 93.677                                | 0.4996280 | 0.1171372 | 2.3156973  | -0.2498140 ±j | 0.2339448 | 0.6850159  |
|        |         |                                       | 0.3710548 | 0.4361398 | 2.9956604  | -0.1855274 ±j | 0.6338134 | 1.7798149  |
|        |         |                                       | 0.2067537 | 0.8004613 | 6.0218242  | -0.1033769 ±j | 0.8886926 | 4.3272986  |
|        |         |                                       | 0.0640480 | 1.0096317 | 45.0599777 | -0.0320240 ±j | 1.0042938 | 15.6882912 |
| 1.70   | 104.940 | 104.940                               | 0.4824761 | 0.1084534 | 2.9819909  | -0.2412380 ±j | 0.2241821 | 0.6825679  |
|        |         |                                       | 0.3721096 | 0.4141948 | 3.9311886  | -0.1860548 ±j | 0.6160993 | 1.7295433  |
|        |         |                                       | 0.2181199 | 0.7848866 | 8.1360237  | -0.1090599 ±j | 0.8791999 | 4.0617033  |
|        |         |                                       | 0.0699364 | 1.0102448 | 62.2665524 | -0.0349682 ±j | 1.0045009 | 14.3717620 |
| 2.00   | 118.455 | 118.455                               | 0.4681833 | 0.1015281 | 4.1367342  | -0.2340917 ±j | 0.2161695 | 0.6805771  |
|        |         |                                       | 0.3724921 | 0.3959923 | 5.5450630  | -0.1862461 ±j | 0.6010862 | 1.6893758  |
|        |         |                                       | 0.2278062 | 0.7712958 | 11.7666735 | -0.1139031 ±j | 0.8708168 | 3.8551832  |
|        |         |                                       | 0.0752005 | 1.0107754 | 91.7615329 | -0.0376003 ±j | 1.0046699 | 13.3692333 |

| CASE A |         | Passband Ripple: Ap(dB)=0.5 |           |           |               |               |           |            |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 9      | 1.05    | 54.468                      | 0.4861938 | 0.3803594 | 1.1114059     | -0.2430969 ±j | 0.5668010 | 1.2684919  |
|        |         |                             | 0.2147303 | 0.7524110 | 1.2054102     | -0.1073651 ±j | 0.8607461 | 4.0395619  |
|        |         |                             | 0.0747552 | 0.9400076 | 1.5942707     | -0.0373776 ±j | 0.9688191 | 12.9695368 |
|        |         |                             | 0.0174366 | 1.0032091 | 3.9936736     | -0.0087183 ±j | 1.0015653 | 57.4424451 |
|        |         |                             |           |           | -0.3395244    |               |           |            |
| 1.10   | 65.899  | 0.4655463                   | 0.3125520 | 1.2243475 | -0.2327731 ±j | 0.5082998     | 1.2008764 |            |
|        |         |                             | 0.2438096 | 0.6824232 | 1.3703136     | -0.1219048 ±j | 0.8170450 | 3.3882556  |
|        |         |                             | 0.0998634 | 0.9128846 | 1.9377187     | -0.0499317 ±j | 0.9541443 | 9.5675714  |
|        |         |                             | 0.0258367 | 1.0043618 | 5.2992478     | -0.0129184 ±j | 1.0020953 | 38.7889219 |
|        |         |                             |           |           | -0.2991593    |               |           |            |
| 1.15   | 74.129  | 0.4510578                   | 0.2777950 | 1.3416657 | -0.2255289 ±j | 0.4763735     | 1.1685034 |            |
|        |         |                             | 0.2586106 | 0.6405871 | 1.5336053     | -0.1293053 ±j | 0.7898527 | 3.0948727  |
|        |         |                             | 0.1158719 | 0.8945684 | 2.2599957     | -0.0579360 ±j | 0.9440402 | 8.1626016  |
|        |         |                             | 0.0317160 | 1.0051123 | 6.4899114     | -0.0158580 ±j | 1.0024275 | 31.6103352 |
|        |         |                             |           |           | -0.2780775    |               |           |            |
| 1.20   | 80.821  | 0.4403313                   | 0.2557840 | 1.4637563 | -0.2201656 ±j | 0.4553143     | 1.1485692 |            |
|        |         |                             | 0.2677978 | 0.6116898 | 1.6996171     | -0.1338989 ±j | 0.7705588 | 2.9205097  |
|        |         |                             | 0.1273916 | 0.8809412 | 2.5791043     | -0.0636958 ±j | 0.9364209 | 7.3677112  |
|        |         |                             | 0.0361996 | 1.0056604 | 7.6523927     | -0.0180998 ±j | 1.0026629 | 27.7027163 |
|        |         |                             |           |           | -0.2644721    |               |           |            |
| 1.25   | 86.567  | 0.4320261                   | 0.2403529 | 1.5907740 | -0.2160131 ±j | 0.4401037     | 1.1347879 |            |
|        |         |                             | 0.2740949 | 0.5902180 | 1.8699785     | -0.1370474 ±j | 0.7559339 | 2.8028855  |
|        |         |                             | 0.1362060 | 0.8702734 | 2.9015215     | -0.0681030 ±j | 0.9303953 | 6.8490682  |
|        |         |                             | 0.0397756 | 1.0060846 | 8.8171818     | -0.0198878 ±j | 1.0028405 | 25.2173884 |
|        |         |                             |           |           | -0.2547775    |               |           |            |
| 1.30   | 91.657  | 0.4253848                   | 0.2288519 | 1.7227963 | -0.2126924 ±j | 0.4285019     | 1.1245929 |            |
|        |         |                             | 0.2786845 | 0.5735226 | 2.0454918     | -0.1393422 ±j | 0.7443832 | 2.7174556  |
|        |         |                             | 0.1432147 | 0.8616459 | 3.2303598     | -0.0716074 ±j | 0.9254827 | 6.4815178  |
|        |         |                             | 0.0427109 | 1.0064249 | 9.9987492     | -0.0213554 ±j | 1.0029800 | 23.4883219 |
|        |         |                             |           |           | -0.2474516    |               |           |            |
| 1.35   | 96.259  | 0.4199446                   | 0.2199183 | 1.8598680 | -0.2099723 ±j | 0.4193208     | 1.1167055 |            |
|        |         |                             | 0.2821748 | 0.5601259 | 2.2266128     | -0.1410874 ±j | 0.7349968 | 2.6523118  |
|        |         |                             | 0.1489392 | 0.8545055 | 3.5673591     | -0.0744696 ±j | 0.9213901 | 6.2065242  |
|        |         |                             | 0.0451698 | 1.0067050 | 11.2051201    | -0.0225849 ±j | 1.0030927 | 22.2127734 |
|        |         |                             |           |           | -0.2416939    |               |           |            |
| 1.40   | 100.477 | 0.4154043                   | 0.2127674 | 2.0020170 | -0.2077021 ±j | 0.4118582     | 1.1104054 |            |
|        |         |                             | 0.2849139 | 0.5491225 | 2.4136247     | -0.1424570 ±j | 0.7272060 | 2.6008841  |
|        |         |                             | 0.1537094 | 0.8484917 | 3.9135894     | -0.0768547 ±j | 0.9179243 | 5.9927119  |
|        |         |                             | 0.0472618 | 1.0069398 | 12.4412023    | -0.0236309 ±j | 1.0031856 | 21.2320112 |
|        |         |                             |           |           | -0.2370385    |               |           |            |
| 1.45   | 104.385 | 0.4115580                   | 0.2069110 | 2.1492622 | -0.2057790 ±j | 0.4056674     | 1.1052506 |            |
|        |         |                             | 0.2871164 | 0.5399196 | 2.6067151     | -0.1435582 ±j | 0.7206321 | 2.5592135  |
|        |         |                             | 0.1577473 | 0.8433562 | 4.2697534     | -0.0788736 ±j | 0.9149509 | 5.8216181  |
|        |         |                             | 0.0490637 | 1.0071397 | 13.7102067    | -0.0245319 ±j | 1.0032636 | 20.4542807 |
|        |         |                             |           |           | -0.2331925    |               |           |            |
| 1.50   | 108.034 | 0.4082594                   | 0.2020271 | 2.3016164 | -0.2041297 ±j | 0.4004475     | 1.1009528 |            |
|        |         |                             | 0.2889224 | 0.5321097 | 2.8060141     | -0.1444612 ±j | 0.7150110 | 2.5247558  |
|        |         |                             | 0.1612089 | 0.8389209 | 4.6363361     | -0.0806044 ±j | 0.9123726 | 5.6816117  |
|        |         |                             | 0.0506315 | 1.0073118 | 15.0143415    | -0.0253157 ±j | 1.0033299 | 19.8226285 |
|        |         |                             |           |           | -0.2299608    |               |           |            |
| 1.70   | 120.705 | 0.3987509                   | 0.1886109 | 2.9622803 | -0.1993755 ±j | 0.3858242     | 1.0891349 |            |
|        |         |                             | 0.2937201 | 0.5099988 | 3.6668482     | -0.1468600 ±j | 0.6988784 | 2.4313694  |
|        |         |                             | 0.1711869 | 0.8259680 | 6.2125942     | -0.0855935 ±j | 0.9047882 | 5.3089786  |
|        |         |                             | 0.0552720 | 1.0078122 | 20.6082544    | -0.0276360 ±j | 1.0035180 | 18.1628608 |
|        |         |                             |           |           | -0.2209585    |               |           |            |
| 2.00   | 135.909 | 0.3905643                   | 0.1777770 | 4.1074418 | -0.1952821 ±j | 0.3736869     | 1.0795563 |            |
|        |         |                             | 0.2973909 | 0.4914086 | 5.1532091     | -0.1486954 ±j | 0.6850535 | 2.3571855  |
|        |         |                             | 0.1797849 | 0.8146068 | 8.9221914     | -0.0898925 ±j | 0.8980680 | 5.0201968  |
|        |         |                             | 0.0594201 | 1.0082486 | 30.2010593    | -0.0297100 ±j | 1.0036762 | 16.8986015 |
|        |         |                             |           |           | -0.2135410    |               |           |            |



| CASE A |      | Passband Ripple: Ap(dB)=0.5 |                                                               |                                                               |                                                                  |                                                                                   |                                                               |                                                                 |
|--------|------|-----------------------------|---------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|
| n      | Ws   | As(dB)                      | A1                                                            | B1                                                            | C1                                                               | P1                                                                                | Q1                                                            |                                                                 |
| 10     | 1.05 | 62.873                      | 0.5660682<br>0.3424897<br>0.1522744<br>0.0570525<br>0.0141655 | 0.1566533<br>0.5087624<br>0.8067940<br>0.9511247<br>1.0024388 | 1.1096718<br>1.1814619<br>1.4386640<br>2.5336482<br>16.8596102   | -0.2830341 ±j<br>-0.1712449 ±j<br>-0.0761372 ±j<br>-0.0285263 ±j<br>-0.0070828 ±j | 0.2766677<br>0.6924143<br>0.8949844<br>0.9748390<br>1.0011936 | 0.6991994<br>2.0826195<br>5.8986745<br>17.0940022<br>70.6799320 |
|        | 1.10 | 75.574                      | 0.5086451<br>0.3462323<br>0.1799921<br>0.0774991<br>0.0209683 | 0.1235691<br>0.4331751<br>0.7464275<br>0.9289424<br>1.0033524 | 1.2215638<br>1.3338339<br>1.7140833<br>3.2619424<br>23.1838025   | -0.2543226 ±j<br>-0.1731162 ±j<br>-0.0899960 ±j<br>-0.0387495 ±j<br>-0.0104842 ±j | 0.2426708<br>0.6349850<br>0.8592603<br>0.9630373<br>1.0016199 | 0.6910987<br>1.9009212<br>4.7999913<br>12.4364878<br>47.7708391 |
|        | 1.15 | 84.719                      | 0.4773827<br>0.3451219<br>0.1952438<br>0.0907674<br>0.0257269 | 0.1076013<br>0.3923745<br>0.7092363<br>0.9138656<br>1.0039546 | 1.3379528<br>1.4860346<br>1.9755745<br>3.9305495<br>28.9230322   | -0.2386913 ±j<br>-0.1725609 ±j<br>-0.0976219 ±j<br>-0.0453837 ±j<br>-0.0128635 ±j | 0.2250060<br>0.6021604<br>0.8364845<br>0.9548853<br>1.0018928 | 0.6871349<br>1.8150052<br>4.3133855<br>10.5320123<br>38.9465795 |
|        | 1.20 | 92.154                      | 0.4567729<br>0.3431514<br>0.2052345<br>0.1004228<br>0.0293547 | 0.0978035<br>0.3657863<br>0.6830684<br>0.9025971<br>1.0043977 | 1.4591581<br>1.6414311<br>2.2359899<br>4.5854918<br>34.5122486   | -0.2283865 ±j<br>-0.1715757 ±j<br>-0.1026173 ±j<br>-0.0502114 ±j<br>-0.0146773 ±j | 0.2136425<br>0.5799552<br>0.8200842<br>0.9487233<br>1.0020890 | 0.6846630<br>1.7624951<br>4.0270005<br>9.4605148<br>34.1409252  |
|        | 1.25 | 98.539                      | 0.4418878<br>0.3411111<br>0.2123741<br>0.1078709<br>0.0322476 | 0.0910726<br>0.3467902<br>0.6633709<br>0.8937448<br>1.0047427 | 1.5853042<br>1.8012990<br>2.5000000<br>5.2430274<br>40.1039839   | -0.2209439 ±j<br>-0.1705556 ±j<br>-0.1061870 ±j<br>-0.0539354 ±j<br>-0.0161238 ±j | 0.2055636<br>0.5636497<br>0.8075241<br>0.9438409<br>1.0022388 | 0.6829390<br>1.7263845<br>3.8351003<br>8.7640037<br>31.0834965  |
|        | 1.30 | 104.194                     | 0.4305328<br>0.3392052<br>0.2177581<br>0.1138303<br>0.0346218 | 0.0861275<br>0.3324373<br>0.6479047<br>0.8865656<br>1.0050206 | 1.7164539<br>1.9662686<br>2.7698611<br>5.9108926<br>45.7705353   | -0.2152664 ±j<br>-0.1696026 ±j<br>-0.1088790 ±j<br>-0.0569152 ±j<br>-0.0173109 ±j | 0.1994691<br>0.5510646<br>0.7975275<br>0.9398544<br>1.0023577 | 0.6816552<br>1.6997787<br>3.6964198<br>8.2717523<br>28.9559723  |
|        | 1.35 | 109.307                     | 0.4215454<br>0.3374816<br>0.2219718<br>0.1187223<br>0.0366104 | 0.0823275<br>0.3211716<br>0.6353989<br>0.8806103<br>1.0052501 | 1.8526432<br>2.1366988<br>3.0468391<br>6.5933849<br>51.5519660   | -0.2107727 ±j<br>-0.1687408 ±j<br>-0.1109859 ±j<br>-0.0593611 ±j<br>-0.0183052 ±j | 0.1946854<br>0.5410158<br>0.7893548<br>0.9365290<br>1.0024545 | 0.6806569<br>1.6792617<br>3.5910827<br>7.9042334<br>27.3862263  |
|        | 1.40 | 113.994                     | 0.4142389<br>0.3359403<br>0.2253613<br>0.1228156<br>0.0383022 | 0.0793114<br>0.3120795<br>0.6250633<br>0.8755850<br>1.0054432 | 1.9938949<br>2.3128131<br>3.3317143<br>7.2931353<br>57.4727614   | -0.2071194 ±j<br>-0.1679701 ±j<br>-0.1126806 ±j<br>-0.0614078 ±j<br>-0.0191511 ±j | 0.1908218<br>0.5327903<br>0.7825384<br>0.9337098<br>1.0025350 | 0.6798561<br>1.6629169<br>3.5081865<br>7.6189568<br>26.1790975  |
|        | 1.45 | 118.336                     | 0.4081763<br>0.3345658<br>0.2281462<br>0.1262926<br>0.0397593 | 0.0768580<br>0.3045834<br>0.6163743<br>0.8712866<br>1.0056078 | 2.1402240<br>2.4947597<br>3.6250000<br>8.0118665<br>63.5489356   | -0.2040881 ±j<br>-0.1672829 ±j<br>-0.1140731 ±j<br>-0.0631463 ±j<br>-0.0198796 ±j | 0.1876327<br>0.5259276<br>0.7767635<br>0.9312890<br>1.0026029 | 0.6791985<br>1.6495732<br>3.4411926<br>7.3909921<br>25.2217819  |
|        | 1.50 | 122.391                     | 0.4030636<br>0.3333393<br>0.2304736<br>0.1292822<br>0.0410269 | 0.0748234<br>0.2982974<br>0.6089685<br>0.8675691<br>1.0057499 | 2.2916411<br>2.6826414<br>3.9270510<br>8.7507642<br>69.7914985   | -0.2015318 ±j<br>-0.1666696 ±j<br>-0.1152368 ±j<br>-0.0646411 ±j<br>-0.0205135 ±j | 0.1849548<br>0.5201141<br>0.7718089<br>0.9291882<br>1.0026610 | 0.6786487<br>1.6384691<br>3.3859163<br>7.2046589<br>24.4442050  |
|        | 1.70 | 136.470                     | 0.3887351<br>0.3295733<br>0.2368810<br>0.1379456<br>0.0447788 | 0.0692867<br>0.2808647<br>0.5878413<br>0.8566848<br>1.0061645 | 2.9483149<br>3.4947482<br>5.2271136<br>11.9220243<br>96.5555666  | -0.1943675 ±j<br>-0.1647866 ±j<br>-0.1184405 ±j<br>-0.0689728 ±j<br>-0.0223894 ±j | 0.1775049<br>0.5036964<br>0.7575046<br>0.9229992<br>1.0028276 | 0.6771289<br>1.6080392<br>3.2366811<br>6.7096910<br>22.4007078  |
|        | 2.00 | 153.362                     | 0.3768354<br>0.3260773<br>0.2420556<br>0.1454664<br>0.0481321 | 0.0648713<br>0.2666081<br>0.5698927<br>0.8471036<br>1.0065279 | 4.0866858<br>4.8979715<br>7.4641016<br>17.3634536<br>142.4309671 | -0.1884177 ±j<br>-0.1630386 ±j<br>-0.1210278 ±j<br>-0.0727332 ±j<br>-0.0240660 ±j | 0.1713771<br>0.4899250<br>0.7451476<br>0.9175040<br>1.0029699 | 0.6758881<br>1.5834930<br>3.1187565<br>6.3271145<br>20.8438644  |

| CASE A |      | Passband Ripple: Ap(dB)=0.5 |                                                               |                                                               |                                                                 |                                                                                                 |                                                                             |                                                                 |
|--------|------|-----------------------------|---------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------|
| n      | Ws   | As(dB)                      | A1                                                            | B1                                                            | C1                                                              | P1                                                                                              | Q1                                                                          |                                                                 |
| 11     | 1.05 | 71.278                      | 0.4401038<br>0.2471588<br>0.1130248<br>0.0450523<br>0.0117320 | 0.2685600<br>0.6100288<br>0.8454853<br>0.9594870<br>1.0019170 | 1.1084015<br>1.1652129<br>1.3488607<br>1.9760810<br>5.6021835   | -0.2200519 ±j<br>-0.1235794 ±j<br>-0.0565124 ±j<br>-0.0225261 ±j<br>-0.0058660 ±j<br>-0.2745452 | 0.4691877<br>0.7712048<br>0.9177645<br>0.9792750<br>1.0009408<br>85.3184055 | 1.1775124<br>3.1600871<br>8.1354084<br>21.7421762<br>85.3184055 |
|        | 1.10 | 85.249                      | 0.4108444<br>0.2619503<br>0.1379180<br>0.0619925<br>0.0173537 | 0.2176881<br>0.5342593<br>0.7935188<br>0.9410149<br>1.0026599 | 1.2195217<br>1.3088558<br>1.5834523<br>2.4791006<br>7.5378437   | -0.2054222 ±j<br>-0.1309751 ±j<br>-0.0689590 ±j<br>-0.0309963 ±j<br>-0.0086769 ±j<br>-0.2426206 | 0.4189151<br>0.7191000<br>0.8881236<br>0.9695639<br>1.0012915<br>57.7011273 | 1.1356383<br>2.7903406<br>6.4588872<br>15.6480074<br>57.7011273 |
|        | 1.15 | 95.309                      | 0.3930661<br>0.2678111<br>0.1522844<br>0.0731274<br>0.0212844 | 0.1921728<br>0.4916173<br>0.7607892<br>0.9284010<br>1.0031542 | 1.3352275<br>1.4533340<br>1.8085794<br>2.9446236<br>9.2991673   | -0.1965331 ±j<br>-0.1339055 ±j<br>-0.0761422 ±j<br>-0.0365637 ±j<br>-0.0106422 ±j<br>-0.2258538 | 0.3918515<br>0.6882489<br>0.8689025<br>0.9628417<br>1.0015193<br>47.0567531 | 1.1152709<br>2.6180927<br>5.7276542<br>13.1761327<br>47.0567531 |
|        | 1.20 | 103.487                     | 0.3806910<br>0.2707356<br>0.1619948<br>0.0812960<br>0.0242803 | 0.1761954<br>0.4631582<br>0.7374435<br>0.9189420<br>1.0035200 | 1.4557817<br>1.6013465<br>2.0339626<br>3.4024453<br>11.0168385  | -0.1903455 ±j<br>-0.1353678 ±j<br>-0.0809974 ±j<br>-0.0406480 ±j<br>-0.0121402 ±j<br>-0.2150016 | 0.3741176<br>0.6669586<br>0.8549169<br>0.9577525<br>1.0016849<br>41.2580036 | 1.1026168<br>2.5137337<br>5.3010683<br>11.7916519<br>41.2580036 |
|        | 1.25 | 110.510                     | 0.3714459<br>0.2723563<br>0.1690974<br>0.0876341<br>0.0266690 | 0.1650742<br>0.4424958<br>0.7196992<br>0.9114925<br>1.0038060 | 1.5812870<br>1.7539211<br>2.2631658<br>3.8631607<br>12.7367378  | -0.1857229 ±j<br>-0.1361781 ±j<br>-0.0845487 ±j<br>-0.0438171 ±j<br>-0.0133345 ±j<br>-0.2072542 | 0.3613602<br>0.6511154<br>0.8441272<br>0.9537151<br>1.0018124<br>37.5680209 | 1.0938155<br>2.4424020<br>5.0169352<br>10.8944007<br>37.5680209 |
|        | 1.30 | 116.732                     | 0.3642261<br>0.2733048<br>0.1745529<br>0.0927282<br>0.0286291 | 0.1568272<br>0.4266990<br>0.7056639<br>0.9054388<br>1.0040371 | 1.7117951<br>1.9115674<br>2.4979196<br>4.3318290<br>14.4806247  | -0.1821131 ±j<br>-0.1366524 ±j<br>-0.0872765 ±j<br>-0.0463641 ±j<br>-0.0143145 ±j<br>-0.2013920 | 0.3516561<br>0.6387684<br>0.8354919<br>0.9504153<br>1.0019143<br>34.9999461 | 1.0872753<br>2.3900861<br>4.8125125<br>10.2616651<br>34.9999461 |
|        | 1.35 | 122.355                     | 0.3584118<br>0.2738742<br>0.1788871<br>0.0969248<br>0.0302708 | 0.1504451<br>0.4141873<br>0.6942490<br>0.9004088<br>1.0042284 | 1.8473359<br>2.0745762<br>2.7391978<br>4.8112671<br>16.2605612  | -0.1792059 ±j<br>-0.1369371 ±j<br>-0.0894435 ±j<br>-0.0484624 ±j<br>-0.0151354 ±j<br>-0.1967801 | 0.3439918<br>0.6288366<br>0.8284014<br>0.9476604<br>1.0019977<br>33.1049429 | 1.0821980<br>2.3498885<br>4.6577765<br>9.7900533<br>33.1049429  |
|        | 1.40 | 127.511                     | 0.3536213<br>0.2742166<br>0.1824175<br>0.1004467<br>0.0316673 | 0.1453515<br>0.4040165<br>0.6847703<br>0.8961584<br>1.0043896 | 1.9879279<br>2.2431285<br>2.9876021<br>5.3032020<br>18.0839213  | -0.1768107 ±j<br>-0.1371083 ±j<br>-0.0912088 ±j<br>-0.0502233 ±j<br>-0.0158336 ±j<br>-0.1930483 | 0.3377716<br>0.6206592<br>0.8224666<br>0.9453232<br>1.0020673<br>31.6475778 | 1.0781312<br>2.3179594<br>4.5363434<br>9.4244686<br>31.6475778  |
|        | 1.45 | 132.287                     | 0.3496037<br>0.2744174<br>0.1853494<br>0.1034456<br>0.0328700 | 0.1411901<br>0.3955816<br>0.6767704<br>0.8925185<br>1.0045274 | 2.1335836<br>2.4173448<br>3.2435289<br>5.8087659<br>19.9555287  | -0.1748018 ±j<br>-0.1372087 ±j<br>-0.0926747 ±j<br>-0.0517228 ±j<br>-0.0164350 ±j<br>-0.1899634 | 0.3326175<br>0.6138040<br>0.8174239<br>0.9433151<br>1.0021264<br>30.4917108 | 1.0747960<br>2.2919569<br>4.4384302<br>9.1326428<br>30.4917108  |
|        | 1.50 | 136.748                     | 0.3461860<br>0.2745272<br>0.1878224<br>0.1060297<br>0.0339162 | 0.1377262<br>0.3884736<br>0.6699293<br>0.8893674<br>1.0046465 | 2.2843118<br>2.5973085<br>3.5072526<br>6.3287388<br>21.8787000  | -0.1730930 ±j<br>-0.1372636 ±j<br>-0.0939112 ±j<br>-0.0530148 ±j<br>-0.0169581 ±j<br>-0.1873699 | 0.3282759<br>0.6079739<br>0.8130867<br>0.9415715<br>1.0021771<br>29.5528138 | 1.0720100<br>2.2703637<br>4.3577967<br>8.8943284<br>29.5528138  |
|        | 1.70 | 152.234                     | 0.3364660<br>0.2745398<br>0.1947461<br>0.1135463<br>0.0370127 | 0.1282418<br>0.3685935<br>0.6502981<br>0.8801242<br>1.0049948 | 2.9380530<br>3.3756369<br>4.6433716<br>8.5619394<br>30.1261720  | -0.1682330 ±j<br>-0.1372699 ±j<br>-0.0973730 ±j<br>-0.0567732 ±j<br>-0.0185064 ±j<br>-0.1801391 | 0.3161321<br>0.5913970<br>0.8005102<br>0.9364299<br>1.0023234<br>27.0851231 | 1.0643236<br>2.2114062<br>4.1408312<br>8.2622593<br>27.0851231  |
|        | 2.00 | 170.816                     | 0.3282386<br>0.2742128<br>0.2004746<br>0.1201059<br>0.0397799 | 0.1206157<br>0.3521493<br>0.6334858<br>0.8719664<br>1.0053011 | 4.0714332<br>4.7212543<br>6.5999975<br>12.3963998<br>44.2665611 | -0.1641193 ±j<br>-0.1371064 ±j<br>-0.1002373 ±j<br>-0.0600529 ±j<br>-0.0198900 ±j<br>-0.1741745 | 0.3060729<br>0.5773657<br>0.7895811<br>0.9318584<br>1.0024498<br>25.2048608 | 1.0580651<br>2.1640916<br>3.9701690<br>7.7747346<br>25.2048608  |

| CASE A |      | Passband Ripple: Ap(dB)=0.5 |           |           |             |               |           |            |
|--------|------|-----------------------------|-----------|-----------|-------------|---------------|-----------|------------|
| n      | Ws   | As(dB)                      | A1        | B1        | C1          | P1            | Q1        |            |
| 12     | 1.10 | 94.924                      | 0.4280839 | 0.0856591 | 1.2179786   | -0.2140419 ±j | 0.1996126 | 0.6836880  |
|        |      |                             | 0.3270051 | 0.3236895 | 1.2909254   | -0.1635026 ±j | 0.5449370 | 1.7398416  |
|        |      |                             | 0.2027545 | 0.6144251 | 1.4996665   | -0.1013772 ±j | 0.7772694 | 3.8660195  |
|        |      |                             | 0.1089483 | 0.8288458 | 2.0872157   | -0.0544741 ±j | 0.9087785 | 8.3563459  |
|        |      |                             | 0.0507918 | 0.9502874 | 4.3499304   | -0.0253959 ±j | 0.9744960 | 19.1926007 |
|        |      |                             | 0.0145993 | 1.0021683 | 33.0577896  | -0.0072997 ±j | 1.0010570 | 68.5704271 |
|        | 1.15 | 105.898                     | 0.4010591 | 0.0746009 | 1.3331670   | -0.2005295 ±j | 0.1854421 | 0.6810259  |
|        |      |                             | 0.3197251 | 0.2899522 | 1.4297858   | -0.1598626 ±j | 0.5141946 | 1.6841719  |
|        |      |                             | 0.2118520 | 0.5726032 | 1.7009576   | -0.1059260 ±j | 0.7492549 | 3.5718587  |
|        |      |                             | 0.1220246 | 0.8000971 | 2.4494590   | -0.0610123 ±j | 0.8923982 | 7.3303348  |
|        |      |                             | 0.0602432 | 0.9395895 | 5.2979222   | -0.0301216 ±j | 0.9688561 | 16.0901910 |
|        |      |                             | 0.0178993 | 1.0025779 | 41.3060302  | -0.0089497 ±j | 1.0012481 | 55.9399157 |
|        | 1.20 | 114.820                     | 0.3833252 | 0.0678160 | 1.4532283   | -0.1916626 ±j | 0.1762992 | 0.6793579  |
|        |      |                             | 0.3140005 | 0.2683621 | 1.5724303   | -0.1570002 ±j | 0.4936730 | 1.6497962  |
|        |      |                             | 0.2172660 | 0.5441464 | 1.9034206   | -0.1086330 ±j | 0.7296200 | 3.3952063  |
|        |      |                             | 0.1310529 | 0.7793759 | 2.8072245   | -0.0655264 ±j | 0.8803875 | 6.7363847  |
|        |      |                             | 0.0672250 | 0.9315450 | 6.2244021   | -0.0336125 ±j | 0.9645803 | 14.3572452 |
|        |      |                             | 0.0204157 | 1.0028860 | 49.3373729  | -0.0102078 ±j | 1.0013899 | 49.0525790 |
|        | 1.25 | 122.482                     | 0.3705539 | 0.0631548 | 1.5782485   | -0.1852769 ±j | 0.1697860 | 0.6781909  |
|        |      |                             | 0.3094171 | 0.2531186 | 1.7197065   | -0.1547085 ±j | 0.4787315 | 1.6259895  |
|        |      |                             | 0.2208518 | 0.5232104 | 2.1098820   | -0.1104259 ±j | 0.7148542 | 3.2751958  |
|        |      |                             | 0.1377602 | 0.7635096 | 3.1681544   | -0.0688801 ±j | 0.8710712 | 6.3428348  |
|        |      |                             | 0.0726622 | 0.9251987 | 7.1532769   | -0.0363311 ±j | 0.9611861 | 13.2375902 |
|        |      |                             | 0.0224210 | 1.0031255 | 57.3715316  | -0.0112105 ±j | 1.0014988 | 44.6707357 |
|        | 1.30 | 129.269                     | 0.3608306 | 0.0597303 | 1.7082709   | -0.1804153 ±j | 0.1648653 | 0.6773199  |
|        |      |                             | 0.3056710 | 0.2416983 | 1.8720353   | -0.1528355 ±j | 0.4672682 | 1.6083572  |
|        |      |                             | 0.2233897 | 0.5070472 | 2.3217202   | -0.1116949 ±j | 0.7032578 | 3.1875796  |
|        |      |                             | 0.1429745 | 0.7508882 | 3.5359122   | -0.0714872 ±j | 0.8635843 | 6.0607885  |
|        |      |                             | 0.0770504 | 0.9200325 | 8.0959007   | -0.0385252 ±j | 0.9584093 | 12.4487799 |
|        |      |                             | 0.0240670 | 1.0033215 | 65.5126430  | -0.0120335 ±j | 1.0015871 | 41.6195819 |
|        | 1.35 | 135.404                     | 0.3531459 | 0.0570986 | 1.8433207   | -0.1765729 ±j | 0.1609987 | 0.6766414  |
|        |      |                             | 0.3025545 | 0.2327918 | 2.0296574   | -0.1512773 ±j | 0.4581561 | 1.5947045  |
|        |      |                             | 0.2252705 | 0.4941479 | 2.5397132   | -0.1126352 ±j | 0.6938740 | 3.1204997  |
|        |      |                             | 0.1471578 | 0.7405775 | 3.9125428   | -0.0735789 ±j | 0.8574168 | 5.8479285  |
|        |      |                             | 0.0806722 | 0.9157357 | 9.0585736   | -0.0403361 ±j | 0.9560903 | 11.8620823 |
|        |      |                             | 0.0254450 | 1.0034825 | 73.8184125  | -0.0127225 ±j | 1.0016589 | 39.3687496 |
|        | 1.40 | 141.028                     | 0.3469054 | 0.0550097 | 1.9834134   | -0.1734527 ±j | 0.1578730 | 0.6760964  |
|        |      |                             | 0.2999230 | 0.2256400 | 2.1927230   | -0.1499615 ±j | 0.4507233 | 1.5837923  |
|        |      |                             | 0.2267127 | 0.4835982 | 2.7643424   | -0.1133563 ±j | 0.6861112 | 3.0673727  |
|        |      |                             | 0.1505929 | 0.7319841 | 4.2993023   | -0.0752964 ±j | 0.8522409 | 5.6812826  |
|        |      |                             | 0.0837197 | 0.9121006 | 10.0451492  | -0.0418598 ±j | 0.9541218 | 11.4075908 |
|        |      |                             | 0.0266174 | 1.0036190 | 82.3241078  | -0.0133087 ±j | 1.0017195 | 37.6372792 |
|        | 1.45 | 146.239                     | 0.3417319 | 0.0533105 | 2.1285596   | -0.1708660 ±j | 0.1552911 | 0.6756484  |
|        |      |                             | 0.2976734 | 0.2197675 | 2.3613317   | -0.1488367 ±j | 0.4445393 | 1.5748594  |
|        |      |                             | 0.2278482 | 0.4748053 | 2.9959256   | -0.1139241 ±j | 0.6795783 | 3.0242111  |
|        |      |                             | 0.1534652 | 0.7247093 | 4.6970152   | -0.0767326 ±j | 0.8478334 | 5.5471780  |
|        |      |                             | 0.0863194 | 0.9089849 | 11.0581496  | -0.0431597 ±j | 0.9524296 | 11.0451026 |
|        |      |                             | 0.0276271 | 1.0037358 | 91.0527944  | -0.0138135 ±j | 1.0017709 | 36.2639312 |
|        | 1.50 | 151.105                     | 0.3373723 | 0.0519013 | 2.2787664   | -0.1686861 ±j | 0.1531218 | 0.6752735  |
|        |      |                             | 0.2957299 | 0.2148597 | 2.5355530   | -0.1478649 ±j | 0.4393127 | 1.5674089  |
|        |      |                             | 0.2287617 | 0.4673648 | 3.2346828   | -0.1143808 ±j | 0.6740043 | 2.9884414  |
|        |      |                             | 0.1559020 | 0.7184721 | 5.1062498   | -0.0779510 ±j | 0.8440354 | 5.4369243  |
|        |      |                             | 0.0885639 | 0.9062852 | 12.0993095  | -0.0442820 ±j | 0.9509597 | 10.7491855 |
|        |      |                             | 0.0285055 | 1.0038374 | 100.0203299 | -0.0142528 ±j | 1.0018155 | 35.1481567 |
|        | 1.70 | 167.999                     | 0.3251689 | 0.0480663 | 2.9302881   | -0.1625844 ±j | 0.1470804 | 0.6742354  |
|        |      |                             | 0.2900590 | 0.2013271 | 3.2893923   | -0.1450295 ±j | 0.4246098 | 1.5469091  |
|        |      |                             | 0.2310982 | 0.4464031 | 4.2640673   | -0.1155491 ±j | 0.6580665 | 2.8911258  |
|        |      |                             | 0.1627968 | 0.7004919 | 6.8651328   | -0.0813984 ±j | 0.8329863 | 5.1410947  |
|        |      |                             | 0.0951077 | 0.8983563 | 16.5660270  | -0.0475539 ±j | 0.9466229 | 9.9657179  |
|        |      |                             | 0.0311046 | 1.0041332 | 138.4661013 | -0.0155523 ±j | 1.0019438 | 32.2159977 |
|        | 2.00 | 188.270                     | 0.3150500 | 0.0450077 | 4.0598914   | -0.1575250 ±j | 0.1421042 | 0.6733861  |
|        |      |                             | 0.2851008 | 0.1903441 | 4.5932605   | -0.1425504 ±j | 0.4123390 | 1.5302816  |
|        |      |                             | 0.2327777 | 0.4288939 | 6.0382667   | -0.1163888 ±j | 0.6444746 | 2.8134138  |
|        |      |                             | 0.1685869 | 0.6849560 | 9.8873550   | -0.0842935 ±j | 0.8233411 | 4.9093058  |
|        |      |                             | 0.1008413 | 0.8913446 | 24.2272012  | -0.0504206 ±j | 0.9427631 | 9.3623419  |
|        |      |                             | 0.0334271 | 1.0043945 | 204.3626509 | -0.0167136 ±j | 1.0020555 | 29.9814879 |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=1.0$ |           |           |           |                             |           |           |
|--------|------|---------------------------------------|-----------|-----------|-----------|-----------------------------|-----------|-----------|
| n      | Ws   | As(dB)                                | A1        | B1        | C1        | P1                          | Q1        |           |
| 2      | 1.05 | 2.816                                 | 0.3141664 | 1.1672218 | 1.4386640 | -0.1570832 ±j               | 1.0688997 | 3.4388793 |
|        | 1.10 | 4.025                                 | 0.4582576 | 1.2099342 | 1.7140833 | -0.2291288 ±j               | 1.0758412 | 2.4003315 |
|        | 1.15 | 5.126                                 | 0.5619915 | 1.2286108 | 1.9755745 | -0.2809958 ±j               | 1.0722183 | 1.9723201 |
|        | 1.20 | 6.150                                 | 0.6411310 | 1.2358199 | 2.2359899 | -0.3205655 ±j               | 1.0644518 | 1.7339270 |
|        | 1.25 | 7.112                                 | 0.7033182 | 1.2369152 | 2.5000000 | -0.3516591 ±j               | 1.0551071 | 1.5813139 |
|        | 1.30 | 8.018                                 | 0.7532000 | 1.2346478 | 2.7698611 | -0.3766000 ±j               | 1.0453804 | 1.4752350 |
|        | 1.35 | 8.875                                 | 0.7938715 | 1.2305468 | 3.0468391 | -0.3969357 ±j               | 1.0358517 | 1.3973296 |
|        | 1.40 | 9.687                                 | 0.8274948 | 1.2254971 | 3.3317143 | -0.4137474 ±j               | 1.0267961 | 1.3377990 |
|        | 1.45 | 10.459                                | 0.8556278 | 1.2200214 | 3.6250000 | -0.4278139 ±j               | 1.0183304 | 1.2909186 |
|        | 1.50 | 11.194                                | 0.8794183 | 1.2144311 | 3.9270510 | -0.4397091 ±j               | 1.0104885 | 1.2531151 |
|        | 1.70 | 13.828                                | 0.9456448 | 1.1936113 | 5.2271136 | -0.4728224 ±j               | 0.9849113 | 1.1553230 |
|        | 2.00 | 17.095                                | 0.9989416 | 1.1700773 | 7.4641016 | -0.4994708 ±j               | 0.9594822 | 1.0828472 |
| 3      | 1.05 | 8.134                                 | 0.1310075 | 1.0387959 | 1.2054102 | -0.0655037 ±j<br>-0.9478046 | 1.0171063 | 7.7798102 |
|        | 1.10 | 11.480                                | 0.1953017 | 1.0424072 | 1.3703136 | -0.0976508 ±j<br>-0.8161613 | 1.0163029 | 5.2277254 |
|        | 1.15 | 14.057                                | 0.2396804 | 1.0413033 | 1.5336053 | -0.1198402 ±j<br>-0.7466455 | 1.0133813 | 4.2575148 |
|        | 1.20 | 16.209                                | 0.2729227 | 1.0388411 | 1.6996171 | -0.1364613 ±j<br>-0.7019989 | 1.0100591 | 3.7345212 |
|        | 1.25 | 18.082                                | 0.2989903 | 1.0360216 | 1.8699785 | -0.1494951 ±j<br>-0.6704248 | 1.0068132 | 3.4042965 |
|        | 1.30 | 19.754                                | 0.3200651 | 1.0332080 | 2.0454918 | -0.1600326 ±j<br>-0.6467461 | 1.0037916 | 3.1758176 |
|        | 1.35 | 21.272                                | 0.3374866 | 1.0305391 | 2.2266128 | -0.1687433 ±j<br>-0.6282656 | 1.0010318 | 3.0079852 |
|        | 1.40 | 22.668                                | 0.3521368 | 1.0280632 | 2.4136247 | -0.1760684 ±j<br>-0.6134164 | 0.9985305 | 2.8793764 |
|        | 1.45 | 23.964                                | 0.3646268 | 1.0257904 | 2.6067151 | -0.1823134 ±j<br>-0.6012166 | 0.9962692 | 2.7776705 |
|        | 1.50 | 25.176                                | 0.3753961 | 1.0237139 | 2.8060141 | -0.1876980 ±j<br>-0.5910153 | 0.9942250 | 2.6952534 |
|        | 1.70 | 29.390                                | 0.4067359 | 1.0170764 | 3.6668482 | -0.2033680 ±j<br>-0.5628556 | 0.9877843 | 2.4795009 |
|        | 2.00 | 34.454                                | 0.4340674 | 1.0105937 | 5.1532091 | -0.2170337 ±j<br>-0.5399584 | 0.9815753 | 2.3159603 |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=1.0$ |                        |                        |                         |                                              |                        |                         |
|--------|------|---------------------------------------|------------------------|------------------------|-------------------------|----------------------------------------------|------------------------|-------------------------|
| n      | Ws   | As(dB)                                | A1                     | B1                     | C1                      | P1                                           | Q1                     |                         |
| 4      | 1.05 | 15.840                                | 0.8018519<br>0.0739253 | 0.6848574<br>1.0106709 | 1.1536336<br>3.3125181  | -0.4009259 ±j<br>-0.0369626 ±j               | 0.7239584<br>1.0046416 | 1.0320623<br>13.5991579 |
|        | 1.10 | 20.832                                | 0.7984578<br>0.1089689 | 0.5670420<br>1.0096813 | 1.2909254<br>4.3499304  | -0.3992289 ±j<br>-0.0544844 ±j               | 0.6384812<br>1.0033507 | 0.9430954<br>9.2212483  |
|        | 1.15 | 24.467                                | 0.7859532<br>0.1331269 | 0.5042001<br>1.0079680 | 1.4287858<br>5.2979222  | -0.3929766 ±j<br>-0.0665635 ±j               | 0.5914131<br>1.0017671 | 0.9034514<br>7.5414943  |
|        | 1.20 | 27.432                                | 0.7739424<br>0.1513461 | 0.4638475<br>1.0062382 | 1.5724303<br>6.2244021  | -0.3869712 ±j<br>-0.0756731 ±j               | 0.5604469<br>1.0002559 | 0.8799924<br>6.6279478  |
|        | 1.25 | 29.982                                | 0.7635226<br>0.1657527 | 0.4353766<br>1.0046391 | 1.7197065<br>7.1532769  | -0.3817613 ±j<br>-0.0828764 ±j               | 0.5381774<br>0.9988847 | 0.8641929<br>6.0470612  |
|        | 1.30 | 32.242                                | 0.7546367<br>0.1774958 | 0.4140859<br>1.0031982 | 1.8720353<br>8.0959007  | -0.3773184 ±j<br>-0.0887479 ±j               | 0.5212646<br>0.9976583 | 0.8527217<br>5.6429390  |
|        | 1.35 | 34.286                                | 0.7470501<br>0.1872767 | 0.3975167<br>1.0019102 | 2.0296574<br>9.0585736  | -0.3735251 ±j<br>-0.0936383 ±j               | 0.5079328<br>0.9965651 | 0.8439719<br>5.3447907  |
|        | 1.40 | 36.160                                | 0.7405329<br>0.1955579 | 0.3842395<br>1.0007603 | 2.1927230<br>10.0451492 | -0.3702664 ±j<br>-0.0977789 ±j               | 0.4971340<br>0.9955901 | 0.8370601<br>5.1155197  |
|        | 1.45 | 37.897                                | 0.7348931<br>0.2026610 | 0.3733586<br>0.9997324 | 2.3613317<br>11.0581496 | -0.3674465 ±j<br>-0.1013305 ±j               | 0.4882025<br>0.9947183 | 0.8314553<br>4.9336883  |
|        | 1.50 | 39.518                                | 0.7299768<br>0.2088189 | 0.3642812<br>0.9988112 | 2.5355530<br>12.0993095 | -0.3649884 ±j<br>-0.1044094 ±j               | 0.4806919<br>0.9939365 | 0.8268169<br>4.7859915  |
|        | 1.70 | 45.149                                | 0.7154396<br>0.2269252 | 0.3393372<br>0.9959469 | 3.2893923<br>16.5660270 | -0.3577198 ±j<br>-0.1134626 ±j               | 0.4597540<br>0.9915004 | 0.8142219<br>4.3977979  |
|        | 2.00 | 51.906                                | 0.7025459<br>0.2429568 | 0.3191969<br>0.9932263 | 4.5932605<br>24.2272012 | -0.3512729 ±j<br>-0.1214784 ±j               | 0.4424977<br>0.9891761 | 0.8041826<br>4.1019942  |
| 5      | 1.05 | 24.135                                | 0.3623708<br>0.0471182 | 0.7698202<br>1.0028850 | 1.1334220<br>1.7737385  | -0.1811854 ±j<br>-0.0235591 ±j<br>-0.5117943 | 0.8584824<br>1.0011643 | 2.4212600<br>21.2538240 |
|        | 1.10 | 30.470                                | 0.4042892<br>0.0692414 | 0.6885409<br>1.0016402 | 1.2593204<br>2.1930925  | -0.2021446 ±j<br>-0.0346207 ±j<br>-0.4465618 | 0.8047847<br>1.0002208 | 2.0524509<br>14.4540559 |
|        | 1.15 | 35.040                                | 0.4238210<br>0.0845634 | 0.6402325<br>1.0003870 | 1.3881033<br>2.5834170  | -0.2119105 ±j<br>-0.0422817 ±j<br>-0.4130252 | 0.7715740<br>0.9992994 | 1.8879322<br>11.8277311 |
|        | 1.20 | 38.757                                | 0.4351357<br>0.0961674 | 0.6070893<br>0.9992712 | 1.5211268<br>2.9683674  | -0.2175678 ±j<br>-0.0480837 ±j<br>-0.3915787 | 0.7481668<br>0.9984784 | 1.7906124<br>10.3947442 |
|        | 1.25 | 41.949                                | 0.4424480<br>0.1053752 | 0.5826070<br>0.9982970 | 1.6589139<br>3.3563960  | -0.2212240 ±j<br>-0.0526876 ±j<br>-0.3763893 | 0.7305251<br>0.9977580 | 1.7251451<br>9.4818138  |
|        | 1.30 | 44.776                                | 0.4475070<br>0.1129026 | 0.5636648<br>0.9974476 | 1.8017262<br>3.7515494  | -0.2237535 ±j<br>-0.0564513 ±j<br>-0.3649614 | 0.7166583<br>0.9971263 | 1.6776856<br>8.8458846  |
|        | 1.35 | 47.333                                | 0.4511771<br>0.1191876 | 0.5485287<br>0.9967040 | 1.9497131<br>4.1560845  | -0.2255886 ±j<br>-0.0595938 ±j<br>-0.3560095 | 0.7054350<br>0.9965704 | 1.6415443<br>8.3762969  |
|        | 1.40 | 49.676                                | 0.4539353<br>0.1245201 | 0.5361407<br>0.9960500 | 2.1029685<br>4.5713865  | -0.2269677 ±j<br>-0.0622601 ±j<br>-0.3487902 | 0.6961511<br>0.9960792 | 1.6130411<br>8.0149522  |
|        | 1.45 | 51.847                                | 0.4560661<br>0.1291025 | 0.5258113<br>0.9954716 | 2.2615546<br>4.9983644  | -0.2280331 ±j<br>-0.0645512 ±j<br>-0.3428387 | 0.6883402<br>0.9956429 | 1.5899635<br>7.7282284  |
|        | 1.50 | 53.875                                | 0.4577493<br>0.1330813 | 0.5170686<br>0.9949575 | 2.4255147<br>5.4376446  | -0.2288747 ±j<br>-0.0665406 ±j<br>-0.3378463 | 0.6816780<br>0.9952536 | 1.5708921<br>7.4952354  |
|        | 1.70 | 60.914                                | 0.4618954<br>0.1448152 | 0.4924354<br>0.9933796 | 3.1356145<br>7.3252003  | -0.2309477 ±j<br>-0.0724076 ±j<br>-0.3239800 | 0.6626451<br>0.9940507 | 1.5192561<br>6.8824550  |

| CASE A |        | Passband Ripple: $A_p(\text{dB})=1.0$ |           |           |                    |                    |           |            |  |
|--------|--------|---------------------------------------|-----------|-----------|--------------------|--------------------|-----------|------------|--|
| n      | Ws     | As(dB)                                | A1        | B1        | C1                 | P1                 | Q1        |            |  |
| 6      | 1.05   | 32.523                                | 0.6811085 | 0.3336560 | 1.1233258          | -0.3405543 $\pm j$ | 0.4665606 | 0.8480729  |  |
|        |        |                                       | 0.1985054 | 0.8387522 | 1.4386640          | -0.0992527 $\pm j$ | 0.9104401 | 4.6136488  |  |
|        |        |                                       | 0.0325668 | 1.0004560 | 6.5287683          | -0.0162834 $\pm j$ | 1.0000954 | 30.7131157 |  |
| 1.10   | 40.142 | 0.6301790                             | 0.2667623 | 1.2433620 | -0.3150895 $\pm j$ | 0.4092443          | 0.8195931 |            |  |
|        |        |                                       | 0.2374609 | 0.7788725 | 1.7140833          | -0.1187304 $\pm j$ | 0.8745145 | 3.7165596  |  |
|        |        |                                       | 0.0478536 | 0.9994041 | 8.8264550          | -0.0239268 $\pm j$ | 0.9994156 | 20.8908219 |  |
| 1.15   | 45.628 | 0.5998243                             | 0.2337473 | 1.3669587 | -0.2999122 $\pm j$ | 0.3792096          | 0.8060262 |            |  |
|        |        |                                       | 0.2590118 | 0.7413085 | 1.9755745          | -0.1295059 $\pm j$ | 0.8511972 | 3.3241445  |  |
|        |        |                                       | 0.0584682 | 0.9984900 | 10.9158033         | -0.0292341 $\pm j$ | 0.9988170 | 17.0903855 |  |
| 1.20   | 50.089 | 0.5789335                             | 0.2132674 | 1.4950350 | -0.2894667 $\pm j$ | 0.3598283          | 0.7976890 |            |  |
|        |        |                                       | 0.2731605 | 0.7146367 | 2.2359899          | -0.1365803 $\pm j$ | 0.8342556 | 3.0947437  |  |
|        |        |                                       | 0.0665223 | 0.9977176 | 12.9526713         | -0.0332611 $\pm j$ | 0.9983042 | 15.0153911 |  |
| 1.25   | 53.920 | 0.5634455                             | 0.1991032 | 1.6279471 | -0.2817228 $\pm j$ | 0.3460282          | 0.7919308 |            |  |
|        |        |                                       | 0.2832823 | 0.6944462 | 2.5000000          | -0.1416411 $\pm j$ | 0.8212089 | 2.9417101  |  |
|        |        |                                       | 0.0729227 | 0.9970617 | 14.9917591         | -0.0364613 $\pm j$ | 0.9978638 | 13.6929981 |  |
| 1.30   | 57.313 | 0.5514179                             | 0.1886488 | 1.7658735 | -0.2757090 $\pm j$ | 0.3356089          | 0.7876733 |            |  |
|        |        |                                       | 0.2909193 | 0.6785315 | 2.7698611          | -0.1454596 $\pm j$ | 0.8107854 | 2.8314734  |  |
|        |        |                                       | 0.0781612 | 0.9964994 | 17.0590037         | -0.0390806 $\pm j$ | 0.9974829 | 12.7716574 |  |
| 1.35   | 60.381 | 0.5417730                             | 0.1805878 | 1.9089166 | -0.2708865 $\pm j$ | 0.3274267          | 0.7843805 |            |  |
|        |        |                                       | 0.2968977 | 0.6656266 | 3.0468391          | -0.1484489 $\pm j$ | 0.8022403 | 2.7479479  |  |
|        |        |                                       | 0.0825396 | 0.9960131 | 19.1687817         | -0.0412698 $\pm j$ | 0.9971509 | 12.0912216 |  |
| 1.40   | 63.193 | 0.5338532                             | 0.1741728 | 2.0571405 | -0.2669266 $\pm j$ | 0.3208161          | 0.7817507 |            |  |
|        |        |                                       | 0.3017070 | 0.6549380 | 3.3317143          | -0.1508535 $\pm j$ | 0.7950982 | 2.6823451  |  |
|        |        |                                       | 0.0862576 | 0.9955891 | 21.3298812         | -0.0431288 $\pm j$ | 0.9968596 | 11.5675798 |  |
| 1.45   | 65.798 | 0.5272295                             | 0.1689437 | 2.2105880 | -0.2636147 $\pm j$ | 0.3153585          | 0.7795992 |            |  |
|        |        |                                       | 0.3056585 | 0.6459370 | 3.6250000          | -0.1528292 $\pm j$ | 0.7890375 | 2.6294120  |  |
|        |        |                                       | 0.0894549 | 0.9952166 | 23.5480505         | -0.0447275 $\pm j$ | 0.9966023 | 11.1520440 |  |
| 1.50   | 68.231 | 0.5216076                             | 0.1645999 | 2.3692888 | -0.2608038 $\pm j$ | 0.3107753          | 0.7778053 |            |  |
|        |        |                                       | 0.3089605 | 0.6382548 | 3.9270510          | -0.1544802 $\pm j$ | 0.7838307 | 2.5857951  |  |
|        |        |                                       | 0.0922330 | 0.9948873 | 25.8272420         | -0.0461165 $\pm j$ | 0.9963737 | 10.8143585 |  |
| 1.70   | 76.678 | 0.5056817                             | 0.1527462 | 3.0569811 | -0.2528409 $\pm j$ | 0.2980229          | 0.7728725 |            |  |
|        |        |                                       | 0.3180482 | 0.6162887 | 5.2271136          | -0.1590241 $\pm j$ | 0.7687653 | 2.4683066  |  |
|        |        |                                       | 0.1004355 | 0.9938853 | 35.6008780         | -0.0502178 $\pm j$ | 0.9956724 | 9.9261500  |  |
| 2.00   | 86.814 | 0.4922716                             | 0.1432581 | 4.2481552 | -0.2461358 $\pm j$ | 0.2875331          | 0.7688734 |            |  |
|        |        |                                       | 0.3253826 | 0.5975737 | 7.4641016          | -0.1626913 $\pm j$ | 0.7557151 | 2.3757539  |  |
|        |        |                                       | 0.1077420 | 0.9929575 | 52.3568408         | -0.0538710 $\pm j$ | 0.9950153 | 9.2486883  |  |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=1.0$ |           |           |               |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1            | P1            | Q1        |            |
| 7      | 1.05    | 40.926                                | 0.4125868 | 0.5070710 | 1.1175213     | -0.2062934 ±j | 0.6815527 | 1.7259137  |
|        |         |                                       | 0.1239053 | 0.8830076 | 1.3083409     | -0.0619527 ±j | 0.9376404 | 7.5838949  |
|        |         |                                       | 0.0238401 | 0.9996461 | 2.7143721     | -0.0119201 ±j | 0.9997520 | 41.9386786 |
|        |         |                                       |           |           |               | -0.3522483    |           |            |
| 1.10   | 49.816  | 0.4135944                             | 0.4287344 | 1.2341277 | -0.2067972 ±j | 0.6212643     | 1.5831409 |            |
|        |         |                                       | 0.1552919 | 0.8373389 | 1.5239435     | -0.0776460 ±j | 0.9117620 | 5.8925300  |
|        |         |                                       | 0.0350477 | 0.9987953 | 3.5147693     | -0.0175239 ±j | 0.9992438 | 28.5153204 |
|        |         |                                       |           |           |               | -0.3101749    |           |            |
| 1.15   | 56.218  | 0.4102937                             | 0.3867974 | 1.3546897 | -0.2051468 ±j | 0.5871220     | 1.5158177 |            |
|        |         |                                       | 0.1739255 | 0.8078156 | 1.7321918     | -0.0869627 ±j | 0.8945686 | 5.1676485  |
|        |         |                                       | 0.0428408 | 0.9981052 | 4.2484927     | -0.0214204 ±j | 0.9988225 | 23.3201262 |
|        |         |                                       |           |           |               | -0.2882254    |           |            |
| 1.20   | 61.422  | 0.4066321                             | 0.3596063 | 1.4798722 | -0.2033161 ±j | 0.5641533     | 1.4747281 |            |
|        |         |                                       | 0.1867416 | 0.7864404 | 1.9413408     | -0.0933708 ±j | 0.8818857 | 4.7488862  |
|        |         |                                       | 0.0487597 | 0.9975387 | 4.9666973     | -0.0243799 ±j | 0.9984710 | 20.4834837 |
|        |         |                                       |           |           |               | -0.2740688    |           |            |
| 1.25   | 65.891  | 0.4032558                             | 0.3402477 | 1.6099341 | -0.2016279 ±j | 0.5473517     | 1.4464952 |            |
|        |         |                                       | 0.1962331 | 0.7700293 | 2.1544332     | -0.0981165 ±j | 0.8720106 | 4.4717906  |
|        |         |                                       | 0.0534669 | 0.9970655 | 5.6874343     | -0.0267335 ±j | 0.9981738 | 18.6756956 |
|        |         |                                       |           |           |               | -0.2639854    |           |            |
| 1.30   | 69.851  | 0.4002690                             | 0.3256593 | 1.7450051 | -0.2001345 ±j | 0.5344207     | 1.4257056 |            |
|        |         |                                       | 0.2035926 | 0.7569523 | 2.3729509     | -0.1017963 ±j | 0.8640543 | 4.2733877  |
|        |         |                                       | 0.0573220 | 0.9966643 | 6.4192876     | -0.0286610 ±j | 0.9979193 | 17.4161853 |
|        |         |                                       |           |           |               | -0.2563680    |           |            |
| 1.35   | 73.429  | 0.3976535                             | 0.3142323 | 1.8851599 | -0.1988268 ±j | 0.5241185     | 1.4096802 |            |
|        |         |                                       | 0.2094836 | 0.7462560 | 2.5977295     | -0.1047418 ±j | 0.8574877 | 4.1237641  |
|        |         |                                       | 0.0605458 | 0.9963200 | 7.1670237     | -0.0302729 ±j | 0.9976991 | 16.4860155 |
|        |         |                                       |           |           |               | -0.2503823    |           |            |
| 1.40   | 76.710  | 0.3953640                             | 0.3050253 | 2.0304452 | -0.1976820 ±j | 0.5157006     | 1.3969176 |            |
|        |         |                                       | 0.2143119 | 0.7373335 | 2.8292857     | -0.1071559 ±j | 0.8519690 | 4.0066902  |
|        |         |                                       | 0.0632845 | 0.9960215 | 7.9335602     | -0.0316422 ±j | 0.9975070 | 15.7701963 |
|        |         |                                       |           |           |               | -0.2455435    |           |            |
| 1.45   | 79.750  | 0.3933536                             | 0.2974448 | 2.1808921 | -0.1966768 ±j | 0.5086876     | 1.3865008 |            |
|        |         |                                       | 0.2183423 | 0.7297750 | 3.0679607     | -0.1091711 ±j | 0.8472642 | 3.9125203  |
|        |         |                                       | 0.0656405 | 0.9957605 | 8.7208069     | -0.0328203 ±j | 0.9973381 | 15.2021655 |
|        |         |                                       |           |           |               | -0.2415466    |           |            |
| 1.50   | 82.588  | 0.3915802                             | 0.2910953 | 2.3365223 | -0.1957901 ±j | 0.5027540     | 1.3778339 |            |
|        |         |                                       | 0.2217567 | 0.7232912 | 3.3139902     | -0.1108784 ±j | 0.8432065 | 3.8351270  |
|        |         |                                       | 0.0676883 | 0.9955306 | 9.5300781     | -0.0338441 ±j | 0.9971886 | 14.7405596 |
|        |         |                                       |           |           |               | -0.2381883    |           |            |
| 1.70   | 92.443  | 0.3862321                             | 0.2735217 | 3.0111362 | -0.1931160 ±j | 0.4860328     | 1.3540900 |            |
|        |         |                                       | 0.2313912 | 0.7045843 | 4.3744590     | -0.1156956 ±j | 0.8313837 | 3.6276025  |
|        |         |                                       | 0.0737382 | 0.9948354 | 13.0029293    | -0.0368691 ±j | 0.9967327 | 13.5264291 |
|        |         |                                       |           |           |               | -0.2288352    |           |            |
| 2.00   | 104.268 | 0.3813687                             | 0.2591886 | 4.1800429 | -0.1906844 ±j | 0.4720467     | 1.3349435 |            |
|        |         |                                       | 0.2394498 | 0.6884471 | 6.2017764     | -0.1197249 ±j | 0.8210439 | 3.4651401  |
|        |         |                                       | 0.0791319 | 0.9941965 | 18.9610948    | -0.0395660 ±j | 0.9963087 | 12.6004015 |
|        |         |                                       |           |           |               | -0.2211307    |           |            |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=1.0$ |           |           |               |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1            | P1            | Q1        |            |
| 8      | 1.05    | 49.331                                | 0.5481570 | 0.1914969 | 1.1138641     | -0.2740785 ±j | 0.3411421 | 0.7983181  |
|        |         |                                       | 0.2607426 | 0.6403573 | 1.2431181     | -0.1303713 ±j | 0.7895319 | 3.0690159  |
|        |         |                                       | 0.0845236 | 0.9117553 | 1.9061395     | -0.0422618 ±j | 0.9539231 | 11.2969504 |
|        |         |                                       | 0.0182048 | 0.9993874 | 11.0466061    | -0.0091024 ±j | 0.9996522 | 54.9137035 |
| 1.10   | 59.491  | 0.4973283                             | 0.1520454 | 1.2282855 | -0.2486642 ±j | 0.3003523     | 0.7840493 |            |
|        |         |                                       | 0.2793766 | 0.5637799 | 1.4271032     | -0.1396883 ±j | 0.7377446 | 2.6876009  |
|        |         |                                       | 0.1094716 | 0.8759402 | 2.3804113     | -0.0547358 ±j | 0.9343148 | 8.5494004  |
|        |         |                                       | 0.0267768 | 0.9986977 | 15.1062239    | -0.0133884 ±j | 0.9992589 | 37.3214626 |
| 1.15   | 66.807  | 0.4689980                             | 0.1328252 | 1.3469136 | -0.2344990 ±j | 0.2789900     | 0.7770863 |            |
|        |         |                                       | 0.2872371 | 0.5202517 | 1.6072975     | -0.1436186 ±j | 0.7068419 | 2.5111125  |
|        |         |                                       | 0.1248946 | 0.8523519 | 2.8200771     | -0.0624473 ±j | 0.9211147 | 7.3920638  |
|        |         |                                       | 0.0327422 | 0.9981600 | 18.7925269    | -0.0163711 ±j | 0.9989454 | 30.5135176 |
| 1.20   | 72.755  | 0.4500983                             | 0.1209745 | 1.4702527 | -0.2250491 ±j | 0.2651931     | 0.7727509 |            |
|        |         |                                       | 0.2914195 | 0.4910437 | 1.7895085     | -0.1457097 ±j | 0.6854286 | 2.4045926  |
|        |         |                                       | 0.1357821 | 0.8350645 | 3.2528314     | -0.0678911 ±j | 0.9112932 | 6.7300364  |
|        |         |                                       | 0.0372757 | 0.9977265 | 22.3835994    | -0.0186378 ±j | 0.9986887 | 26.7966172 |
| 1.25   | 77.863  | 0.4363460                             | 0.1128079 | 1.5984994 | -0.2181730 ±j | 0.2553595     | 0.7697306 |            |
|        |         |                                       | 0.2939108 | 0.4697622 | 1.9759013     | -0.1469554 ±j | 0.6694523 | 2.3319727  |
|        |         |                                       | 0.1439996 | 0.8216731 | 3.6885364     | -0.0719998 ±j | 0.9035979 | 6.2948934  |
|        |         |                                       | 0.0408827 | 0.9973684 | 25.9769795    | -0.0204414 ±j | 0.9984741 | 24.4280128 |
| 1.30   | 82.388  | 0.4258006                             | 0.1067949 | 1.7317524 | -0.2129003 ±j | 0.2479282     | 0.7674834 |            |
|        |         |                                       | 0.2954992 | 0.4534510 | 2.1675370     | -0.1477496 ±j | 0.6569787 | 2.2788140  |
|        |         |                                       | 0.1504657 | 0.8109285 | 4.1319051     | -0.0752328 ±j | 0.8973675 | 5.9848581  |
|        |         |                                       | 0.0438378 | 0.9970669 | 29.6189023    | -0.0219189 ±j | 0.9982918 | 22.7778655 |
| 1.35   | 86.478  | 0.4174218                             | 0.1021667 | 1.8700686 | -0.2087109 ±j | 0.2420878     | 0.7657370 |            |
|        |         |                                       | 0.2965587 | 0.4405070 | 2.3650162     | -0.1482793 ±j | 0.6469314 | 2.2380294  |
|        |         |                                       | 0.1557033 | 0.8020911 | 4.5855625     | -0.0778516 ±j | 0.8922053 | 5.7519375  |
|        |         |                                       | 0.0463097 | 0.9968097 | 33.3349904    | -0.0231549 ±j | 0.9981350 | 21.5592547 |
| 1.40   | 90.227  | 0.4105896                             | 0.0984885 | 2.0134836 | -0.2052948 ±j | 0.2373659     | 0.7643369 |            |
|        |         |                                       | 0.2972881 | 0.4299690 | 2.5687116     | -0.1486440 ±j | 0.6386501 | 2.2056728  |
|        |         |                                       | 0.1600382 | 0.7946855 | 5.0511190     | -0.0800191 ±j | 0.8878527 | 5.5702426  |
|        |         |                                       | 0.0484103 | 0.9965875 | 37.1409040    | -0.0242051 ±j | 0.9979988 | 20.6215015 |
| 1.45   | 93.701  | 0.4049070                             | 0.0954934 | 2.1620209 | -0.2024535 ±j | 0.2334652     | 0.7631878 |            |
|        |         |                                       | 0.2978018 | 0.4212188 | 2.7788694     | -0.1489009 ±j | 0.6317020 | 2.1793479  |
|        |         |                                       | 0.1636868 | 0.7883879 | 5.5296305     | -0.0818434 ±j | 0.8841321 | 5.4244589  |
|        |         |                                       | 0.0502177 | 0.9963939 | 41.0468858    | -0.0251088 ±j | 0.9978795 | 19.8773774 |
| 1.50   | 96.945  | 0.4001055                             | 0.0930075 | 2.3156973 | -0.2000528 ±j | 0.2301878     | 0.7622273 |            |
|        |         |                                       | 0.2981696 | 0.4138378 | 2.9956604     | -0.1490848 ±j | 0.6257887 | 2.1575049  |
|        |         |                                       | 0.1667996 | 0.7829682 | 6.0218242     | -0.0833998 ±j | 0.8809158 | 5.3048972  |
|        |         |                                       | 0.0517888 | 0.9962238 | 45.0599777    | -0.0258944 ±j | 0.9977741 | 19.2726853 |
| 1.70   | 108.208 | 0.3866047                             | 0.0862332 | 2.9819909 | -0.1933024 ±j | 0.2210598     | 0.7595741 |            |
|        |         |                                       | 0.2988743 | 0.3931586 | 3.9311886     | -0.1494371 ±j | 0.6089557 | 2.0979509  |
|        |         |                                       | 0.1756955 | 0.7672394 | 8.1360237     | -0.0878477 ±j | 0.8715057 | 4.9854564  |
|        |         |                                       | 0.0564324 | 0.9957117 | 62.2665524    | -0.0282162 ±j | 0.9974545 | 17.6822710 |
| 2.00   | 121.722 | 0.3753443                             | 0.0808206 | 4.1367342 | -0.1876722 ±j | 0.2135409     | 0.7574101 |            |
|        |         |                                       | 0.2990855 | 0.3760145 | 5.5450630     | -0.1495427 ±j | 0.5946861 | 2.0502509  |
|        |         |                                       | 0.1832702 | 0.7535607 | 11.7666735    | -0.0916351 ±j | 0.8632287 | 4.7366071  |
|        |         |                                       | 0.0605744 | 0.9952437 | 91.7615329    | -0.0302872 ±j | 0.9971592 | 16.4693151 |



| CASE A |         | Passband Ripple: Ap(dB)=1.0 |           |           |               |               |           |            |  |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|--|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |  |
| 9      | 1.05    | 57.736                      | 0.3904946 | 0.3426467 | 1.1114059     | -0.1952473 ±j | 0.5518380 | 1.4990229  |  |
|        |         |                             | 0.1750282 | 0.7309782 | 1.2054102     | -0.0875141 ±j | 0.8504819 | 4.8847718  |  |
|        |         |                             | 0.0613937 | 0.9311952 | 1.5942707     | -0.0306968 ±j | 0.9644962 | 15.7179810 |  |
|        |         |                             | 0.0143566 | 0.9993314 | 3.9936736     | -0.0071783 ±j | 0.9996399 | 69.6310722 |  |
|        |         |                             |           |           |               | -0.2698779    |           |            |  |
| 1.10   | 69.167  | 0.3734728                   | 0.2822060 | 1.2243475 | -0.1867364 ±j | 0.4973284     | 1.4224079 |            |  |
|        |         |                             | 0.1975839 | 0.6619103 | 1.3703136     | -0.0987919 ±j | 0.8075584 | 4.1176373  |  |
|        |         |                             | 0.0814468 | 0.9024380 | 1.9377187     | -0.0407234 ±j | 0.9490941 | 11.6636498 |  |
|        |         |                             | 0.0211256 | 0.9987655 | 5.2992478     | -0.0105628 ±j | 0.9993267 | 47.3067468 |  |
|        |         |                             |           |           |               | -0.2385414    |           |            |  |
| 1.15   | 77.397  | 0.3617656                   | 0.2511874 | 1.3416657 | -0.1808828 ±j | 0.4674065     | 1.3853889 |            |  |
|        |         |                             | 0.2090359 | 0.6209460 | 1.5336053     | -0.1045179 ±j | 0.7810391 | 3.7696943  |  |
|        |         |                             | 0.0941747 | 0.8832611 | 2.2599957     | -0.0470874 ±j | 0.9386394 | 9.9795338  |  |
|        |         |                             | 0.0258390 | 0.9983355 | 6.4899114     | -0.0129195 ±j | 0.9990839 | 38.6690271 |  |
|        |         |                             |           |           |               | -0.2220775    |           |            |  |
| 1.20   | 84.089  | 0.3531559                   | 0.2315222 | 1.4637563 | -0.1765779 ±j | 0.4475963     | 1.3624793 |            |  |
|        |         |                             | 0.2161378 | 0.5927585 | 1.6996171     | -0.1080689 ±j | 0.7622858 | 3.5621171  |  |
|        |         |                             | 0.1033110 | 0.8690916 | 2.5791043     | -0.0516555 ±j | 0.9308186 | 9.0237324  |  |
|        |         |                             | 0.0294223 | 0.9979931 | 7.6523927     | -0.0147112 ±j | 0.9988877 | 33.9536897 |  |
|        |         |                             |           |           |               | -0.2114193    |           |            |  |
| 1.25   | 89.835  | 0.3465116                   | 0.2177234 | 1.5907740 | -0.1732558 ±j | 0.4332503     | 1.3465883 |            |  |
|        |         |                             | 0.2210038 | 0.5718621 | 1.8699785     | -0.1105019 ±j | 0.7480985 | 3.4217313  |  |
|        |         |                             | 0.1102905 | 0.8580494 | 2.9015215     | -0.0551452 ±j | 0.9246666 | 8.3988188  |  |
|        |         |                             | 0.0322742 | 0.9977123 | 8.8171818     | -0.0161371 ±j | 0.9987251 | 30.9490644 |  |
|        |         |                             |           |           |               | -0.2038095    |           |            |  |
| 1.30   | 94.925  | 0.3412085                   | 0.2074316 | 1.7227963 | -0.1706042 ±j | 0.4222864     | 1.3348044 |            |  |
|        |         |                             | 0.2245500 | 0.5556390 | 2.0454918     | -0.1122750 ±j | 0.7369079 | 3.3195815  |  |
|        |         |                             | 0.1158338 | 0.8491482 | 3.2303598     | -0.0579169 ±j | 0.9196705 | 7.9553005  |  |
|        |         |                             | 0.0346112 | 0.9974772 | 9.9987492     | -0.0173056 ±j | 0.9985879 | 28.8559415 |  |
|        |         |                             |           |           |               | -0.1980510    |           |            |  |
| 1.35   | 99.526  | 0.3368697                   | 0.1994324 | 1.8598680 | -0.1684349 ±j | 0.4135965     | 1.3256713 |            |  |
|        |         |                             | 0.2272468 | 0.5426356 | 2.2266128     | -0.1136234 ±j | 0.7278223 | 3.2415779  |  |
|        |         |                             | 0.1203575 | 0.8417995 | 3.5673591     | -0.0601787 ±j | 0.9155206 | 7.6230942  |  |
|        |         |                             | 0.0365664 | 0.9972773 | 11.2051201    | -0.0182832 ±j | 0.9984703 | 27.3102728 |  |
|        |         |                             |           |           |               | -0.1935203    |           |            |  |
| 1.40   | 103.745 | 0.3332518                   | 0.1930264 | 2.0020170 | -0.1666259 ±j | 0.4065245     | 1.3183656 |            |  |
|        |         |                             | 0.2293632 | 0.5319641 | 2.4136247     | -0.1146816 ±j | 0.7202862 | 3.1799286  |  |
|        |         |                             | 0.1241246 | 0.8356222 | 3.9135894     | -0.0620623 ±j | 0.9120145 | 7.3645670  |  |
|        |         |                             | 0.0382281 | 0.9971052 | 12.4412023    | -0.0191141 ±j | 0.9983686 | 26.1208773 |  |
|        |         |                             |           |           |               | -0.1898540    |           |            |  |
| 1.45   | 107.652 | 0.3301887                   | 0.1877778 | 2.1492622 | -0.1650943 ±j | 0.4006515     | 1.3123811 |            |  |
|        |         |                             | 0.2310653 | 0.5230445 | 2.6067151     | -0.1155326 ±j | 0.7139305 | 3.1299300  |  |
|        |         |                             | 0.1273117 | 0.8303555 | 4.2697534     | -0.0636558 ±j | 0.9090123 | 7.1575414  |  |
|        |         |                             | 0.0396581 | 0.9969556 | 13.7102067    | -0.0198291 ±j | 0.9982797 | 25.1771005 |  |
|        |         |                             |           |           |               | -0.1868232    |           |            |  |
| 1.50   | 111.302 | 0.3275629                   | 0.1833992 | 2.3016164 | -0.1637814 ±j | 0.3956954     | 1.3073867 |            |  |
|        |         |                             | 0.2324611 | 0.5154788 | 2.8060141     | -0.1162305 ±j | 0.7084979 | 3.0885542  |  |
|        |         |                             | 0.1300427 | 0.8258128 | 4.6363361     | -0.0650214 ±j | 0.9064133 | 6.9880297  |  |
|        |         |                             | 0.0409014 | 0.9968243 | 15.0143415    | -0.0204507 ±j | 0.9982014 | 24.4101851 |  |
|        |         |                             |           |           |               | -0.1842751    |           |            |  |
| 1.70   | 123.972 | 0.3199991                   | 0.1713634 | 2.9622803 | -0.1599995 ±j | 0.3817899     | 1.2936307 |            |  |
|        |         |                             | 0.2361700 | 0.4940771 | 3.6668482     | -0.1180850 ±j | 0.6929163 | 2.9762714  |  |
|        |         |                             | 0.1379092 | 0.8125762 | 6.2125942     | -0.0689546 ±j | 0.8987889 | 6.5364008  |  |
|        |         |                             | 0.0445767 | 0.9964306 | 20.6082544    | -0.0222883 ±j | 0.9979648 | 22.3931880 |  |
|        |         |                             |           |           |               | -0.1771703    |           |            |  |
| 2.00   | 139.176 | 0.3134914                   | 0.1616355 | 4.1074418 | -0.1567457 ±j | 0.3702246     | 1.2824568 |            |  |
|        |         |                             | 0.2390095 | 0.4761012 | 5.1532091     | -0.1195047 ±j | 0.6795733 | 2.8869186  |  |
|        |         |                             | 0.1446814 | 0.8010006 | 8.9221914     | -0.0723407 ±j | 0.8920580 | 6.1859104  |  |
|        |         |                             | 0.0478559 | 0.9960723 | 30.2010593    | -0.0239280 ±j | 0.9977473 | 20.8549792 |  |
|        |         |                             |           |           |               | -0.1713093    |           |            |  |

| CASE A |         | Passband Ripple: Ap(dB)=1.0 |           |             |               |               |            |            |
|--------|---------|-----------------------------|-----------|-------------|---------------|---------------|------------|------------|
| n      | Ws      | As(dB)                      | A1        | B1          | C1            | P1            | Q1         |            |
| 10     | 1.05    | 66.141                      | 0.4519541 | 0.1234522   | 1.1096718     | -0.2259771 ±j | 0.2690474  | 0.7774187  |
|        |         |                             | 0.2764450 | 0.4824927   | 1.1814619     | -0.1382225 ±j | 0.6807256  | 2.5126766  |
|        |         |                             | 0.1240616 | 0.7926010   | 1.4386640     | -0.0620308 ±j | 0.8881178  | 7.1761265  |
|        |         |                             | 0.0466938 | 0.9448778   | 2.5336482     | -0.0233469 ±j | 0.9717678  | 20.8175070 |
|        |         |                             | 0.0116123 | 0.9993517   | 16.8596102    | -0.0058062 ±j | 0.9996589  | 86.0873806 |
| 1.10   | 78.842  | 0.4067748                   | 0.0977905 | 1.2215638   | -0.2033874 ±j | 0.2375375     | 0.7687663  |            |
|        |         | 0.2787519                   | 0.4109674 | 1.3338339   | -0.1393759 ±j | 0.6257330     | 2.2997780  |            |
|        |         | 0.1459045                   | 0.7321492 | 1.7140833   | -0.0729523 ±j | 0.8525416     | 5.8645008  |            |
|        |         | 0.0630738                   | 0.9213215 | 3.2619424   | -0.0315369 ±j | 0.9593367     | 15.2179769 |            |
|        |         | 0.0170933                   | 0.9988812 | 23.1838025  | -0.0085466 ±j | 0.9994039     | 58.4697596 |            |
| 1.15   | 87.987  | 0.3821192                   | 0.0853393 | 1.3379528   | -0.1910596 ±j | 0.2209877     | 0.7644969  |            |
|        |         | 0.2775940                   | 0.3724340 | 1.4860346   | -0.1387970 ±j | 0.5942805     | 2.1984398  |            |
|        |         | 0.1578954                   | 0.6951763 | 1.9755745   | -0.0789477 ±j | 0.8300262     | 5.2805365  |            |
|        |         | 0.0736630                   | 0.9054747 | 3.9305495   | -0.0368315 ±j | 0.9508513     | 12.9178108 |            |
|        |         | 0.0209113                   | 0.9985299 | 28.9230322  | -0.0104557 ±j | 0.9992100     | 47.7858609 |            |
| 1.20   | 95.422  | 0.3658414                   | 0.0776771 | 1.4591581   | -0.1829207 ±j | 0.2102787     | 0.7618223  |            |
|        |         | 0.2758792                   | 0.3473384 | 1.6414311   | -0.1379396 ±j | 0.5729843     | 2.1362762  |            |
|        |         | 0.1657426                   | 0.6692586 | 2.2359899   | -0.0828713 ±j | 0.8138740     | 4.9358606  |            |
|        |         | 0.0813524                   | 0.8936980 | 4.5854918   | -0.0406762 ±j | 0.9444805     | 11.6204992 |            |
|        |         | 0.0238147                   | 0.9982525 | 34.5122486  | -0.0119074 ±j | 0.9990549     | 41.9541158 |            |
| 1.25   | 101.806 | 0.3540732                   | 0.0724032 | 1.5853042   | -0.1770366 ±j | 0.2026358     | 0.7599515  |            |
|        |         | 0.2741657                   | 0.3294124 | 1.8012990   | -0.1370828 ±j | 0.5573336     | 2.0934225  |            |
|        |         | 0.1713478                   | 0.6497946 | 2.5000000   | -0.0856739 ±j | 0.8015326     | 4.7044575  |            |
|        |         | 0.0872756                   | 0.8844815 | 5.2430274   | -0.0436378 ±j | 0.9394558     | 10.7758457 |            |
|        |         | 0.0261259                   | 0.9980263 | 40.1039839  | -0.0130630 ±j | 0.9989273     | 38.2383859 |            |
| 1.30   | 107.462 | 0.3450894                   | 0.0685232 | 1.7164539   | -0.1725447 ±j | 0.1968541     | 0.7585554  |            |
|        |         | 0.2725891                   | 0.3158689 | 1.9662686   | -0.1362945 ±j | 0.5452456     | 2.0617926  |            |
|        |         | 0.1755738                   | 0.6345362 | 2.7698611   | -0.0877869 ±j | 0.7917258     | 4.5369959  |            |
|        |         | 0.0920102                   | 0.8770274 | 5.9108926   | -0.0460051 ±j | 0.9353668     | 10.1781929 |            |
|        |         | 0.0280202                   | 0.9978377 | 45.7705353  | -0.0140101 ±j | 0.9988200     | 35.6499954 |            |
| 1.35   | 112.575 | 0.3379746                   | 0.0655385 | 1.8526432   | -0.1689873 ±j | 0.1923066     | 0.7574679  |            |
|        |         | 0.2711753                   | 0.3052385 | 2.1366988   | -0.1355876 ±j | 0.5355880     | 2.0373683  |            |
|        |         | 0.1788810                   | 0.6222129 | 3.0468391   | -0.0894405 ±j | 0.7837176     | 4.4096616  |            |
|        |         | 0.0958936                   | 0.8708570 | 6.5933849   | -0.0479468 ±j | 0.9319647     | 9.7315945  |            |
|        |         | 0.0296051                   | 0.9976776 | 51.5519660  | -0.0148026 ±j | 0.9987285     | 33.7387050 |            |
| 1.40   | 117.262 | 0.3321879                   | 0.0631676 | 1.9938949   | -0.1660940 ±j | 0.1886275     | 0.7565945  |            |
|        |         | 0.2699176                   | 0.2966588 | 2.3128131   | -0.1349588 ±j | 0.5276788     | 2.0178898  |            |
|        |         | 0.1815412                   | 0.6120371 | 3.3317143   | -0.0907706 ±j | 0.7770443     | 4.3093690  |            |
|        |         | 0.0991410                   | 0.8656588 | 7.2931353   | -0.0495705 ±j | 0.9290864     | 9.3846900  |            |
|        |         | 0.0309523                   | 0.9975402 | 57.4727614  | -0.0154762 ±j | 0.9986494     | 32.2679962 |            |
| 1.45   | 121.604 | 0.3273845                   | 0.0612376 | 2.1402240   | -0.1636923 ±j | 0.1855868     | 0.7558767  |            |
|        |         | 0.2688001                   | 0.2895847 | 2.4947597   | -0.1344000 ±j | 0.5210771     | 2.0019741  |            |
|        |         | 0.1837270                   | 0.6034886 | 3.6250000   | -0.0918635 ±j | 0.7713947     | 4.2282598  |            |
|        |         | 0.1018981                   | 0.8612185 | 8.0118665   | -0.0509491 ±j | 0.9266190     | 9.1073157  |            |
|        |         | 0.0321118                   | 0.9974209 | 63.5489356  | -0.0160559 ±j | 0.9985806     | 31.1010290 |            |
| 1.50   | 125.658 | 0.3233325                   | 0.0596362 | 2.2916411   | -0.1616663 ±j | 0.1830307     | 0.7552759  |            |
|        |         | 0.2678055                   | 0.2836523 | 2.6826414   | -0.1339028 ±j | 0.5154827     | 1.9887201  |            |
|        |         | 0.1855537                   | 0.5962067 | 3.9270510   | -0.0927768 ±j | 0.7665502     | 4.1612983  |            |
|        |         | 0.1042678                   | 0.8573826 | 8.7507642   | -0.0521339 ±j | 0.9244807     | 8.8804906  |            |
|        |         | 0.0331199                   | 0.9973165 | 69.7914985  | -0.0165600 ±j | 0.9985200     | 30.1527688 |            |
| 1.70   | 139.737 | 0.3119705                   | 0.0552744 | 2.9483149   | -0.1559852 ±j | 0.1759061     | 0.7536130  |            |
|        |         | 0.2647636                   | 0.2671981 | 3.4947482   | -0.1323818 ±j | 0.4996731     | 1.9523533  |            |
|        |         | 0.1905834                   | 0.5754527 | 5.2271136   | -0.0952917 ±j | 0.7525770     | 3.9803360  |            |
|        |         | 0.1111301                   | 0.8461732 | 11.9220243  | -0.0555651 ±j | 0.9181970     | 8.2774745  |            |
|        |         | 0.0361005                   | 0.9970038 | 96.5555666  | -0.0180502 ±j | 0.9983376     | 27.6589231 |            |
| 2.00   | 156.630 | 0.3025276                   | 0.0517914 | 4.0866858   | -0.1512638 ±j | 0.1700313     | 0.7522527  |            |
|        |         | 0.2619515                   | 0.2537386 | 4.8979715   | -0.1309757 ±j | 0.4863989     | 1.9229696  |            |
|        |         | 0.1946467                   | 0.5578421 | 7.4641016   | -0.0973233 ±j | 0.7405203     | 3.8371489  |            |
|        |         | 0.1170818                   | 0.8363313 | 17.3634536  | -0.0585409 ±j | 0.9126359     | 7.8108760  |            |
|        |         | 0.0387604                   | 0.9967202 | 142.4309671 | -0.0193802 ±j | 0.9981706     | 25.7571520 |            |

| CASE A |         | Passband Ripple: Ap(dB)=1.0 |           |            |               |               |            |             |
|--------|---------|-----------------------------|-----------|------------|---------------|---------------|------------|-------------|
| n      | Ws      | As(dB)                      | A1        | B1         | C1            | P1            | Q1         |             |
| 11     | 1.05    | 74.546                      | 0.3530157 | 0.2427470  | 1.1084015     | -0.1765079 ±j | 0.4599913  | 1.3956705   |
|        |         |                             | 0.1999614 | 0.5915738  | 1.1652129     | -0.0999807 ±j | 0.7626124  | 3.8464342   |
|        |         |                             | 0.0919889 | 0.8356314  | 1.3488607     | -0.0459944 ±j | 0.9129709  | 9.9373839   |
|        |         |                             | 0.0367738 | 0.9548502  | 1.9760810     | -0.0183869 ±j | 0.9769913  | 26.5722972  |
|        |         |                             | 0.0095866 | 0.9993990  | 5.6021835     | -0.0047933 ±j | 0.9996880  | 104.2807935 |
|        |         |                             |           |            |               | -0.2191573    |            |             |
| 1.10   | 88.517  | 0.3295533                   | 0.1972019 | 1.2195217  | -0.1647767 ±j | 0.4123718     | 1.3475032  |             |
|        |         | 0.2112986                   | 0.5178762 | 1.3088558  | -0.1056493 ±j | 0.7118388     | 3.4057784  |             |
|        |         | 0.1117631                   | 0.7831881 | 1.5834523  | -0.0558815 ±j | 0.8832131     | 7.9183486  |             |
|        |         | 0.0503684                   | 0.9352233 | 2.4791006  | -0.0251842 ±j | 0.9667415     | 19.1999072 |             |
|        |         | 0.0141153                   | 0.9990028 | 7.5378437  | -0.0070576 ±j | 0.9994763     | 70.8098069 |             |
|        |         |                             |           |            | -0.1940717    |               |            |             |
| 1.15   | 98.576  | 0.3153526                   | 0.1743090 | 1.3352275  | -0.1576763 ±j | 0.3865840     | 1.3239253  |             |
|        |         | 0.2157596                   | 0.4765359 | 1.4533340  | -0.1078798 ±j | 0.6818342     | 3.1994668  |             |
|        |         | 0.1231491                   | 0.7503727 | 1.8085794  | -0.0615746 ±j | 0.8640494     | 7.0340784  |             |
|        |         | 0.0592757                   | 0.9219349 | 2.9446236  | -0.0296378 ±j | 0.9597169     | 16.1984549 |             |
|        |         | 0.0172709                   | 0.9987105 | 9.2991673  | -0.0086354 ±j | 0.9993177     | 57.8635627 |             |
|        |         |                             |           |            | -0.1808453    |               |            |             |
| 1.20   | 106.755 | 0.3054802                   | 0.1599540 | 1.4557817  | -0.1527401 ±j | 0.3696275     | 1.3092256  |             |
|        |         | 0.2179691                   | 0.4489849 | 1.6013465  | -0.1089845 ±j | 0.6611409     | 3.0741213  |             |
|        |         | 0.1308369                   | 0.7270458 | 2.0396266  | -0.0654185 ±j | 0.8501566     | 6.5170430  |             |
|        |         | 0.0657982                   | 0.9120178 | 3.4024453  | -0.0328991 ±j | 0.9544294     | 14.5140098 |             |
|        |         | 0.0196710                   | 0.9984813 | 11.0168385 | -0.0098355 ±j | 0.9991920     | 50.7975827 |             |
|        |         |                             |           |            | -0.1722670    |               |            |             |
| 1.25   | 113.778 | 0.2981089                   | 0.1499524 | 1.5812870  | -0.1490545 ±j | 0.3574006     | 1.2989780  |             |
|        |         | 0.2191821                   | 0.4289973 | 1.7539211  | -0.1095911 ±j | 0.6457454     | 2.9882856  |             |
|        |         | 0.1364569                   | 0.7093543 | 2.2631658  | -0.0682284 ±j | 0.8394636     | 6.1721458  |             |
|        |         | 0.0708529                   | 0.9042323 | 3.8631607  | -0.0354264 ±j | 0.9502511     | 13.4209313 |             |
|        |         | 0.0215819                   | 0.9982951 | 12.7367378 | -0.0107909 ±j | 0.9990889     | 46.2957112 |             |
|        |         |                             |           |            | -0.1661348    |               |            |             |
| 1.30   | 119.999 | 0.2923541                   | 0.1425302 | 1.7117951  | -0.1461771 ±j | 0.3480840     | 1.2913507  |             |
|        |         | 0.2198835                   | 0.4137239 | 1.9115674  | -0.1099418 ±j | 0.6337481     | 2.9252473  |             |
|        |         | 0.1407720                   | 0.6953822 | 2.4979196  | -0.0703860 ±j | 0.8309200     | 5.9237339  |             |
|        |         | 0.0749117                   | 0.8979202 | 4.3318290  | -0.0374559 ±j | 0.9468460     | 12.6493738 |             |
|        |         | 0.0231481                   | 0.9981402 | 14.4806247 | -0.0115741 ±j | 0.9990026     | 43.1598570 |             |
|        |         |                             |           |            | -0.1614905    |               |            |             |
| 1.35   | 125.623 | 0.2877203                   | 0.1367831 | 1.8473359  | -0.1438601 ±j | 0.3407159     | 1.2854220  |             |
|        |         | 0.2202975                   | 0.4016304 | 2.0745762  | -0.1101487 ±j | 0.6240975     | 2.8767609  |             |
|        |         | 0.1441994                   | 0.6840315 | 2.7391978  | -0.0720997 ±j | 0.8239133     | 5.7355431  |             |
|        |         | 0.0782532                   | 0.8926849 | 4.8112671  | -0.0391266 ±j | 0.9440095     | 12.0738787 |             |
|        |         | 0.0244588                   | 0.9980092 | 16.2605612 | -0.0122294 ±j | 0.9989292     | 40.8443537 |             |
|        |         |                             |           |            | -0.1578342    |               |            |             |
| 1.40   | 130.779 | 0.2839027                   | 0.1321942 | 1.9879279  | -0.1419513 ±j | 0.3347298     | 1.2806685  |             |
|        |         | 0.2205402                   | 0.3918019 | 2.2431285  | -0.1102701 ±j | 0.6161513     | 2.8382163  |             |
|        |         | 0.1469908                   | 0.6746144 | 2.9876021  | -0.0734954 ±j | 0.8180543     | 5.5877570  |             |
|        |         | 0.0810560                   | 0.8882673 | 5.3032020  | -0.0405280 ±j | 0.9416075     | 11.6275127 |             |
|        |         | 0.0255730                   | 0.9978968 | 18.0839213 | -0.0127865 ±j | 0.9988660     | 39.0626692 |             |
|        |         |                             |           |            | -0.1548740    |               |            |             |
| 1.45   | 135.555 | 0.2807012                   | 0.1284434 | 2.1335836  | -0.1403506 ±j | 0.3297652     | 1.2767671  |             |
|        |         | 0.2206767                   | 0.3836521 | 2.4173448  | -0.1103384 ±j | 0.6094896     | 2.8068052  |             |
|        |         | 0.1493088                   | 0.6666720 | 3.2435289  | -0.0746544 ±j | 0.8130798     | 5.4685302  |             |
|        |         | 0.0834415                   | 0.8844886 | 5.8087659  | -0.0417208 ±j | 0.9395467     | 11.2710398 |             |
|        |         | 0.0265319                   | 0.9977994 | 19.9555287 | -0.0132659 ±j | 0.9988110     | 37.6489866 |             |
|        |         |                             |           |            | -0.1524259    |               |            |             |
| 1.50   | 140.015 | 0.2779778                   | 0.1253205 | 2.2843118  | -0.1389889 ±j | 0.3255804     | 1.2735059  |             |
|        |         | 0.2207455                   | 0.3767852 | 2.5973085  | -0.1103727 ±j | 0.6038237     | 2.7807060  |             |
|        |         | 0.1512638                   | 0.6598840 | 3.5072526  | -0.0756319 ±j | 0.8088039     | 5.3703012  |             |
|        |         | 0.0854962                   | 0.8812204 | 6.3287388  | -0.0427481 ±j | 0.9377595     | 10.9798216 |             |
|        |         | 0.0273657                   | 0.9977142 | 21.8787000 | -0.0136829 ±j | 0.9987627     | 36.5002705 |             |
|        |         |                             |           |            | -0.1503670    |               |            |             |
| 1.70   | 155.502 | 0.2702324                   | 0.1167647 | 2.9380530  | -0.1351162 ±j | 0.3138603     | 1.2644984  |             |
|        |         | 0.2207083                   | 0.3575827 | 3.3756369  | -0.1103542 ±j | 0.5877114     | 2.7093776  |             |
|        |         | 0.1567370                   | 0.6404237 | 4.6433716  | -0.0783685 ±j | 0.7964183     | 5.1057809  |             |
|        |         | 0.0914694                   | 0.8716498 | 8.5619394  | -0.0457347 ±j | 0.9325010     | 10.2069355 |             |
|        |         | 0.0298312                   | 0.9974596 | 30.1261720 | -0.0149156 ±j | 0.9986176     | 33.4793318 |             |
|        |         |                             |           |            | -0.1446232    |               |            |             |
| 2.00   | 174.084 | 0.2636762                   | 0.1098799 | 4.0714332  | -0.1318381 ±j | 0.3041359     | 1.2571533  |             |
|        |         | 0.2204144                   | 0.3417018 | 4.7212543  | -0.1102072 ±j | 0.5740698     | 2.6520616  |             |
|        |         | 0.1612654                   | 0.6237784 | 6.5999975  | -0.0806327 ±j | 0.7856696     | 4.8974950  |             |
|        |         | 0.0966775                   | 0.8632218 | 12.3963998 | -0.0483388 ±j | 0.9278390     | 9.6102727  |             |
|        |         | 0.0320318                   | 0.9972293 | 44.2665611 | -0.0160159 ±j | 0.9984852     | 31.1756996 |             |
|        |         |                             |           |            | -0.1398815    |               |            |             |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=1.0$ |           |           |             |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|-------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1          | P1            | Q1        |            |
| 12     | 1.10    | 98.192                                | 0.3429521 | 0.0680710 | 1.2179786   | -0.1714761 ±j | 0.1966391 | 0.7607596  |
|        |         |                                       | 0.2628897 | 0.3074698 | 1.2909254   | -0.1314449 ±j | 0.5386948 | 2.1092478  |
|        |         |                                       | 0.1636992 | 0.6021557 | 1.4996665   | -0.0818496 ±j | 0.7716582 | 4.7403231  |
|        |         |                                       | 0.0882416 | 0.8211138 | 2.0872157   | -0.0441208 ±j | 0.9050786 | 10.2690074 |
|        |         |                                       | 0.0412067 | 0.9457438 | 4.3499304   | -0.0206034 ±j | 0.9722753 | 23.6003735 |
|        |         |                                       | 0.0118535 | 0.9991158 | 33.0577896  | -0.0059267 ±j | 0.9995402 | 84.3261398 |
| 1.15   | 109.166 |                                       | 0.3215241 | 0.0593757 | 1.3331670   | -0.1607620 ±j | 0.1831155 | 0.7578635  |
|        |         |                                       | 0.2569594 | 0.2755989 | 1.4297858   | -0.1284797 ±j | 0.5090107 | 2.0430276  |
|        |         |                                       | 0.1708226 | 0.5610377 | 1.7009576   | -0.0854113 ±j | 0.7441389 | 4.3848082  |
|        |         |                                       | 0.0986531 | 0.7921418 | 2.4494590   | -0.0493266 ±j | 0.8886556 | 9.0217487  |
|        |         |                                       | 0.0487834 | 0.9344554 | 5.2979222   | -0.0243917 ±j | 0.9663646 | 19.8155943 |
|        |         |                                       | 0.0145052 | 0.9988689 | 41.3060302  | -0.0072526 ±j | 0.9994080 | 68.9019050 |
| 1.20   | 118.088 |                                       | 0.3074456 | 0.0540293 | 1.4532283   | -0.1537228 ±j | 0.1743520 | 0.7560430  |
|        |         |                                       | 0.2523298 | 0.2551976 | 1.5724303   | -0.1261649 ±j | 0.4891626 | 2.0020266  |
|        |         |                                       | 0.1750588 | 0.5331090 | 1.9034206   | -0.0875294 ±j | 0.7248777 | 4.1708444  |
|        |         |                                       | 0.1058342 | 0.7713245 | 2.8072245   | -0.0529171 ±j | 0.8766552 | 8.2983660  |
|        |         |                                       | 0.0543669 | 0.9260038 | 6.2244021   | -0.0271835 ±j | 0.9619069 | 17.6999361 |
|        |         |                                       | 0.0165224 | 0.9986763 | 49.3373729  | -0.0082612 ±j | 0.9993038 | 60.4838641 |
| 1.25   | 125.749 |                                       | 0.2972983 | 0.0503513 | 1.5782485   | -0.1486492 ±j | 0.1680914 | 0.7547668  |
|        |         |                                       | 0.2486358 | 0.2407894 | 1.7197065   | -0.1243179 ±j | 0.4746940 | 1.9735810  |
|        |         |                                       | 0.1778634 | 0.5125828 | 2.1098820   | -0.0889317 ±j | 0.7104041 | 4.0252742  |
|        |         |                                       | 0.1111657 | 0.7554156 | 3.1681544   | -0.0555829 ±j | 0.8673673 | 7.8184759  |
|        |         |                                       | 0.0587146 | 0.9193529 | 7.1532769   | -0.0293573 ±j | 0.9583794 | 16.3303249 |
|        |         |                                       | 0.0181287 | 0.9985208 | 57.3715316  | -0.0090644 ±j | 0.9992190 | 55.1202694 |
| 1.30   | 132.536 |                                       | 0.2895683 | 0.0476463 | 1.7082709   | -0.1447842 ±j | 0.1633519 | 0.7538129  |
|        |         |                                       | 0.2456228 | 0.2299921 | 1.8720353   | -0.1228114 ±j | 0.4635833 | 1.9524857  |
|        |         |                                       | 0.1798478 | 0.4967469 | 2.3217202   | -0.0899239 ±j | 0.6990426 | 3.9188848  |
|        |         |                                       | 0.1153088 | 0.7427788 | 3.5359122   | -0.0576544 ±j | 0.8599156 | 7.4742426  |
|        |         |                                       | 0.0622156 | 0.9139513 | 8.0959007   | -0.0311078 ±j | 0.9555018 | 15.3660590 |
|        |         |                                       | 0.0194451 | 0.9983908 | 65.5126430  | -0.0097226 ±j | 0.9991478 | 51.3853260 |
| 1.35   | 138.671 |                                       | 0.2834562 | 0.0455660 | 1.8433207   | -0.1417281 ±j | 0.1596220 | 0.7530690  |
|        |         |                                       | 0.2431193 | 0.2215696 | 2.0296574   | -0.1215596 ±j | 0.4547449 | 1.9361355  |
|        |         |                                       | 0.1813180 | 0.4841148 | 2.5397132   | -0.0906590 ±j | 0.6898520 | 3.8373656  |
|        |         |                                       | 0.1186317 | 0.7324659 | 3.9125428   | -0.0593158 ±j | 0.8537843 | 7.2142794  |
|        |         |                                       | 0.0651067 | 0.9094642 | 9.0585736   | -0.0325534 ±j | 0.9531026 | 14.6476188 |
|        |         |                                       | 0.0205470 | 0.9982814 | 73.8184125  | -0.0102735 ±j | 0.9990875 | 48.6270957 |
| 1.40   | 144.296 |                                       | 0.2784909 | 0.0439139 | 1.9834134   | -0.1392455 ±j | 0.1566032 | 0.7524709  |
|        |         |                                       | 0.2410073 | 0.2148051 | 2.1927230   | -0.1205036 ±j | 0.4475310 | 1.9230571  |
|        |         |                                       | 0.1824452 | 0.4737873 | 2.7643424   | -0.0912226 ±j | 0.6822505 | 3.7727609  |
|        |         |                                       | 0.1213597 | 0.7238779 | 4.2993023   | -0.0606799 ±j | 0.8486435 | 7.0106451  |
|        |         |                                       | 0.0675378 | 0.9056731 | 10.0451492  | -0.0337689 ±j | 0.9510693 | 14.0908955 |
|        |         |                                       | 0.0214838 | 0.9981881 | 82.3241078  | -0.0107419 ±j | 0.9990359 | 46.5046140 |
| 1.45   | 149.506 |                                       | 0.2743735 | 0.0425692 | 2.1285596   | -0.1371867 ±j | 0.1541071 | 0.7519789  |
|        |         |                                       | 0.2392029 | 0.2092498 | 2.3613317   | -0.1196015 ±j | 0.4415261 | 1.9123442  |
|        |         |                                       | 0.1833326 | 0.4651820 | 2.9959256   | -0.0916663 ±j | 0.6758545 | 3.7202470  |
|        |         |                                       | 0.1236405 | 0.7166125 | 4.6970152   | -0.0618202 ±j | 0.8442694 | 6.8467043  |
|        |         |                                       | 0.0696099 | 0.9024272 | 11.0581496  | -0.0348049 ±j | 0.9493239 | 13.6469375 |
|        |         |                                       | 0.0222899 | 0.9981067 | 91.0527944  | -0.0111450 ±j | 0.9989907 | 44.8208596 |
| 1.50   | 154.372 |                                       | 0.2709028 | 0.0414536 | 2.2787664   | -0.1354514 ±j | 0.1520083 | 0.7515669  |
|        |         |                                       | 0.2376449 | 0.2046064 | 2.5355530   | -0.1188225 ±j | 0.4364488 | 1.9034043  |
|        |         |                                       | 0.1840463 | 0.4579018 | 3.2346828   | -0.0920231 ±j | 0.6703980 | 3.6767075  |
|        |         |                                       | 0.1255752 | 0.7103868 | 5.1062498   | -0.0627876 ±j | 0.8405025 | 6.7118699  |
|        |         |                                       | 0.0713979 | 0.8996173 | 12.0993095  | -0.0356989 ±j | 0.9478095 | 13.2844543 |
|        |         |                                       | 0.0229910 | 0.9980358 | 100.0203299 | -0.0114955 ±j | 0.9989513 | 43.4525923 |
| 1.70   | 171.266 |                                       | 0.2611840 | 0.0384156 | 2.9302881   | -0.1305920 ±j | 0.1461552 | 0.7504251  |
|        |         |                                       | 0.2331022 | 0.1917992 | 3.2893923   | -0.1165511 ±j | 0.4221552 | 1.8787846  |
|        |         |                                       | 0.1858715 | 0.4373987 | 4.2640673   | -0.0929357 ±j | 0.6547989 | 3.5581639  |
|        |         |                                       | 0.1310484 | 0.6924557 | 6.8651328   | -0.0655242 ±j | 0.8295555 | 6.3498642  |
|        |         |                                       | 0.0766114 | 0.8913750 | 16.5660270  | -0.0383057 ±j | 0.9433492 | 12.3235851 |
|        |         |                                       | 0.0250642 | 0.9978246 | 138.4661013 | -0.0125321 ±j | 0.9988331 | 39.8541797 |
| 2.00   | 191.538 |                                       | 0.2531208 | 0.0359904 | 4.0598914   | -0.1265604 ±j | 0.1413255 | 0.7494897  |
|        |         |                                       | 0.2291338 | 0.1814010 | 4.5932605   | -0.1145669 ±j | 0.4102139 | 1.8587915  |
|        |         |                                       | 0.1871828 | 0.4202794 | 6.0382667   | -0.0935914 ±j | 0.6414983 | 3.4634039  |
|        |         |                                       | 0.1356437 | 0.6770210 | 9.8873550   | -0.0678219 ±j | 0.8200129 | 6.0659850  |
|        |         |                                       | 0.0811739 | 0.8841008 | 24.2272012  | -0.0405870 ±j | 0.9393900 | 11.5833528 |
|        |         |                                       | 0.0269146 | 0.9976334 | 204.3626509 | -0.0134573 ±j | 0.9987253 | 37.1105402 |

| CASE A |      | Passband Ripple: Ap(dB)=2.0 |           |           |           |                             |           |           |  |
|--------|------|-----------------------------|-----------|-----------|-----------|-----------------------------|-----------|-----------|--|
| n      | Ws   | As(dB)                      | A1        | B1        | C1        | P1                          | Q1        |           |  |
| 2      | 1.05 | 4.859                       | 0.3136639 | 1.0351449 | 1.4386640 | -0.1568320 ±j               | 1.0052605 | 3.2436648 |  |
|        | 1.10 | 6.482                       | 0.4255997 | 1.0231136 | 1.7140833 | -0.2127998 ±j               | 0.9888528 | 2.3766248 |  |
|        | 1.15 | 7.849                       | 0.4974621 | 1.0074934 | 1.9755745 | -0.2487310 ±j               | 0.9724332 | 2.0177211 |  |
|        | 1.20 | 9.058                       | 0.5483446 | 0.9920957 | 2.2359899 | -0.2741723 ±j               | 0.9575622 | 1.8164491 |  |
|        | 1.25 | 10.153                      | 0.5863258 | 0.9779034 | 2.5000000 | -0.2931629 ±j               | 0.9444358 | 1.6865878 |  |
|        | 1.30 | 11.157                      | 0.6157013 | 0.9651268 | 2.7698611 | -0.3078506 ±j               | 0.9329281 | 1.5955930 |  |
|        | 1.35 | 12.089                      | 0.6390291 | 0.9537230 | 3.0468391 | -0.3195146 ±j               | 0.9228399 | 1.5282362 |  |
|        | 1.40 | 12.958                      | 0.6579441 | 0.9435677 | 3.3317143 | -0.3289721 ±j               | 0.9139721 | 1.4763778 |  |
|        | 1.45 | 13.774                      | 0.6735442 | 0.9345178 | 3.6250000 | -0.3367721 ±j               | 0.9061470 | 1.4352505 |  |
|        | 1.50 | 14.545                      | 0.6865949 | 0.9264359 | 3.9270510 | -0.3432974 ±j               | 0.8992123 | 1.4018681 |  |
|        | 1.70 | 17.266                      | 0.7223837 | 0.9015363 | 5.2271136 | -0.3611918 ±j               | 0.8781098 | 1.3143884 |  |
|        | 2.00 | 20.587                      | 0.7508225 | 0.8782917 | 7.4641016 | -0.3754112 ±j               | 0.8586956 | 1.2481942 |  |
| 3      | 1.05 | 11.284                      | 0.1169874 | 0.9918898 | 1.2054102 | -0.0584937 ±j<br>-0.6604420 | 0.9942174 | 8.5131956 |  |
|        | 1.10 | 14.843                      | 0.1653282 | 0.9786380 | 1.3703136 | -0.0826641 ±j<br>-0.5784161 | 0.9858015 | 5.9836220 |  |
|        | 1.15 | 17.499                      | 0.1972194 | 0.9677663 | 1.5336053 | -0.0986097 ±j<br>-0.5345278 | 0.9787964 | 4.9881059 |  |
|        | 1.20 | 19.690                      | 0.2205506 | 0.9588561 | 1.6996171 | -0.1102753 ±j<br>-0.5060357 | 0.9729828 | 4.4398525 |  |
|        | 1.25 | 21.583                      | 0.2385806 | 0.9514530 | 1.8699785 | -0.1192903 ±j<br>-0.4857139 | 0.9681027 | 4.0884487 |  |
|        | 1.30 | 23.268                      | 0.2530129 | 0.9452168 | 2.0454918 | -0.1265065 ±j<br>-0.4703696 | 0.9639569 | 3.8425805 |  |
|        | 1.35 | 24.793                      | 0.2648577 | 0.9398993 | 2.2266128 | -0.1324289 ±j<br>-0.4583270 | 0.9603967 | 3.6603957 |  |
|        | 1.40 | 26.194                      | 0.2747642 | 0.9353176 | 2.4136247 | -0.1373821 ±j<br>-0.4486061 | 0.9573107 | 3.5198117 |  |
|        | 1.45 | 27.494                      | 0.2831740 | 0.9313339 | 2.6067151 | -0.1415870 ±j<br>-0.4405886 | 0.9546136 | 3.4079986 |  |
|        | 1.50 | 28.708                      | 0.2904004 | 0.9278429 | 2.8060141 | -0.1452002 ±j<br>-0.4338623 | 0.9522394 | 3.3169582 |  |
|        | 1.70 | 32.926                      | 0.3113123 | 0.9173954 | 3.6668482 | -0.1556562 ±j<br>-0.4151863 | 0.9450749 | 3.0766773 |  |
|        | 2.00 | 37.992                      | 0.3294230 | 0.9079441 | 5.1532091 | -0.1647115 ±j<br>-0.3998774 | 0.9385171 | 2.8925154 |  |

| CASE A |      | Passband Ripple: $A_p(dB)=2.0$ |                        |                        |                         |                                                                  |                         |  |
|--------|------|--------------------------------|------------------------|------------------------|-------------------------|------------------------------------------------------------------|-------------------------|--|
| n      | Ws   | As(dB)                         | A1                     | B1                     | C1                      | P1                                                               | Q1                      |  |
| 4      | 1.05 | 19.316                         | 0.6124313<br>0.0614681 | 0.5265116<br>0.9886165 | 1.1536336<br>3.3125181  | -0.3062156 ±j 0.6578325<br>-0.0307340 ±j 0.9938168               | 1.1848043<br>16.1757478 |  |
|        | 1.10 | 24.351                         | 0.6024918<br>0.0879121 | 0.4371857<br>0.9799054 | 1.2909254<br>4.3499304  | -0.3012459 ±j 0.5885887<br>-0.0439560 ±j 0.9889253               | 1.0974426<br>11.2601332 |  |
|        | 1.15 | 27.997                         | 0.5908654<br>0.1057704 | 0.3901620<br>0.9733899 | 1.4297858<br>5.2979222  | -0.2954327 ±j 0.5503468<br>-0.0528852 ±j 0.9851868               | 1.0571435<br>9.3277992  |  |
|        | 1.20 | 30.967                         | 0.5809676<br>0.1190836 | 0.3600399<br>0.9682625 | 1.5724303<br>6.2244021  | -0.2904838 ±j 0.5250325<br>-0.0595418 ±j 0.9822002               | 1.0328171<br>8.2631328  |  |
|        | 1.25 | 33.518                         | 0.5727672<br>0.1295293 | 0.3387860<br>0.9640962 | 1.7197065<br>7.1532769  | -0.2863836 ±j 0.5067252<br>-0.0647646 ±j 0.9797457               | 1.0162127<br>7.5804023  |  |
|        | 1.30 | 35.780                         | 0.5659389<br>0.1378955 | 0.3228796<br>0.9606340 | 1.8720353<br>8.0959007  | -0.2829694 ±j 0.4927554<br>-0.0689977 ±j 0.9776878               | 1.0040394<br>7.1025469  |  |
|        | 1.35 | 37.824                         | 0.5601922<br>0.1450163 | 0.3104882<br>0.9577083 | 2.0296574<br>9.0585736  | -0.2800961 ±j 0.4816995<br>-0.0725081 ±j 0.9759359               | 0.9946848<br>6.7483852  |  |
|        | 1.40 | 39.699                         | 0.5553023<br>0.1509399 | 0.3005487<br>0.9552029 | 2.1927230<br>10.0451492 | -0.2776511 ±j 0.4727140<br>-0.0754699 ±j 0.9744266               | 0.9872519<br>6.4750607  |  |
|        | 1.45 | 41.435                         | 0.5510988<br>0.1560063 | 0.2923952<br>0.9530341 | 2.3613317<br>11.0581496 | -0.2755494 ±j 0.4652609<br>-0.0780032 ±j 0.9731133               | 0.9811957<br>6.2576608  |  |
|        | 1.50 | 43.057                         | 0.5474526<br>0.1603881 | 0.2855870<br>0.9511395 | 2.5355530<br>12.0993095 | -0.2737263 ±j 0.4589782<br>-0.0801941 ±j 0.9719611               | 0.9761639<br>6.0806485  |  |
|        | 1.70 | 48.688                         | 0.5367487<br>0.1732188 | 0.2668462<br>0.9454952 | 3.2893923<br>16.5660270 | -0.2683744 ±j 0.4413858<br>-0.0866094 ±j 0.9685009               | 0.9624086<br>5.6135103  |  |
|        | 2.00 | 55.445                         | 0.5273285<br>0.1845168 | 0.2516746<br>0.9404104 | 4.5932605<br>24.2272012 | -0.2636643 ±j 0.4267971<br>-0.0922584 ±j 0.9653491               | 0.9513458<br>5.2556046  |  |
| 5      | 1.05 | 27.664                         | 0.2827771<br>0.0378649 | 0.7064894<br>0.9905133 | 1.1334220<br>1.7737385  | -0.1413886 ±j 0.8285521<br>-0.0189325 ±j 0.9950652<br>-0.3756808 | 2.9724089<br>26.2840846 |  |
|        | 1.10 | 34.007                         | 0.3109588<br>0.0546265 | 0.6296168<br>0.9846628 | 1.2593204<br>2.1930925  | -0.1554794 ±j 0.7781021<br>-0.0273132 ±j 0.9919258<br>-0.3305280 | 2.5517334<br>18.1652102 |  |
|        | 1.15 | 38.578                         | 0.3239790<br>0.0660876 | 0.5848194<br>0.9804150 | 1.3881033<br>2.5834170  | -0.1619895 ±j 0.7473813<br>-0.0330438 ±j 0.9896076<br>-0.3069727 | 2.3604454<br>14.9825314 |  |
|        | 1.20 | 42.295                         | 0.3314875<br>0.0747025 | 0.5543557<br>0.9771162 | 1.5211268<br>2.9683674  | -0.1657438 ±j 0.7258682<br>-0.0373513 ±j 0.9877860<br>-0.2917893 | 2.2460896<br>13.2323801 |  |
|        | 1.25 | 45.487                         | 0.3363243<br>0.0815032 | 0.5319660<br>0.9744556 | 1.6589139<br>3.3563960  | -0.1681621 ±j 0.7097095<br>-0.0407516 ±j 0.9863036<br>-0.2809803 | 2.1686214<br>12.1117416 |  |
|        | 1.30 | 48.315                         | 0.3396616<br>0.0870412 | 0.5146989<br>0.9722551 | 1.8017262<br>3.7515494  | -0.1698308 ±j 0.6970340<br>-0.0435206 ±j 0.9850690<br>-0.2728183 | 2.1121762<br>11.3283074 |  |
|        | 1.35 | 50.872                         | 0.3420769<br>0.0916514 | 0.5009321<br>0.9704014 | 1.9497131<br>4.1560845  | -0.1710385 ±j 0.6867882<br>-0.0458257 ±j 0.9840231<br>-0.2664071 | 2.0690247<br>10.7482184 |  |
|        | 1.40 | 53.215                         | 0.3438881<br>0.0955535 | 0.4896832<br>0.9688177 | 2.1029685<br>4.5713865  | -0.1719440 ±j 0.6783203<br>-0.0477767 ±j 0.9831252<br>-0.2612258 | 2.0348878<br>10.3008856 |  |
|        | 1.45 | 55.386                         | 0.3452843<br>0.0988998 | 0.4803150<br>0.9674492 | 2.2615546<br>4.9983644  | -0.1726422 ±j 0.6712002<br>-0.0494499 ±j 0.9823461<br>-0.2569469 | 2.0071795<br>9.9453150  |  |
|        | 1.50 | 57.414                         | 0.3463850<br>0.1018006 | 0.4723933<br>0.9662552 | 2.4255147<br>5.4376446  | -0.1731925 ±j 0.6651298<br>-0.0509003 ±j 0.9816641<br>-0.2533525 | 1.9842336<br>9.6559624  |  |
|        | 1.70 | 64.453                         | 0.3490844<br>0.1103299 | 0.4501067<br>0.9627054 | 3.1356145<br>7.3252003  | -0.1745422 ±j 0.6477876<br>-0.0561650 ±j 0.9796235<br>-0.2433453 | 1.9218846<br>8.8931030  |  |
|        | 2.00 | 72.889                         | 0.3508793<br>0.1178841 | 0.4315283<br>0.9595146 | 4.3649509<br>10.5677323 | -0.1754397 ±j 0.6330475<br>-0.0589420 ±j 0.9777732<br>-0.2351056 | 1.8721766<br>8.3094175  |  |

| CASE A |        | Passband Ripple: Ap(dB)=2.0 |           |           |            |               |           |            |
|--------|--------|-----------------------------|-----------|-----------|------------|---------------|-----------|------------|
| n      | Ws     | As(dB)                      | A1        | B1        | C1         | P1            | Q1        |            |
| 6      | 1.05   | 36.061                      | 0.5111416 | 0.2605921 | 1.1233258  | -0.2555708 ±j | 0.4419001 | 0.9987100  |
|        |        |                             | 0.1547305 | 0.8082030 | 1.4386640  | -0.0773653 ±j | 0.8956660 | 5.8101088  |
|        |        |                             | 0.0257033 | 0.9925803 | 6.5287683  | -0.0128517 ±j | 0.9962004 | 38.7608694 |
| 1.10   | 43.680 | 43.680                      | 0.4731884 | 0.2097168 | 1.2433620  | -0.2365942 ±j | 0.3920970 | 0.9677933  |
|        |        |                             | 0.1829988 | 0.7478541 | 1.7140833  | -0.0914994 ±j | 0.8599314 | 4.7256360  |
|        |        |                             | 0.0373012 | 0.9884223 | 8.8264550  | -0.0186506 ±j | 0.9940193 | 26.6531291 |
| 1.15   | 49.167 | 49.167                      | 0.4507393 | 0.1844414 | 1.3669587  | -0.2253697 ±j | 0.3655816 | 0.9528043  |
|        |        |                             | 0.1985542 | 0.7106435 | 1.9755745  | -0.0992771 ±j | 0.8371306 | 4.2456761  |
|        |        |                             | 0.0452828 | 0.9854430 | 10.9158033 | -0.0226414 ±j | 0.9924366 | 21.9221163 |
| 1.20   | 53.628 | 53.628                      | 0.4353211 | 0.1686972 | 1.4950350  | -0.2176606 ±j | 0.3483118 | 0.9435050  |
|        |        |                             | 0.2087443 | 0.6844517 | 2.2359899  | -0.1043722 ±j | 0.8207059 | 3.9632984  |
|        |        |                             | 0.0513069 | 0.9831437 | 12.9526713 | -0.0256534 ±j | 0.9912041 | 19.3255941 |
| 1.25   | 57.459 | 57.459                      | 0.4238986 | 0.1577765 | 1.6279471  | -0.2119493 ±j | 0.3359374 | 0.9370421  |
|        |        |                             | 0.2160265 | 0.6647315 | 2.5000000  | -0.1080133 ±j | 0.8081241 | 3.7741233  |
|        |        |                             | 0.0560764 | 0.9812961 | 14.9917591 | -0.0280382 ±j | 0.9902070 | 17.6652456 |
| 1.30   | 60.852 | 60.852                      | 0.4150302 | 0.1496983 | 1.7658735  | -0.2075151 ±j | 0.3265514 | 0.9322422  |
|        |        |                             | 0.2215182 | 0.6492449 | 2.7698611  | -0.1107591 ±j | 0.7981086 | 3.6374321  |
|        |        |                             | 0.0599694 | 0.9797718 | 17.0590037 | -0.0299847 ±j | 0.9893800 | 16.5056541 |
| 1.35   | 63.920 | 63.920                      | 0.4079189 | 0.1434589 | 1.9089166  | -0.2039595 ±j | 0.3191543 | 0.9285172  |
|        |        |                             | 0.2258162 | 0.6367211 | 3.0468391  | -0.1129081 ±j | 0.7899195 | 3.5336176  |
|        |        |                             | 0.0632161 | 0.9784900 | 19.1687817 | -0.0316080 ±j | 0.9886814 | 15.6476998 |
| 1.40   | 66.732 | 66.732                      | 0.4020792 | 0.1384868 | 2.0571405  | -0.2010396 ±j | 0.3131611 | 0.9255344  |
|        |        |                             | 0.2292735 | 0.6263696 | 3.3317143  | -0.1146367 ±j | 0.7830888 | 3.4519267  |
|        |        |                             | 0.0659683 | 0.9773963 | 21.3298812 | -0.0329841 ±j | 0.9880832 | 14.9864970 |
| 1.45   | 69.337 | 69.337                      | 0.3971947 | 0.1344293 | 2.2105880  | -0.1985974 ±j | 0.3082018 | 0.9230886  |
|        |        |                             | 0.2321141 | 0.6176667 | 3.6250000  | -0.1160570 ±j | 0.7773014 | 3.3859116  |
|        |        |                             | 0.0683316 | 0.9764521 | 23.5480505 | -0.0341658 ±j | 0.9875651 | 14.4611902 |
| 1.50   | 71.770 | 71.770                      | 0.3930486 | 0.1310555 | 2.3692888  | -0.1965243 ±j | 0.3040290 | 0.9210459  |
|        |        |                             | 0.2344880 | 0.6102486 | 3.9270510  | -0.1172440 ±j | 0.7723357 | 3.3314461  |
|        |        |                             | 0.0703824 | 0.9756291 | 25.8272420 | -0.0351912 ±j | 0.9871123 | 14.0338889 |
| 1.70   | 80.218 | 80.218                      | 0.3813002 | 0.1218335 | 3.0569811  | -0.1906501 ±j | 0.2923800 | 0.9154115  |
|        |        |                             | 0.2410233 | 0.5890842 | 5.2271136  | -0.1205117 ±j | 0.7579981 | 3.1844145  |
|        |        |                             | 0.0764248 | 0.9731853 | 35.6008780 | -0.0382124 ±j | 0.9857612 | 12.9081347 |
| 2.00   | 90.353 | 90.353                      | 0.3714031 | 0.1144356 | 4.2481552  | -0.1857016 ±j | 0.2827552 | 0.9108251  |
|        |        |                             | 0.2463012 | 0.5711018 | 7.4641016  | -0.1231506 ±j | 0.7456110 | 3.0682469  |
|        |        |                             | 0.0817913 | 0.9709923 | 52.3568408 | -0.0408956 ±j | 0.9845404 | 12.0476110 |

| CASE A |         | Passband Ripple: Ap(dB)=2.0 |           |           |               |               |           |            |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 7      | 1.05    | 44.465                      | 0.3139858 | 0.4634754 | 1.1175213     | -0.1569929 ±j | 0.6624414 | 2.1682197  |
|        |         |                             | 0.0961583 | 0.8660320 | 1.3083409     | -0.0480792 ±j | 0.9293656 | 9.6778762  |
|        |         |                             | 0.0186156 | 0.9941851 | 2.7143721     | -0.0093078 ±j | 0.9970449 | 53.5619149 |
|        |         |                             |           |           |               | -0.2628752    |           |            |
| 1.10   | 53.355  | 0.3135763                   | 0.3922515 | 1.2341277 | -0.1567882 ±j | 0.6063572     | 1.9972804 |            |
|        |         |                             | 0.1194738 | 0.8189812 | 1.5239435     | -0.0597369 ±j | 0.9030020 | 7.5746807  |
|        |         |                             | 0.0271219 | 0.9910876 | 3.5147693     | -0.0135610 ±j | 0.9954414 | 36.7058432 |
|        |         |                             |           |           |               | -0.2324188    |           |            |
| 1.15   | 59.757  | 0.3106594                   | 0.3542146 | 1.3546897 | -0.1553297 ±j | 0.5745322     | 1.9157939 |            |
|        |         |                             | 0.1332485 | 0.7889845 | 1.7321918     | -0.0666242 ±j | 0.8857459 | 6.6661039  |
|        |         |                             | 0.0329978 | 0.9888844 | 4.2484927     | -0.0164989 ±j | 0.9942898 | 30.1361158 |
|        |         |                             |           |           |               | -0.2164078    |           |            |
| 1.20   | 64.961  | 0.3076916                   | 0.3295665 | 1.4798722 | -0.1538458 ±j | 0.5530805     | 1.8657605 |            |
|        |         |                             | 0.1427002 | 0.7674261 | 1.9413408     | -0.0713501 ±j | 0.8731181 | 6.1389437  |
|        |         |                             | 0.0374431 | 0.9871903 | 4.9666973     | -0.0187215 ±j | 0.9933981 | 26.5355904 |
|        |         |                             |           |           |               | -0.2060398    |           |            |
| 1.25   | 69.430  | 0.3050316                   | 0.3120200 | 1.6099341 | -0.1525158 ±j | 0.5373630     | 1.8312450 |            |
|        |         |                             | 0.1496903 | 0.7509521 | 2.1544332     | -0.0748451 ±j | 0.8633367 | 5.7891199  |
|        |         |                             | 0.0409686 | 0.9858321 | 5.6874343     | -0.0204843 ±j | 0.9926794 | 24.2354222 |
|        |         |                             |           |           |               | -0.1986358    |           |            |
| 1.30   | 73.390  | 0.3027112                   | 0.2987962 | 1.7450051 | -0.1513556 ±j | 0.5252501     | 1.8057556 |            |
|        |         |                             | 0.1551054 | 0.7378684 | 2.3729509     | -0.0775527 ±j | 0.8554847 | 5.5381219  |
|        |         |                             | 0.0438499 | 0.9847132 | 6.4192876     | -0.0219250 ±j | 0.9920849 | 22.6300872 |
|        |         |                             |           |           |               | -0.1930323    |           |            |
| 1.35   | 76.968  | 0.3006963                   | 0.2884365 | 1.8851599 | -0.1503481 ±j | 0.5155889     | 1.7860643 |            |
|        |         |                             | 0.1594374 | 0.7271932 | 2.5977295     | -0.0797187 ±j | 0.8490219 | 5.3485330  |
|        |         |                             | 0.0462554 | 0.9837734 | 7.1670237     | -0.0231277 ±j | 0.9915838 | 21.4429645 |
|        |         |                             |           |           |               | -0.1886232    |           |            |
| 1.40   | 80.249  | 0.2989421                   | 0.2800881 | 2.0304452 | -0.1494710 ±j | 0.5076874     | 1.7703547 |            |
|        |         |                             | 0.1629863 | 0.7183054 | 2.8292857     | -0.0814932 ±j | 0.8436020 | 5.2000006  |
|        |         |                             | 0.0482963 | 0.9829722 | 7.9335602     | -0.0241482 ±j | 0.9911554 | 20.5284621 |
|        |         |                             |           |           |               | -0.1850551    |           |            |
| 1.45   | 83.289  | 0.2974077                   | 0.2732134 | 2.1808921 | -0.1487038 ±j | 0.5010994     | 1.7575144 |            |
|        |         |                             | 0.1659479 | 0.7107879 | 3.0679607     | -0.0829740 ±j | 0.8389894 | 5.0804036  |
|        |         |                             | 0.0500501 | 0.9822809 | 8.7208069     | -0.0250251 ±j | 0.9907849 | 19.8021620 |
|        |         |                             |           |           |               | -0.1821052    |           |            |
| 1.50   | 86.127  | 0.2960581                   | 0.2674542 | 2.3365223 | -0.1480290 ±j | 0.4955216     | 1.7468186 |            |
|        |         |                             | 0.1684563 | 0.7043474 | 3.3139902     | -0.0842281 ±j | 0.8350168 | 4.9820289  |
|        |         |                             | 0.0515730 | 0.9816787 | 9.5300781     | -0.0257865 ±j | 0.9904614 | 19.2115322 |
|        |         |                             |           |           |               | -0.1796250    |           |            |
| 1.70   | 95.982  | 0.2920054                   | 0.2515091 | 3.0111362 | -0.1460027 ±j | 0.4797836     | 1.7174572 |            |
|        |         |                             | 0.1755317 | 0.6858052 | 4.3744590     | -0.0877659 ±j | 0.8234697 | 4.7178566  |
|        |         |                             | 0.0560649 | 0.9798922 | 13.0029293    | -0.0280325 ±j | 0.9894980 | 17.6562197 |
|        |         |                             |           |           |               | -0.1727091    |           |            |
| 2.00   | 107.807 | 0.2883375                   | 0.2384975 | 4.1800429 | -0.1441687 ±j | 0.4665972     | 1.6937172 |            |
|        |         |                             | 0.1814481 | 0.6698541 | 6.2017764     | -0.0907240 ±j | 0.8134023 | 4.5106357  |
|        |         |                             | 0.0600607 | 0.9782907 | 18.9610948    | -0.0300303 ±j | 0.9886298 | 16.4681041 |
|        |         |                             |           |           |               | -0.1670032    |           |            |



| CASE A |         | Passband Ripple: $A_p(\text{dB})=2.0$ |           |           |               |               |           |            |  |
|--------|---------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|--|
| n      | Ws      | As(dB)                                | A1        | B1        | C1            | P1            | Q1        |            |  |
| 8      | 1.05    | 52.870                                | 0.4121944 | 0.1514614 | 1.1138641     | -0.2060972 ±j | 0.3301293 | 0.9441673  |  |
|        |         |                                       | 0.1994316 | 0.6139011 | 1.2431181     | -0.0997158 ±j | 0.7771473 | 3.9287578  |  |
|        |         |                                       | 0.0653261 | 0.9012849 | 1.9061395     | -0.0326631 ±j | 0.9487982 | 14.5326295 |  |
|        |         |                                       | 0.0141178 | 0.9953693 | 11.0466061    | -0.0070589 ±j | 0.9976570 | 70.6683198 |  |
| 1.10   | 63.030  | 0.3745212                             | 0.1208156 | 1.2282855 | -0.1872606 ±j | 0.2928294     | 0.9280792 |            |  |
|        |         |                                       | 0.2126934 | 0.5400481 | 1.4271032     | -0.1063467 ±j | 0.7271441 | 3.4551130  |  |
|        |         |                                       | 0.0840401 | 0.8640648 | 2.3804113     | -0.0420201 ±j | 0.9286006 | 11.0607969 |  |
|        |         |                                       | 0.0206241 | 0.9929761 | 15.1062239    | -0.0103121 ±j | 0.9964285 | 48.3163147 |  |
| 1.15   | 70.346  | 0.3534993                             | 0.1058020 | 1.3469136 | -0.1767497 ±j | 0.2730595     | 0.9201492 |            |  |
|        |         |                                       | 0.2182513 | 0.4982922 | 1.6072975     | -0.1091256 ±j | 0.6974122 | 3.2343373  |  |
|        |         |                                       | 0.0955612 | 0.8398223 | 2.8200771     | -0.0477806 ±j | 0.9151717 | 9.5898578  |  |
|        |         |                                       | 0.0251292 | 0.9912817 | 18.7925269    | -0.0125646 ±j | 0.9955520 | 39.6204742 |  |
| 1.20   | 76.294  | 0.3394611                             | 0.0965157 | 1.4702527 | -0.1697305 ±j | 0.2602061     | 0.9151850 |            |  |
|        |         |                                       | 0.2211912 | 0.4703399 | 1.7895085     | -0.1105956 ±j | 0.6768371 | 3.1005446  |  |
|        |         |                                       | 0.1036764 | 0.8221625 | 3.2528314     | -0.0518382 ±j | 0.9052487 | 8.7457894  |  |
|        |         |                                       | 0.0285425 | 0.9899818 | 22.3835994    | -0.0142712 ±j | 0.9948759 | 34.8595381 |  |
| 1.25   | 81.402  | 0.3292384                             | 0.0901028 | 1.5984994 | -0.1646192 ±j | 0.2510047     | 0.9117142 |            |  |
|        |         |                                       | 0.2229319 | 0.4500004 | 1.9759013     | -0.1114659 ±j | 0.6614951 | 3.0090837  |  |
|        |         |                                       | 0.1097930 | 0.8085365 | 3.6885364     | -0.0548965 ±j | 0.8975092 | 8.1898381  |  |
|        |         |                                       | 0.0312525 | 0.9889412 | 25.9769795    | -0.0156262 ±j | 0.9943325 | 31.8200704 |  |
| 1.30   | 85.927  | 0.3213947                             | 0.0853739 | 1.7317524 | -0.1606973 ±j | 0.2440291     | 0.9091253 |            |  |
|        |         |                                       | 0.2240341 | 0.4344242 | 2.1675370     | -0.1120171 ±j | 0.6495201 | 2.9420010  |  |
|        |         |                                       | 0.1146014 | 0.7976343 | 4.1319051     | -0.0573007 ±j | 0.8912637 | 7.7931323  |  |
|        |         |                                       | 0.0334691 | 0.9880848 | 29.6189023    | -0.0167345 ±j | 0.9938837 | 29.6997862 |  |
| 1.35   | 90.017  | 0.3151594                             | 0.0817297 | 1.8700686 | -0.1575797 ±j | 0.2385337     | 0.9071094 |            |  |
|        |         |                                       | 0.2247637 | 0.4220704 | 2.3650162     | -0.1123818 ±j | 0.6398755 | 2.8904557  |  |
|        |         |                                       | 0.1184935 | 0.7886864 | 4.5855625     | -0.0592468 ±j | 0.8861017 | 7.4947558  |  |
|        |         |                                       | 0.0353209 | 0.9873661 | 33.3349904    | -0.0176604 ±j | 0.9935060 | 28.1324366 |  |
| 1.40   | 93.766  | 0.3100730                             | 0.0788308 | 2.0134836 | -0.1550365 ±j | 0.2340822     | 0.9054909 |            |  |
|        |         |                                       | 0.2252615 | 0.4120169 | 2.5687116     | -0.1126307 ±j | 0.6319266 | 2.8495129  |  |
|        |         |                                       | 0.1217132 | 0.7812008 | 5.0511190     | -0.0608566 ±j | 0.8817580 | 7.2617877  |  |
|        |         |                                       | 0.0368929 | 0.9867537 | 37.1409040    | -0.0184464 ±j | 0.9931835 | 26.9253738 |  |
| 1.45   | 97.240  | 0.3058410                             | 0.0764685 | 2.1620209 | -0.1529205 ±j | 0.2303994     | 0.9041608 |            |  |
|        |         |                                       | 0.2256084 | 0.4036716 | 2.7788694     | -0.1128042 ±j | 0.6252574 | 2.8161699  |  |
|        |         |                                       | 0.1244221 | 0.7748437 | 5.5296305     | -0.0622110 ±j | 0.8780509 | 7.0747261  |  |
|        |         |                                       | 0.0382443 | 0.9862255 | 41.0468858    | -0.0191222 ±j | 0.9929048 | 25.9669458 |  |
| 1.50   | 100.484 | 0.3022642                             | 0.0745066 | 2.3156973 | -0.1511321 ±j | 0.2273010     | 0.9030480 |            |  |
|        |         |                                       | 0.2258536 | 0.3966336 | 2.9956604     | -0.1129268 ±j | 0.6195814 | 2.7884811  |  |
|        |         |                                       | 0.1267324 | 0.7693787 | 6.0218242     | -0.0633662 ±j | 0.8748505 | 6.9212159  |  |
|        |         |                                       | 0.0394183 | 0.9857656 | 45.0599777    | -0.0197092 ±j | 0.9926617 | 25.1876947 |  |
| 1.70   | 111.747 | 0.2922017                             | 0.0691545 | 2.9819909 | -0.1461009 ±j | 0.2186527     | 0.8999686 |            |  |
|        |         |                                       | 0.2263053 | 0.3769221 | 3.9311886     | -0.1131526 ±j | 0.6034224 | 2.7128833  |  |
|        |         |                                       | 0.1333313 | 0.7535490 | 8.1360237     | -0.0666656 ±j | 0.8655084 | 6.5106408  |  |
|        |         |                                       | 0.0428836 | 0.9844020 | 62.2665524    | -0.0214418 ±j | 0.9919387 | 23.1363754 |  |
| 2.00   | 125.261 | 0.2838033                             | 0.0648719 | 4.1367342 | -0.1419016 ±j | 0.2115084     | 0.8974512 |            |  |
|        |         |                                       | 0.2264098 | 0.3605862 | 5.5450630     | -0.1132049 ±j | 0.5897210 | 2.6522192  |  |
|        |         |                                       | 0.1389465 | 0.7398168 | 11.7666735    | -0.0694733 ±j | 0.8573158 | 6.1903384  |  |
|        |         |                                       | 0.0459691 | 0.9831807 | 91.7615329    | -0.0229845 ±j | 0.9912882 | 21.5700441 |  |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=2.0$ |           |           |            |               |           |            |
|--------|---------|---------------------------------------|-----------|-----------|------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                                | A1        | B1        | C1         | P1            | Q1        |            |
| 9      | 1.05    | 61.275                                | 0.2956393 | 0.3139293 | 1.1114059  | -0.1478197 ±j | 0.5404430 | 1.8951943  |
|        |         |                                       | 0.1340293 | 0.7142252 | 1.2054102  | -0.0670146 ±j | 0.8424573 | 6.3054772  |
|        |         |                                       | 0.0472919 | 0.9242138 | 1.5942707  | -0.0236460 ±j | 0.9610695 | 20.3282236 |
|        |         |                                       | 0.0110814 | 0.9962453 | 3.9936736  | -0.0055407 ±j | 0.9981055 | 90.0719745 |
|        |         |                                       |           |           |            | -0.2027271    |           |            |
| 1.10   | 72.706  |                                       | 0.2825167 | 0.2590195 | 1.2243475  | -0.1412583 ±j | 0.4889433 | 1.8014497  |
|        |         |                                       | 0.1506373 | 0.6459529 | 1.3703136  | -0.0753186 ±j | 0.8001750 | 5.3354129  |
|        |         |                                       | 0.0624051 | 0.8942185 | 1.9377187  | -0.0312025 ±j | 0.9451164 | 15.1531098 |
|        |         |                                       | 0.0162190 | 0.9943423 | 5.2992478  | -0.0081095 ±j | 0.9971341 | 61.4813435 |
|        |         |                                       |           |           |            | -0.1796165    |           |            |
| 1.15   | 80.936  |                                       | 0.2736176 | 0.2308102 | 1.3416657  | -0.1368088 ±j | 0.4605361 | 1.7558336  |
|        |         |                                       | 0.1590537 | 0.6056953 | 1.5336053  | -0.0795268 ±j | 0.7741904 | 4.8930916  |
|        |         |                                       | 0.0719640 | 0.8743952 | 2.2599957  | -0.0359820 ±j | 0.9343985 | 12.9938636 |
|        |         |                                       | 0.0197822 | 0.9929991 | 6.4899114  | -0.0098911 ±j | 0.9964443 | 50.3732998 |
|        |         |                                       |           |           |            | -0.1674192    |           |            |
| 1.20   | 87.628  |                                       | 0.2671048 | 0.2129102 | 1.4637563  | -0.1335524 ±j | 0.4416717 | 1.7274939  |
|        |         |                                       | 0.1642696 | 0.5780725 | 1.6996171  | -0.0821348 ±j | 0.7558614 | 4.6284334  |
|        |         |                                       | 0.0788125 | 0.8598206 | 2.5791043  | -0.0394062 ±j | 0.9264274 | 11.7654601 |
|        |         |                                       | 0.0224845 | 0.9919704 | 7.6523927  | -0.0112423 ±j | 0.9959137 | 44.2960949 |
|        |         |                                       |           |           |            | -0.1595042    |           |            |
| 1.25   | 93.374  |                                       | 0.2620907 | 0.2003411 | 1.5907740  | -0.1310453 ±j | 0.4279816 | 1.7077861  |
|        |         |                                       | 0.1678424 | 0.5576300 | 1.8699785  | -0.0839212 ±j | 0.7420156 | 4.4490921  |
|        |         |                                       | 0.0840377 | 0.8484998 | 2.9015215  | -0.0420188 ±j | 0.9201816 | 10.9610441 |
|        |         |                                       | 0.0246316 | 0.9911477 | 8.8171818  | -0.0123158 ±j | 0.9954878 | 40.4181499 |
|        |         |                                       |           |           |            | -0.1538443    |           |            |
| 1.30   | 98.464  |                                       | 0.2580943 | 0.1909611 | 1.7227963  | -0.1290471 ±j | 0.4175021 | 1.6931449  |
|        |         |                                       | 0.1704459 | 0.5417774 | 2.0454918  | -0.0852229 ±j | 0.7311050 | 4.3184106  |
|        |         |                                       | 0.0881840 | 0.8393957 | 3.2303598  | -0.0440920 ±j | 0.9151238 | 10.3894749 |
|        |         |                                       | 0.0263888 | 0.9904712 | 9.9987492  | -0.0131944 ±j | 0.9951367 | 37.7138788 |
|        |         |                                       |           |           |            | -0.1495566    |           |            |
| 1.35   | 103.065 |                                       | 0.2548276 | 0.1836673 | 1.8598680  | -0.1274138 ±j | 0.4091858 | 1.6817812  |
|        |         |                                       | 0.1724258 | 0.5290816 | 2.2266128  | -0.0862129 ±j | 0.7222527 | 4.2185100  |
|        |         |                                       | 0.0915654 | 0.8318929 | 3.5673591  | -0.0457827 ±j | 0.9109319 | 9.9609817  |
|        |         |                                       | 0.0278575 | 0.9899036 | 11.2051201 | -0.0139287 ±j | 0.9948415 | 35.7153602 |
|        |         |                                       |           |           |            | -0.1461804    |           |            |
| 1.40   | 107.284 |                                       | 0.2521053 | 0.1778239 | 2.0020170  | -0.1260526 ±j | 0.4024110 | 1.6726811  |
|        |         |                                       | 0.1739797 | 0.5186689 | 2.4136247  | -0.0869899 ±j | 0.7149138 | 4.1394861  |
|        |         |                                       | 0.0943799 | 0.8255952 | 3.9135894  | -0.0471899 ±j | 0.9073964 | 9.6272920  |
|        |         |                                       | 0.0291046 | 0.9894202 | 12.4412023 | -0.0145523 ±j | 0.9945896 | 34.1765579 |
|        |         |                                       |           |           |            | -0.1434467    |           |            |
| 1.45   | 111.191 |                                       | 0.2498015 | 0.1730347 | 2.1492622  | -0.1249007 ±j | 0.3967802 | 1.6652199  |
|        |         |                                       | 0.1752295 | 0.5099698 | 2.6067151  | -0.0876148 ±j | 0.7087266 | 4.0753507  |
|        |         |                                       | 0.0967600 | 0.8202318 | 4.2697534  | -0.0483800 ±j | 0.9043734 | 9.3599270  |
|        |         |                                       | 0.0301772 | 0.9890035 | 13.7102067 | -0.0150886 ±j | 0.9943721 | 32.9549268 |
|        |         |                                       |           |           |            | -0.1411856    |           |            |
| 1.50   | 114.841 |                                       | 0.2478273 | 0.1690383 | 2.3016164  | -0.1239137 ±j | 0.3920251 | 1.6589886  |
|        |         |                                       | 0.1762545 | 0.5025940 | 2.8060141  | -0.0881272 ±j | 0.7034398 | 4.0222449  |
|        |         |                                       | 0.0987989 | 0.8156102 | 4.6363361  | -0.0493994 ±j | 0.9017594 | 9.1409072  |
|        |         |                                       | 0.0311091 | 0.9886407 | 15.0143415 | -0.0155546 ±j | 0.9941825 | 31.9618213 |
|        |         |                                       |           |           |            | -0.1392838    |           |            |
| 1.70   | 127.511 |                                       | 0.2421433 | 0.1580474 | 2.9622803  | -0.1210716 ±j | 0.3786674 | 1.6418038  |
|        |         |                                       | 0.1789787 | 0.4817422 | 3.6668482  | -0.0894894 ±j | 0.6882832 | 3.8779833  |
|        |         |                                       | 0.1046683 | 0.8021660 | 6.2125942  | -0.0523342 ±j | 0.8941069 | 8.5569075  |
|        |         |                                       | 0.0338612 | 0.9875656 | 20.6082544 | -0.0169306 ±j | 0.9936191 | 29.3481355 |
|        |         |                                       |           |           |            | -0.1339775    |           |            |
| 2.00   | 142.715 |                                       | 0.2372556 | 0.1491578 | 4.1074418  | -0.1186278 ±j | 0.3675395 | 1.6278210  |
|        |         |                                       | 0.1810652 | 0.4642416 | 5.1532091  | -0.0905326 ±j | 0.6753113 | 3.7630248  |
|        |         |                                       | 0.1097176 | 0.7904343 | 8.9221914  | -0.0548588 ±j | 0.8873696 | 8.1031999  |
|        |         |                                       | 0.0363133 | 0.9866031 | 30.2010593 | -0.0181567 ±j | 0.9931130 | 27.3530279 |
|        |         |                                       |           |           |            | -0.1295959    |           |            |

| CASE A |         | Passband Ripple: Ap(dB)=2.0 |           |           |               |               |            |             |  |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|------------|-------------|--|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1         |             |  |
| 10     | 1.05    | 69.680                      | 0.3406445 | 0.0983261 | 1.1096718     | -0.1703222 ±j | 0.2632802  | 0.9205198   |  |
|        |         |                             | 0.2101040 | 0.4622262 | 1.1814619     | -0.1050520 ±j | 0.67117070 | 3.2358848   |  |
|        |         |                             | 0.0949757 | 0.7814684 | 1.4386640     | -0.0474878 ±j | 0.8827306  | 9.3077185   |  |
|        |         |                             | 0.0358749 | 0.9399378 | 2.5336482     | -0.0179375 ±j | 0.9693379  | 27.0245606  |  |
|        |         |                             | 0.0089333 | 0.9969035 | 16.8596102    | -0.0044666 ±j | 0.9984406  | 111.7677880 |  |
| 1.10   | 82.381  | 0.3069819                   | 0.0781395 | 1.2215638 | -0.1534910 ±j | 0.2336237     | 0.9105893  |             |  |
|        |         |                             | 0.2114505 | 0.3938368 | 1.3338339     | -0.1057253 ±j | 0.6185944  | 2.9679008   |  |
|        |         |                             | 0.1112656 | 0.7210009 | 1.7140833     | -0.0556328 ±j | 0.8472932  | 7.6314460   |  |
|        |         |                             | 0.0482506 | 0.9153284 | 3.2619424     | -0.0241253 ±j | 0.9564237  | 19.8283080  |  |
|        |         |                             | 0.0130930 | 0.9953550 | 23.1838025    | -0.0065465 ±j | 0.9976533  | 76.1990968  |  |
| 1.15   | 91.526  | 0.2885769                   | 0.0683048 | 1.3379528 | -0.1442884 ±j | 0.2179119     | 0.9056575  |             |  |
|        |         |                             | 0.2104217 | 0.3570444 | 1.4860346     | -0.1052109 ±j | 0.5881964  | 2.8396871   |  |
|        |         |                             | 0.1201921 | 0.6842201 | 1.9755745     | -0.0600961 ±j | 0.8249900  | 6.8821154   |  |
|        |         |                             | 0.0562277 | 0.8988949 | 3.9305495     | -0.0281138 ±j | 0.9476838  | 16.8618153  |  |
|        |         |                             | 0.0159813 | 0.9942644 | 28.9230322    | -0.0079906 ±j | 0.9970961  | 62.3935308  |  |
| 1.20   | 98.961  | 0.2764119                   | 0.0622391 | 1.4591581 | -0.1382060 ±j | 0.2076973     | 0.9025571  |             |  |
|        |         |                             | 0.2090478 | 0.3330928 | 1.6414311     | -0.1045239 ±j | 0.5675981  | 2.7608136   |  |
|        |         |                             | 0.1260297 | 0.6585093 | 2.2359899     | -0.0630148 ±j | 0.8090355  | 6.4388468   |  |
|        |         |                             | 0.0620107 | 0.8867325 | 4.5854918     | -0.0310054 ±j | 0.9411542  | 15.1855176  |  |
|        |         |                             | 0.0181734 | 0.9934301 | 34.5122486    | -0.0090867 ±j | 0.9966682  | 54.8445451  |  |
| 1.25   | 105.345 | 0.2676103                   | 0.0580578 | 1.5853042 | -0.1338052 ±j | 0.2003846     | 0.9003835  |             |  |
|        |         |                             | 0.2077076 | 0.3159866 | 1.8012990     | -0.1038538 ±j | 0.5524500  | 2.7063377   |  |
|        |         |                             | 0.1301980 | 0.6392343 | 2.5000000     | -0.0650990 ±j | 0.7968666  | 6.1408097   |  |
|        |         |                             | 0.0664606 | 0.8772402 | 5.2430274     | -0.0332303 ±j | 0.9360214  | 14.0927359  |  |
|        |         |                             | 0.0199159 | 0.9927634 | 40.1039839    | -0.0099580 ±j | 0.9963254  | 50.0290872  |  |
| 1.30   | 111.001 | 0.2608873                   | 0.0549784 | 1.7164539 | -0.1304437 ±j | 0.1948406     | 0.8987587  |             |  |
|        |         |                             | 0.2064876 | 0.3030628 | 1.9662686     | -0.1032438 ±j | 0.5407435  | 2.6660744   |  |
|        |         |                             | 0.1333403 | 0.6241424 | 2.7698611     | -0.0666701 ±j | 0.7872087  | 5.9248930   |  |
|        |         |                             | 0.0700145 | 0.8695784 | 5.9108926     | -0.0350073 ±j | 0.9318545  | 13.3188299  |  |
|        |         |                             | 0.0213426 | 0.9922154 | 45.7705353    | -0.0106713 ±j | 0.9960429  | 46.6719011  |  |
| 1.35   | 116.114 | 0.2555607                   | 0.0526076 | 1.8526432 | -0.1277803 ±j | 0.1904727     | 0.8974916  |             |  |
|        |         |                             | 0.2054003 | 0.2929187 | 2.1366988     | -0.1027001 ±j | 0.5313862  | 2.6349508   |  |
|        |         |                             | 0.1357991 | 0.6119642 | 3.0468391     | -0.0678996 ±j | 0.7793291  | 5.7605781   |  |
|        |         |                             | 0.0729282 | 0.8632455 | 6.5933849     | -0.0364641 ±j | 0.9283943  | 12.7400650  |  |
|        |         |                             | 0.0225355 | 0.9917560 | 51.5519660    | -0.0112677 ±j | 0.9958057  | 44.1911777  |  |
| 1.40   | 120.801 | 0.2512268                   | 0.0507231 | 1.9938949 | -0.1256134 ±j | 0.1869343     | 0.8964730  |             |  |
|        |         |                             | 0.2044367 | 0.2847312 | 2.3128131     | -0.1022183 ±j | 0.5237199  | 2.6101091   |  |
|        |         |                             | 0.1377769 | 0.6019152 | 3.3317143     | -0.0688885 ±j | 0.7727675  | 5.6310732   |  |
|        |         |                             | 0.0753631 | 0.8579170 | 7.2931353     | -0.0376815 ±j | 0.9254713  | 12.2903411  |  |
|        |         |                             | 0.0235486 | 0.9913646 | 57.4727614    | -0.0117743 ±j | 0.9956033  | 42.2816425  |  |
| 1.45   | 125.143 | 0.2476283                   | 0.0491884 | 2.1402240 | -0.1238141 ±j | 0.1840067     | 0.8956351  |             |  |
|        |         |                             | 0.2035828 | 0.2779802 | 2.4947597     | -0.1017914 ±j | 0.5173188  | 2.5897974   |  |
|        |         |                             | 0.1394020 | 0.5934776 | 3.6250000     | -0.0697010 ±j | 0.7672154  | 5.5262829   |  |
|        |         |                             | 0.0774297 | 0.8533699 | 8.0118665     | -0.0387149 ±j | 0.9229686  | 11.9305662  |  |
|        |         |                             | 0.0244201 | 0.9910274 | 63.5489356    | -0.0122100 ±j | 0.9954287  | 40.7657785  |  |
| 1.50   | 129.197 | 0.2445919                   | 0.0479144 | 2.2916411 | -0.1222960 ±j | 0.1815435     | 0.8949334  |             |  |
|        |         |                             | 0.2028244 | 0.2723185 | 2.6826414     | -0.1014122 ±j | 0.5118926  | 2.5728730   |  |
|        |         |                             | 0.1407602 | 0.5862934 | 3.9270510     | -0.0703801 ±j | 0.7624566  | 5.4397321   |  |
|        |         |                             | 0.0792054 | 0.8494449 | 8.7507642     | -0.0396027 ±j | 0.9208021  | 11.6362461  |  |
|        |         |                             | 0.0251775 | 0.9907338 | 69.7914985    | -0.0125887 ±j | 0.9952765  | 39.5335965  |  |
| 1.70   | 143.276 | 0.2360744                   | 0.0444416 | 2.9483149 | -0.1180372 ±j | 0.1746678     | 0.8929888  |             |  |
|        |         |                             | 0.2005114 | 0.2566134 | 3.4947482     | -0.1002557 ±j | 0.4965503  | 2.5263909   |  |
|        |         |                             | 0.1445004 | 0.5658322 | 5.2271136     | -0.0722502 ±j | 0.7487404  | 5.2056496   |  |
|        |         |                             | 0.0843447 | 0.8379914 | 11.9220243    | -0.0421724 ±j | 0.9144468  | 10.8533025  |  |
|        |         |                             | 0.0274148 | 0.9898642 | 96.5555666    | -0.0137074 ±j | 0.9948248  | 36.2912547  |  |
| 2.00   | 160.169 | 0.2289915                   | 0.0416658 | 4.0866858 | -0.1144958 ±j | 0.1689869     | 0.8913959  |             |  |
|        |         |                             | 0.1983798 | 0.2437642 | 4.8979715     | -0.0991899 ±j | 0.4836585  | 2.4887858   |  |
|        |         |                             | 0.1475226 | 0.5484861 | 7.4641016     | -0.0737613 ±j | 0.7369161  | 5.0202381   |  |
|        |         |                             | 0.0887989 | 0.8279541 | 17.3634536    | -0.0443995 ±j | 0.9088359  | 10.2469667  |  |
|        |         |                             | 0.0294093 | 0.9890861 | 142.4309671   | -0.0147046 ±j | 0.9944194  | 33.8168430  |  |

| CASE A |         | Passband Ripple: Ap(dB)=2.0                                   |                                                               |                                                                 |                                                                                                 |                                                                                                 |                                                                              |                                                                   |
|--------|---------|---------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------|
| n      | Ws      | As(dB)                                                        | A1                                                            | B1                                                              | C1                                                                                              | P1                                                                                              | Q1                                                                           |                                                                   |
| 11     | 1.05    | 78.085                                                        | 0.2670193<br>0.1522552<br>0.0703698<br>0.0281956<br>0.0073566 | 0.2229905<br>0.5772323<br>0.8278920<br>0.9511894<br>0.9974073   | 1.1084015<br>1.1652129<br>1.3488607<br>1.9760810<br>5.6021835                                   | -0.1335096 ±j<br>-0.0761276 ±j<br>-0.0351849 ±j<br>-0.0140978 ±j<br>-0.0036783 ±j<br>-0.1651606 | 0.4529522<br>0.7559345<br>0.9092052<br>0.9751875<br>0.9986960<br>135.7552068 | 1.7684818<br>4.9900292<br>12.9300682<br>34.5901008<br>135.7552068 |
| 1.10   | 92.056  | 0.2492821<br>0.1605231<br>0.0852113<br>0.0384815<br>0.0107934 | 0.1814651<br>0.5051660<br>0.7751075<br>0.9306718<br>0.9961231 | 1.2195217<br>1.3088558<br>1.5834523<br>2.4791006<br>7.5378437   | -0.1246411 ±j<br>-0.0802615 ±j<br>-0.0426056 ±j<br>-0.0192408 ±j<br>-0.0053967 ±j<br>-0.1464865 | 0.4073447<br>0.7062040<br>0.8793704<br>0.9645214<br>0.9980451                                   | 1.7088556<br>4.4277137<br>10.3319859<br>25.0695077<br>92.4690778             |                                                                   |
| 1.15   | 102.115 | 0.2385771<br>0.1637577<br>0.0937420<br>0.0452041<br>0.0131818 | 0.1605574<br>0.4648401<br>0.7422403<br>0.9168655<br>0.9952202 | 1.3352275<br>1.4533340<br>1.8085794<br>2.9446236<br>9.2991673   | -0.1192886 ±j<br>-0.0818788 ±j<br>-0.0468710 ±j<br>-0.0226021 ±j<br>-0.0065909 ±j<br>-0.1366110 | 0.3825279<br>0.6768574<br>0.8602578<br>0.9572642<br>0.9975855                                   | 1.6795246<br>4.1634188<br>9.1904726<br>21.1823709<br>75.6807485              |                                                                   |
| 1.20   | 110.294 | 0.2311418<br>0.1653495<br>0.0994973<br>0.0501199<br>0.0149954 | 0.1474331<br>0.4379939<br>0.7189370<br>0.9065974<br>0.9945301 | 1.4557817<br>1.6013465<br>2.0399626<br>3.4024453<br>11.0168385  | -0.1155709 ±j<br>-0.0826747 ±j<br>-0.0497487 ±j<br>-0.0250600 ±j<br>-0.0074977 ±j<br>-0.1301957 | 0.3661645<br>0.6566268<br>0.8464408<br>0.9518243<br>0.9972331                                   | 1.6611888<br>4.0024983<br>8.5218532<br>18.9975079<br>66.5044779              |                                                                   |
| 1.25   | 117.317 | 0.2255924<br>0.1662165<br>0.1037027<br>0.0539258<br>0.0164376 | 0.1382820<br>0.4185290<br>0.7012925<br>0.8985551<br>0.9939788 | 1.5812870<br>1.7539211<br>2.2631658<br>3.8631607<br>12.7367378  | -0.1127962 ±j<br>-0.0831082 ±j<br>-0.0518513 ±j<br>-0.0269629 ±j<br>-0.0082188 ±j<br>-0.1256052 | 0.3543431<br>0.6415778<br>0.8358253<br>0.9475379<br>0.9969510                                   | 1.6483837<br>3.8921424<br>8.0753181<br>17.5782612<br>60.6525813              |                                                                   |
| 1.30   | 123.538 | 0.2212609<br>0.1667124<br>0.1069308<br>0.0569798<br>0.0176188 | 0.1314870<br>0.4036604<br>0.6873736<br>0.8920459<br>0.9935259 | 1.7117951<br>1.9115674<br>2.4979196<br>4.3318290<br>14.4806247  | -0.1106305 ±j<br>-0.0833562 ±j<br>-0.0534654 ±j<br>-0.0284899 ±j<br>-0.0088094 ±j<br>-0.1221260 | 0.3453229<br>0.6298509<br>0.8273542<br>0.9440520<br>0.9967188                                   | 1.6388407<br>3.8110111<br>7.7534285<br>16.5757452<br>56.5735876              |                                                                   |
| 1.35   | 129.162 | 0.2177735<br>0.1670006<br>0.1094943<br>0.0594926<br>0.0186065 | 0.1262232<br>0.3918903<br>0.6760758<br>0.8866540<br>0.9931462 | 1.8473359<br>2.0745762<br>2.7391978<br>4.8112671<br>16.2605612  | -0.1088868 ±j<br>-0.0835003 ±j<br>-0.0547472 ±j<br>-0.0297463 ±j<br>-0.0093033 ±j<br>-0.1193854 | 0.3381818<br>0.6204176<br>0.8204137<br>0.9411531<br>0.9965238                                   | 1.6314157<br>3.7485582<br>7.5094140<br>15.8275657<br>53.5601303              |                                                                   |
| 1.40   | 134.318 | 0.2149006<br>0.1671656<br>0.1115820<br>0.0615994<br>0.0194457 | 0.1220188<br>0.3823262<br>0.6667089<br>0.8821090<br>0.9928230 | 1.9879279<br>2.2431285<br>2.9876021<br>5.3032020<br>18.0839213  | -0.1074503 ±j<br>-0.0835828 ±j<br>-0.0557910 ±j<br>-0.0307997 ±j<br>-0.0097228 ±j<br>-0.1171657 | 0.3323751<br>0.6126500<br>0.8146142<br>0.9387014<br>0.9963576                                   | 1.6254579<br>3.6988792<br>7.3176904<br>15.2470073<br>51.2404687              |                                                                   |
| 1.45   | 139.094 | 0.2124913<br>0.1672545<br>0.1133154<br>0.0633920<br>0.0201676 | 0.1185811<br>0.3743965<br>0.6588130<br>0.8782246<br>0.9925445 | 2.1335836<br>2.4173448<br>3.2435289<br>5.8087659<br>19.9555287  | -0.1062457 ±j<br>-0.0836273 ±j<br>-0.0566577 ±j<br>-0.0316960 ±j<br>-0.0100838 ±j<br>-0.1153294 | 0.3275560<br>0.6061378<br>0.8096931<br>0.9366002<br>0.9962143                                   | 1.6205652<br>3.6583734<br>7.1629517<br>14.7832015<br>49.3993208              |                                                                   |
| 1.50   | 143.554 | 0.2104419<br>0.1672953<br>0.1147774<br>0.0649355<br>0.0207951 | 0.1157182<br>0.3677157<br>0.6520676<br>0.8748673<br>0.9923021 | 2.2843118<br>2.5973085<br>3.5072526<br>6.3287388<br>21.8787000  | -0.1052210 ±j<br>-0.0836476 ±j<br>-0.0573887 ±j<br>-0.0324678 ±j<br>-0.0103975 ±j<br>-0.1137845 | 0.3234915<br>0.6005987<br>0.8054652<br>0.9347797<br>0.9960894                                   | 1.6164732<br>3.6247029<br>7.0354202<br>14.4041859<br>47.9028548              |                                                                   |
| 1.70   | 159.041 | 0.2046135<br>0.1672395<br>0.1186699<br>0.0694204<br>0.0226491 | 0.1078713<br>0.3490361<br>0.6327438<br>0.8650479<br>0.9915842 | 2.9380530<br>3.3756369<br>4.6433716<br>8.5619394<br>30.1261720  | -0.1023067 ±j<br>-0.0836198 ±j<br>-0.0594350 ±j<br>-0.0347102 ±j<br>-0.0113246 ±j<br>-0.1094728 | 0.3120971<br>0.5848451<br>0.7932284<br>0.9294316<br>0.9957188                                   | 1.6051611<br>3.5326141<br>6.6917840<br>13.3977796<br>43.9655945              |                                                                   |
| 2.00   | 177.623 | 0.1996797<br>0.1669987<br>0.1222560<br>0.0733284<br>0.0243024 | 0.1015531<br>0.3335896<br>0.6162207<br>0.8564149<br>0.9909420 | 4.0714332<br>4.7212543<br>6.5999975<br>12.3963998<br>44.2665611 | -0.0998398 ±j<br>-0.0834994 ±j<br>-0.0611280 ±j<br>-0.0366642 ±j<br>-0.0121512 ±j<br>-0.1059110 | 0.3026303<br>0.5715046<br>0.7862600<br>0.9247003<br>0.9953866                                   | 1.5959259<br>3.4585422<br>6.4209805<br>12.6203112<br>40.9613754              |                                                                   |

| CASE A |         | Passband Ripple: Ap(dB)=2.0 |           |             |               |               |            |             |
|--------|---------|-----------------------------|-----------|-------------|---------------|---------------|------------|-------------|
| n      | Ws      | As(dB)                      | A1        | B1          | C1            | P1            | Q1         |             |
| 12     | 1.10    | 101.731                     | 0.2591699 | 0.0545664   | 1.2179786     | -0.1295849 ±j | 0.1943557  | 0.9013182   |
|        |         |                             | 0.1992008 | 0.2949389   | 1.2909254     | -0.0996004 ±j | 0.5338714  | 2.7263084   |
|        |         |                             | 0.1244526 | 0.5926045   | 1.4996665     | -0.0622263 ±j | 0.7672890  | 6.1855525   |
|        |         |                             | 0.0672521 | 0.8150594   | 2.0872157     | -0.0336260 ±j | 0.9021799  | 13.4242143  |
|        |         |                             | 0.0314562 | 0.9421719   | 4.3499304     | -0.0157281 ±j | 0.9705280  | 30.8573157  |
|        |         |                             | 0.0090536 | 0.9967205   | 33.0577896    | -0.0045268 ±j | 0.9983486  | 110.2724398 |
| 1.15   | 112.705 | 0.2431068                   | 0.0476536 | 1.3331670   | -0.1215534 ±j | 0.1813238     | 0.8979466  |             |
|        |         |                             | 0.1946631 | 0.2644991   | 1.4297858     | -0.0973315 ±j | 0.5050007  | 2.6419742   |
|        |         |                             | 0.1297387 | 0.5520415   | 1.7009576     | -0.0648694 ±j | 0.7401578  | 5.7268548   |
|        |         |                             | 0.0750814 | 0.7859245   | 2.4494590     | -0.0375407 ±j | 0.8857286  | 11.8075059  |
|        |         |                             | 0.0371754 | 0.9304310   | 5.2979222     | -0.0185877 ±j | 0.9644094  | 25.9469496  |
|        |         | 0.0110599                   | 0.9959586 | 41.3060302  | -0.0055300 ±j | 0.9979619     | 90.2334827 |             |
| 1.20   | 121.627 | 0.2325431                   | 0.0433961 | 1.4532283   | -0.1162716 ±j | 0.1728497     | 0.8958222  |             |
|        |         |                             | 0.1911396 | 0.2450095   | 1.5724303     | -0.0955698 ±j | 0.4856706  | 2.5896484   |
|        |         |                             | 0.1328806 | 0.5245266   | 1.9034206     | -0.0664403 ±j | 0.7211881  | 5.4503232   |
|        |         |                             | 0.0804773 | 0.7650381   | 2.8072245     | -0.0402386 ±j | 0.8737385  | 10.8684690  |
|        |         |                             | 0.0413909 | 0.9216653   | 6.2244021     | -0.0206955 ±j | 0.9598109  | 23.1943067  |
|        |         | 0.0125854                   | 0.9953788 | 49.3373729  | -0.0062927 ±j | 0.9976669     | 79.2731547 |             |
| 1.25   | 129.288 | 0.2249244                   | 0.0404640 | 1.5782485   | -0.1124622 ±j | 0.1667821     | 0.8943304  |             |
|        |         |                             | 0.1883355 | 0.2312420   | 1.7197065     | -0.0941678 ±j | 0.4715659  | 2.5532955   |
|        |         |                             | 0.1349599 | 0.5043206   | 2.1098820     | -0.0674800 ±j | 0.7069420  | 5.2619717   |
|        |         |                             | 0.0844812 | 0.7491011   | 3.1681544     | -0.0422406 ±j | 0.8644749  | 10.2449587  |
|        |         |                             | 0.0446662 | 0.9147817   | 7.1532769     | -0.0223331 ±j | 0.9561815  | 21.4130987  |
|        |         | 0.0137983                   | 0.9949147 | 57.3715316  | -0.0068991 ±j | 0.9974302     | 72.2884166 |             |
| 1.30   | 136.075 | 0.2191179                   | 0.0383060 | 1.7082709   | -0.1095589 ±j | 0.1621815     | 0.8932142  |             |
|        |         |                             | 0.1860518 | 0.2209228   | 1.8720353     | -0.0930259 ±j | 0.4607266  | 2.5263091   |
|        |         |                             | 0.1364308 | 0.4887397   | 2.3217202     | -0.0682154 ±j | 0.6957632  | 5.1242024   |
|        |         |                             | 0.0875919 | 0.7364548   | 3.5359122     | -0.0437959 ±j | 0.8570512  | 9.7973658   |
|        |         |                             | 0.0473072 | 0.9091992   | 8.0959007     | -0.0236536 ±j | 0.9532254  | 20.1559038  |
|        |         | 0.0147923                   | 0.9945346 | 65.5126430  | -0.0073962 ±j | 0.9972361     | 67.4176384 |             |
| 1.35   | 142.210 | 0.2145250                   | 0.0366454 | 1.8433207   | -0.1072625 ±j | 0.1585564     | 0.8923429  |             |
|        |         |                             | 0.1841561 | 0.2128719   | 2.0296574     | -0.0920780 ±j | 0.4520990  | 2.5053770   |
|        |         |                             | 0.1375204 | 0.4763157   | 2.5397132     | -0.0687602 ±j | 0.6867224  | 5.0185720   |
|        |         |                             | 0.0900859 | 0.7261428   | 3.9125428     | -0.0450430 ±j | 0.8509489  | 9.4591908   |
|        |         |                             | 0.0494836 | 0.9045658   | 9.0585736     | -0.0247418 ±j | 0.9507648  | 19.2202586  |
|        |         | 0.0156233                   | 0.9942151 | 73.8184125  | -0.0078116 ±j | 0.9970728     | 63.8215719 |             |
| 1.40   | 147.835 | 0.2107929                   | 0.0353259 | 1.9834134   | -0.1053965 ±j | 0.1556196     | 0.8916419  |             |
|        |         |                             | 0.1825579 | 0.2064048   | 2.1927230     | -0.0912790 ±j | 0.4450538  | 2.4886233   |
|        |         |                             | 0.1383557 | 0.4661611   | 2.7643424     | -0.0691778 ±j | 0.6792463  | 4.9348169   |
|        |         |                             | 0.0921333 | 0.7175609   | 4.2993023     | -0.0460667 ±j | 0.8458361  | 9.1941736   |
|        |         |                             | 0.0513136 | 0.9006554   | 10.0451492    | -0.0256568 ±j | 0.9486818  | 18.4946765  |
|        |         | 0.0163296                   | 0.9939436 | 82.3241078  | -0.0081648 ±j | 0.9969338     | 61.0528678 |             |
| 1.45   | 153.045 | 0.2076973                   | 0.0342516 | 2.1285596   | -0.1038487 ±j | 0.1531895     | 0.8910650  |             |
|        |         |                             | 0.1811933 | 0.2010930   | 2.3613317     | -0.0905966 ±j | 0.4391871  | 2.4748932   |
|        |         |                             | 0.1390131 | 0.4577015   | 2.9959256     | -0.0695066 ±j | 0.6729564  | 4.8667088   |
|        |         |                             | 0.0938450 | 0.7103038   | 4.6970152     | -0.0469225 ±j | 0.8414880  | 8.9807167   |
|        |         |                             | 0.0528774 | 0.8973090   | 11.0581496    | -0.0264387 ±j | 0.9468949  | 17.9143365  |
|        |         | 0.0169379                   | 0.9937109 | 91.0527944  | -0.0084689 ±j | 0.9968145     | 58.8532959 |             |
| 1.50   | 157.911 | 0.2050876                   | 0.0333600 | 2.2787664   | -0.1025438 ±j | 0.1511449     | 0.8905817  |             |
|        |         |                             | 0.1800153 | 0.1966526   | 2.5355530     | -0.0900077 ±j | 0.4342248  | 2.4634308   |
|        |         |                             | 0.1395418 | 0.4505458   | 3.2346828     | -0.0697709 ±j | 0.6675910  | 4.8102206   |
|        |         |                             | 0.0952965 | 0.7040884   | 5.1062498     | -0.0476483 ±j | 0.8377458  | 8.8051462   |
|        |         |                             | 0.0542202 | 0.8944147   | 12.0993095    | -0.0271101 ±j | 0.9453464  | 17.4424692  |
|        |         | 0.0174656                   | 0.9935065 | 100.0203299 | -0.0087328 ±j | 0.9967097     | 57.0690711 |             |
| 1.70   | 174.805 | 0.1977771                   | 0.0309308 | 2.9302881   | -0.0988886 ±j | 0.1454368     | 0.8892411  |             |
|        |         |                             | 0.1765828 | 0.1844029   | 3.2893923     | -0.0882914 ±j | 0.4202470  | 2.4318423   |
|        |         |                             | 0.1408937 | 0.4303985   | 4.2640673     | -0.0704468 ±j | 0.6522544  | 4.6563320   |
|        |         |                             | 0.0994026 | 0.6861990   | 6.8651328     | -0.0497013 ±j | 0.8268789  | 8.3334993   |
|        |         |                             | 0.0581406 | 0.8859334   | 16.5660270    | -0.0290703 ±j | 0.9407913  | 16.1890327  |
|        |         | 0.0190266                   | 0.9929034 | 138.4661013 | -0.0095133 ±j | 0.9964000     | 52.3710692 |             |
| 2.00   | 195.077 | 0.1917094                   | 0.0289902 | 4.0598914   | -0.0958547 ±j | 0.1407199     | 0.8881418  |             |
|        |         |                             | 0.1735862 | 0.1744544   | 4.5932605     | -0.0867931 ±j | 0.4085601  | 2.4061662   |
|        |         |                             | 0.1418645 | 0.4135817   | 6.0382667     | -0.0709323 ±j | 0.6391794  | 4.5332210   |
|        |         |                             | 0.1028497 | 0.6708138   | 9.8873550     | -0.0514249 ±j | 0.8174162  | 7.9633884   |
|        |         |                             | 0.0615720 | 0.8784582   | 24.2272012    | -0.0307860 ±j | 0.9367553  | 15.2221986  |
|        |         | 0.0204192                   | 0.9923646 | 204.3626509 | -0.0102096 ±j | 0.9961227     | 48.7862555 |             |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=3.0$ |           |           |           |                             |           |           |  |
|--------|------|---------------------------------------|-----------|-----------|-----------|-----------------------------|-----------|-----------|--|
| n      | Ws   | As(dB)                                | A1        | B1        | C1        | P1                          | Q1        |           |  |
| 2      | 1.05 | 6.540                                 | 0.2886861 | 0.9571580 | 1.4386640 | -0.1443430 ±j               | 0.9676379 | 3.3889565 |  |
|        | 1.10 | 8.368                                 | 0.3772832 | 0.9238786 | 1.7140833 | -0.1886416 ±j               | 0.9424929 | 2.5476515 |  |
|        | 1.15 | 9.853                                 | 0.4311711 | 0.8974798 | 1.9755745 | -0.2155856 ±j               | 0.9224980 | 2.1971649 |  |
|        | 1.20 | 11.139                                | 0.4681407 | 0.8760711 | 2.2359899 | -0.2340704 ±j               | 0.9062462 | 1.9993705 |  |
|        | 1.25 | 12.285                                | 0.4951858 | 0.8583926 | 2.5000000 | -0.2475929 ±j               | 0.8927992 | 1.8710043 |  |
|        | 1.30 | 13.327                                | 0.5158226 | 0.8435742 | 2.7698611 | -0.2579113 ±j               | 0.8815078 | 1.7805791 |  |
|        | 1.35 | 14.285                                | 0.5320589 | 0.8309957 | 3.0468391 | -0.2660295 ±j               | 0.8719083 | 1.7133246 |  |
|        | 1.40 | 15.175                                | 0.5451380 | 0.8202034 | 3.3317143 | -0.2725690 ±j               | 0.8636606 | 1.6613241 |  |
|        | 1.45 | 16.007                                | 0.5558746 | 0.8108573 | 3.6250000 | -0.2779373 ±j               | 0.8565093 | 1.6199268 |  |
|        | 1.50 | 16.790                                | 0.5648266 | 0.8026575 | 3.9270510 | -0.2824133 ±j               | 0.8502589 | 1.5862104 |  |
|        | 1.70 | 19.540                                | 0.5892711 | 0.7784662 | 5.2271136 | -0.2946356 ±j               | 0.8316586 | 1.4972858 |  |
|        | 2.00 | 22.880                                | 0.6086410 | 0.7568188 | 7.4641016 | -0.3043205 ±j               | 0.8149894 | 1.4293373 |  |
| 3      | 1.05 | 13.458                                | 0.1023245 | 0.9677264 | 1.2054102 | -0.0511622 ±j<br>-0.5189374 | 0.9823995 | 9.6138356 |  |
|        | 1.10 | 17.093                                | 0.1412271 | 0.9476775 | 1.3703136 | -0.0706135 ±j<br>-0.4579008 | 0.9709229 | 6.8930642 |  |
|        | 1.15 | 19.776                                | 0.1664226 | 0.9330773 | 1.5336053 | -0.0832113 ±j<br>-0.4250036 | 0.9623685 | 5.8042546 |  |
|        | 1.20 | 21.979                                | 0.1846802 | 0.9217743 | 1.6996171 | -0.0923401 ±j<br>-0.4035334 | 0.9556399 | 5.1986671 |  |
|        | 1.25 | 23.880                                | 0.1987058 | 0.9127005 | 1.8699785 | -0.0993529 ±j<br>-0.3881585 | 0.9501734 | 4.8078792 |  |
|        | 1.30 | 25.568                                | 0.2098872 | 0.9052325 | 2.0454918 | -0.1049436 ±j<br>-0.3765131 | 0.9456317 | 4.5330877 |  |
|        | 1.35 | 27.096                                | 0.2190366 | 0.8989711 | 2.2266128 | -0.1095183 ±j<br>-0.3673505 | 0.9417945 | 4.3286858 |  |
|        | 1.40 | 28.499                                | 0.2266716 | 0.8936446 | 2.4136247 | -0.1133358 ±j<br>-0.3599390 | 0.9385092 | 4.1704733 |  |
|        | 1.45 | 29.799                                | 0.2331415 | 0.8890598 | 2.6067151 | -0.1165708 ±j<br>-0.3538158 | 0.9356661 | 4.0443236 |  |
|        | 1.50 | 31.014                                | 0.2386931 | 0.8850745 | 2.8060141 | -0.1193466 ±j<br>-0.3486712 | 0.9331832 | 3.9413958 |  |
|        | 1.70 | 35.234                                | 0.2547202 | 0.8733085 | 3.6668482 | -0.1273601 ±j<br>-0.3343501 | 0.9257904 | 3.6687704 |  |
|        | 2.00 | 40.301                                | 0.2685589 | 0.8628442 | 5.1532091 | -0.1342795 ±j<br>-0.3225693 | 0.9191372 | 3.4588094 |  |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=3.0$ |                        |                        |                         |                                              |                        |                         |
|--------|------|---------------------------------------|------------------------|------------------------|-------------------------|----------------------------------------------|------------------------|-------------------------|
| n      | Ws   | As(dB)                                | A1                     | B1                     | C1                      | P1                                           | Q1                     |                         |
| 4      | 1.05 | 21.603                                | 0.5000958<br>0.0521678 | 0.4589160<br>0.9779638 | 1.1536336<br>3.3125181  | -0.2500479 ±j<br>-0.0260839 ±j               | 0.6295967<br>0.9885765 | 1.3546073<br>18.9565472 |
|        | 1.10 | 26.653                                | 0.4897647<br>0.0736368 | 0.3817794<br>0.9659089 | 1.2909254<br>4.3499304  | -0.2448823 ±j<br>-0.0368184 ±j               | 0.5672848<br>0.9821167 | 1.2615917<br>13.3466690 |
|        | 1.15 | 30.303                                | 0.4796613<br>0.0880057 | 0.3413283<br>0.9573509 | 1.4297858<br>5.2879222  | -0.2398306 ±j<br>-0.0440028 ±j               | 0.5327378<br>0.9774531 | 1.2180118<br>11.1179572 |
|        | 1.20 | 33.274                                | 0.4713742<br>0.0986628 | 0.3154268<br>0.9507937 | 1.5724303<br>6.2244021  | -0.2356871 ±j<br>-0.0493314 ±j               | 0.5097827<br>0.9738378 | 1.1914712<br>9.8830233  |
|        | 1.25 | 35.826                                | 0.4646162<br>0.1069957 | 0.2971449<br>0.9455551 | 1.7197065<br>7.1532769  | -0.2323081 ±j<br>-0.0534979 ±j               | 0.4931307<br>0.9709238 | 1.1732480<br>9.0881816  |
|        | 1.30 | 38.088                                | 0.4590374<br>0.1137325 | 0.2834556<br>0.9412535 | 1.8720353<br>8.0959007  | -0.2295187 ±j<br>-0.0568662 ±j               | 0.4803923<br>0.9685142 | 1.1598304<br>8.5303881  |
|        | 1.35 | 40.132                                | 0.4543674<br>0.1193082 | 0.2727857<br>0.9376507 | 2.0296574<br>9.0585736  | -0.2271837 ±j<br>-0.0596541 ±j               | 0.4702906<br>0.9664844 | 1.1494858<br>8.1161537  |
|        | 1.40 | 42.007                                | 0.4504079<br>0.1240052 | 0.2642225<br>0.9345869 | 2.1927230<br>10.0451492 | -0.2252040 ±j<br>-0.0620026 ±j               | 0.4620668<br>0.9647500 | 1.1412450<br>7.7959652  |
|        | 1.45 | 43.744                                | 0.4470131<br>0.1280175 | 0.2571948<br>0.9319496 | 2.3613317<br>11.0581496 | -0.2235066 ±j<br>-0.0640087 ±j               | 0.4552358<br>0.9632510 | 1.1345165<br>7.5409657  |
|        | 1.50 | 45.366                                | 0.4440740<br>0.1314838 | 0.2513241<br>0.9296564 | 2.5355530<br>12.0993095 | -0.2220370 ±j<br>-0.0657419 ±j               | 0.4494705<br>0.9619430 | 1.1289163<br>7.3331206  |
|        | 1.70 | 50.897                                | 0.4354708<br>0.1416152 | 0.2351509<br>0.9228786 | 3.2893923<br>16.5660270 | -0.2177354 ±j<br>-0.0708076 ±j               | 0.4332922<br>0.9580526 | 1.1135617<br>6.7836338  |
|        | 2.00 | 57.754                                | 0.4279229<br>0.1505143 | 0.2220419<br>0.9168357 | 4.5932605<br>24.2272012 | -0.2139615 ±j<br>-0.0752571 ±j               | 0.4198362<br>0.9545534 | 1.1011638<br>6.3616244  |
| 5      | 1.05 | 29.970                                | 0.2333518<br>0.0316731 | 0.6778885<br>0.9846810 | 1.1334220<br>1.7737385  | -0.1166759 ±j<br>-0.0158366 ±j<br>-0.3019261 | 0.8150308<br>0.9921846 | 3.5283203<br>31.3297479 |
|        | 1.10 | 36.315                                | 0.2550358<br>0.0453239 | 0.6032535<br>0.9767810 | 1.2593204<br>2.1930925  | -0.1275179 ±j<br>-0.0226619 ±j<br>-0.2665905 | 0.7661544<br>0.9880624 | 3.0454306<br>21.8057699 |
|        | 1.15 | 40.887                                | 0.2650162<br>0.0546044 | 0.5601030<br>0.9712159 | 1.3881033<br>2.5834170  | -0.1325081 ±j<br>-0.0273022 ±j<br>-0.2480375 | 0.7365762<br>0.9851246 | 2.8238794<br>18.0480362 |
|        | 1.20 | 44.604                                | 0.2707592<br>0.0615567 | 0.5308647<br>0.9669636 | 1.5211268<br>2.9683674  | -0.1353796 ±j<br>-0.0307784 ±j<br>-0.2360367 | 0.7139169<br>0.9828613 | 2.6909694<br>15.9745785 |
|        | 1.25 | 47.796                                | 0.2744525<br>0.0670321 | 0.5094200<br>0.9635703 | 1.6589139<br>3.3563960  | -0.1372263 ±j<br>-0.0335161 ±j<br>-0.2274741 | 0.7004206<br>0.9810438 | 2.6005833<br>14.6439679 |
|        | 1.30 | 50.624                                | 0.2769973<br>0.0714832 | 0.4929037<br>0.9607851 | 1.8017262<br>3.7515494  | -0.1384987 ±j<br>-0.0357416 ±j<br>-0.2209979 | 0.6882745<br>0.9795446 | 2.5345766<br>13.7122619 |
|        | 1.35 | 53.180                                | 0.2788367<br>0.0751835 | 0.4797477<br>0.9584525 | 1.9497131<br>4.1560845  | -0.1394183 ±j<br>-0.0375917 ±j<br>-0.2159047 | 0.6784616<br>0.9782839 | 2.4840282<br>13.0215541 |
|        | 1.40 | 55.524                                | 0.2802143<br>0.0783120 | 0.4690050<br>0.9564688 | 2.1029685<br>4.5713865  | -0.1401071 ±j<br>-0.0391560 ±j<br>-0.2117847 | 0.6703544<br>0.9772080 | 2.4439848<br>12.4884125 |
|        | 1.45 | 57.695                                | 0.2812750<br>0.0809925 | 0.4600630<br>0.9547608 | 2.2615546<br>4.9983644  | -0.1406375 ±j<br>-0.0404963 ±j<br>-0.2083796 | 0.6635391<br>0.9762791 | 2.4114459<br>12.0643093 |
|        | 1.50 | 59.722                                | 0.2821102<br>0.0833144 | 0.4525047<br>0.9532755 | 2.4255147<br>5.4376446  | -0.1410551 ±j<br>-0.0416572 ±j<br>-0.2055175 | 0.6577295<br>0.9754692 | 2.3844746<br>11.7189677 |
|        | 1.70 | 66.761                                | 0.2841535<br>0.0901323 | 0.4312534<br>0.9488830 | 3.1356145<br>7.3252003  | -0.1420767 ±j<br>-0.0450662 ±j<br>-0.1975405 | 0.6411455<br>0.9730632 | 2.3110708<br>10.8075136 |
|        | 2.00 | 75.208                                | 0.2855054<br>0.0961599 | 0.4135506<br>0.9449629 | 4.3649509<br>10.5677323 | -0.1427527 ±j<br>-0.0480799 ±j<br>-0.1909633 | 0.6270345<br>0.9709023 | 2.2524235<br>10.1091215 |

| CASE A |        | Passband Ripple: Ap(dB)=3.0 |           |           |               |               |           |            |
|--------|--------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws     | As(dB)                      | A1        | B1        | C1            |               | P1        | Q1         |
| 6      | 1.05   | 38.369                      | 0.4147239 | 0.2289483 | 1.1233258     | -0.2073620 ±j | 0.4312184 | 1.1537444  |
|        |        |                             | 0.1276820 | 0.7942265 | 1.4386640     | -0.0638410 ±j | 0.8889043 | 6.9797949  |
|        |        |                             | 0.0213325 | 0.9889110 | 6.5287683     | -0.0106662 ±j | 0.9943828 | 46.6162917 |
| 1.10   | 45.989 | 0.3840532                   | 0.1847936 | 1.2433620 | -0.1920266 ±j | 0.3846028     | 1.1193143 |            |
|        |        |                             | 0.1502553 | 0.7337834 | 1.7140833     | -0.0751277 ±j | 0.8533108 | 5.7010393  |
|        |        |                             | 0.0307872 | 0.9833572 | 8.8264550     | -0.0153936 ±j | 0.9915242 | 32.2096365 |
| 1.15   | 51.476 | 0.3659646                   | 0.1627902 | 1.3669587 | -0.1829823 ±j | 0.3595938     | 1.1024911 |            |
|        |        |                             | 0.1626484 | 0.6967843 | 1.9755745     | -0.0813242 ±j | 0.8307651 | 5.1321504  |
|        |        |                             | 0.0372677 | 0.9794576 | 10.9158033    | -0.0186338 ±j | 0.9895000 | 26.5558844 |
| 1.20   | 55.937 | 0.3535508                   | 0.1490584 | 1.4950350 | -0.1767754 ±j | 0.3432330     | 1.0920094 |            |
|        |        |                             | 0.1707593 | 0.6708372 | 2.2359899     | -0.0853797 ±j | 0.8145843 | 4.7964972  |
|        |        |                             | 0.0421470 | 0.9764814 | 12.9526713    | -0.0210735 ±j | 0.9879460 | 23.4457943 |
| 1.25   | 59.767 | 0.3443565                   | 0.1395210 | 1.6279471 | -0.1721783 ±j | 0.3314749     | 1.0847045 |            |
|        |        |                             | 0.1765531 | 0.6513460 | 2.5000000     | -0.0882765 ±j | 0.8022177 | 4.5712043  |
|        |        |                             | 0.0460038 | 0.9741075 | 14.9917591    | -0.0230019 ±j | 0.9867007 | 21.4540656 |
| 1.30   | 63.161 | 0.3372186                   | 0.1324592 | 1.7658735 | -0.1686093 ±j | 0.3225369     | 1.0792684 |            |
|        |        |                             | 0.1809213 | 0.6360636 | 2.7698611     | -0.0904607 ±j | 0.7923891 | 4.4081914  |
|        |        |                             | 0.0491478 | 0.9721594 | 17.0590037    | -0.0245739 ±j | 0.9856752 | 20.0615445 |
| 1.35   | 66.229 | 0.3314949                   | 0.1270006 | 1.9089166 | -0.1657475 ±j | 0.3154811     | 1.0750432 |            |
|        |        |                             | 0.1843398 | 0.6237191 | 3.0468391     | -0.0921699 ±j | 0.7843621 | 4.2842553  |
|        |        |                             | 0.0517673 | 0.9705280 | 19.1687817    | -0.0258837 ±j | 0.9848137 | 19.0304135 |
| 1.40   | 69.041 | 0.3267946                   | 0.1226479 | 2.0571405 | -0.1633973 ±j | 0.3097568     | 1.0716558 |            |
|        |        |                             | 0.1870896 | 0.6135249 | 3.3317143     | -0.0935448 ±j | 0.7776724 | 4.1866488  |
|        |        |                             | 0.0539861 | 0.9691406 | 21.3298812    | -0.0269930 ±j | 0.9840792 | 18.2352397 |
| 1.45   | 71.646 | 0.3228628                   | 0.1190942 | 2.2105880 | -0.1614314 ±j | 0.3050149     | 1.0688757 |            |
|        |        |                             | 0.1893489 | 0.6049602 | 3.6250000     | -0.0946744 ±j | 0.7720084 | 4.1077184  |
|        |        |                             | 0.0558901 | 0.9679460 | 23.5480505    | -0.0279450 ±j | 0.9834455 | 17.6031690 |
| 1.50   | 74.079 | 0.3195253                   | 0.1161380 | 2.3692888 | -0.1597626 ±j | 0.3010214     | 1.0665518 |            |
|        |        |                             | 0.1912371 | 0.5976641 | 3.9270510     | -0.0956185 ±j | 0.7671514 | 4.0425599  |
|        |        |                             | 0.0575414 | 0.9669070 | 25.8272420    | -0.0287707 ±j | 0.9828933 | 17.0888022 |
| 1.70   | 82.526 | 0.3100668                   | 0.1080516 | 3.0569811 | -0.1550334 ±j | 0.2898556     | 1.0601332 |            |
|        |        |                             | 0.1964360 | 0.5768672 | 5.2271136     | -0.0982180 ±j | 0.7531404 | 3.8664900  |
|        |        |                             | 0.0624020 | 0.9638339 | 35.6008780    | -0.0312010 ±j | 0.9812545 | 15.7326811 |
| 2.00   | 92.662 | 0.3020970                   | 0.1015581 | 4.2481552 | -0.1510485 ±j | 0.2806108     | 1.0548989 |            |
|        |        |                             | 0.2006358 | 0.5592179 | 7.4641016     | -0.1003179 ±j | 0.7410494 | 3.7271955  |
|        |        |                             | 0.0667131 | 0.9610903 | 52.3568408    | -0.0333565 ±j | 0.9797845 | 14.6950512 |



| CASE A |         | Passband Ripple: $A_p(\text{dB})=3.0$ |           |           |               |               |           |            |  |
|--------|---------|---------------------------------------|-----------|-----------|---------------|---------------|-----------|------------|--|
| n      | Ws      | As(dB)                                | A1        | B1        | C1            | P1            | Q1        |            |  |
| 7      | 1.05    | 46.773                                | 0.2563547 | 0.4440430 | 1.1175213     | -0.1281774 ±j | 0.6539217 | 2.5993885  |  |
|        |         |                                       | 0.0792068 | 0.8582471 | 1.3083409     | -0.0396034 ±j | 0.9255694 | 11.6961754 |  |
|        |         |                                       | 0.0153774 | 0.9916580 | 2.7143721     | -0.0076887 ±j | 0.9957906 | 64.7585502 |  |
|        |         |                                       |           |           |               | -0.2127883    |           |            |  |
| 1.10   | 55.664  | 0.2556092                             | 0.3759835 | 1.2341277 | -0.1278046 ±j | 0.5997079     | 2.3988768 |            |  |
|        |         |                                       | 0.0980325 | 0.8106197 | 1.5239435     | -0.0490162 ±j | 0.8990089 | 9.1841445  |  |
|        |         |                                       | 0.0223141 | 0.9875469 | 3.5147693     | -0.0111570 ±j | 0.9936913 | 44.5348851 |  |
|        |         |                                       |           |           |               | -0.1884723    |           |            |  |
| 1.15   | 62.065  | 0.2530862                             | 0.3396718 | 1.3546897 | -0.1265431 ±j | 0.5689100     | 2.3028266 |            |  |
|        |         |                                       | 0.1091305 | 0.7804350 | 1.7321918     | -0.0545653 ±j | 0.8817356 | 8.0950980  |  |
|        |         |                                       | 0.0270914 | 0.9846652 | 4.2484927     | -0.0135457 ±j | 0.9922105 | 36.6279908 |  |
|        |         |                                       |           |           |               | -0.1756460    |           |            |  |
| 1.20   | 67.270  | 0.2506000                             | 0.3161467 | 1.4798722 | -0.1253000 ±j | 0.5481301     | 2.2436919 |            |  |
|        |         |                                       | 0.1167377 | 0.7588097 | 1.9413408     | -0.0583688 ±j | 0.8691391 | 7.4620027  |  |
|        |         |                                       | 0.0306991 | 0.9824674 | 4.9666973     | -0.0153495 ±j | 0.9910761 | 32.2874397 |  |
|        |         |                                       |           |           |               | -0.1673252    |           |            |  |
| 1.25   | 71.739  | 0.2483967                             | 0.2993999 | 1.6099341 | -0.1241984 ±j | 0.5328927     | 2.2028248 |            |  |
|        |         |                                       | 0.1223601 | 0.7423181 | 2.1544332     | -0.0611800 ±j | 0.8594039 | 7.0413402  |  |
|        |         |                                       | 0.0335568 | 0.9807149 | 5.6874343     | -0.0167784 ±j | 0.9901684 | 29.5115127 |  |
|        |         |                                       |           |           |               | -0.1613765    |           |            |  |
| 1.30   | 75.698  | 0.2464859                             | 0.2867781 | 1.7450051 | -0.1232429 ±j | 0.5211423     | 2.1726058 |            |  |
|        |         |                                       | 0.1267140 | 0.7292393 | 2.3729509     | -0.0633570 ±j | 0.8516016 | 6.7392338  |  |
|        |         |                                       | 0.0358901 | 0.9792770 | 6.4192876     | -0.0179450 ±j | 0.9894215 | 27.5726351 |  |
|        |         |                                       |           |           |               | -0.1568706    |           |            |  |
| 1.35   | 79.277  | 0.2448323                             | 0.2768894 | 1.8851599 | -0.1224162 ±j | 0.5117653     | 2.1492375 |            |  |
|        |         |                                       | 0.1301961 | 0.7185794 | 2.5977295     | -0.0650980 ±j | 0.8451874 | 6.5108777  |  |
|        |         |                                       | 0.0378367 | 0.9780729 | 7.1670237     | -0.0189183 ±j | 0.9887947 | 26.1380203 |  |
|        |         |                                       |           |           |               | -0.1533231    |           |            |  |
| 1.40   | 82.558  | 0.2433961                             | 0.2689199 | 2.0304452 | -0.1216981 ±j | 0.5040928     | 2.1305798 |            |  |
|        |         |                                       | 0.1330482 | 0.7097118 | 2.8292857     | -0.0665241 ±j | 0.8398133 | 6.3318717  |  |
|        |         |                                       | 0.0394872 | 0.9770488 | 7.9335602     | -0.0197436 ±j | 0.9882606 | 25.0323507 |  |
|        |         |                                       |           |           |               | -0.1504508    |           |            |  |
| 1.45   | 85.597  | 0.2421419                             | 0.2623567 | 2.1808921 | -0.1210710 ±j | 0.4976932     | 2.1153202 |            |  |
|        |         |                                       | 0.1354279 | 0.7022163 | 3.0679607     | -0.0677140 ±j | 0.8352431 | 6.1876710  |  |
|        |         |                                       | 0.0409049 | 0.9761671 | 8.7208069     | -0.0204524 ±j | 0.9878000 | 24.1538964 |  |
|        |         |                                       |           |           |               | -0.1480752    |           |            |  |
| 1.50   | 88.436  | 0.2410402                             | 0.2568581 | 2.3365223 | -0.1205201 ±j | 0.4922733     | 2.1026025 |            |  |
|        |         |                                       | 0.1374433 | 0.6957982 | 3.3139902     | -0.0687217 ±j | 0.8313095 | 6.0690129  |  |
|        |         |                                       | 0.0421353 | 0.9754002 | 9.5300781     | -0.0210677 ±j | 0.9873988 | 23.4393132 |  |
|        |         |                                       |           |           |               | -0.1460773    |           |            |  |
| 1.70   | 98.291  | 0.2377378                             | 0.2416319 | 3.0111362 | -0.1188689 ±j | 0.4769718     | 2.0676588 |            |  |
|        |         |                                       | 0.1431273 | 0.6773376 | 4.3744590     | -0.0715637 ±j | 0.8198879 | 5.7501614  |  |
|        |         |                                       | 0.0457621 | 0.9731319 | 13.0029293    | -0.0228810 ±j | 0.9862091 | 21.5566036 |  |
|        |         |                                       |           |           |               | -0.1405032    |           |            |  |
| 2.00   | 110.116 | 0.2347551                             | 0.2292041 | 4.1800429 | -0.1173775 ±j | 0.4641408     | 2.0393711 |            |  |
|        |         |                                       | 0.1478795 | 0.6614757 | 6.2017764     | -0.0739398 ±j | 0.8099436 | 5.4998257  |  |
|        |         |                                       | 0.0489849 | 0.9711064 | 18.9610948    | -0.0244924 ±j | 0.9851429 | 20.1173716 |  |
|        |         |                                       |           |           |               | -0.1359011    |           |            |  |

| CASE A |         | Passband Ripple: Ap(dB)=3.0 |           |           |               |               |           |            |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |            |
| 8      | 1.05    | 55.178                      | 0.3347741 | 0.1338238 | 1.1138641     | -0.1673870 ±j | 0.3252774 | 1.0927350  |
|        |         |                             | 0.1632065 | 0.6019557 | 1.2431181     | -0.0816032 ±j | 0.7715547 | 4.7538436  |
|        |         |                             | 0.0537145 | 0.8964850 | 1.9061395     | -0.0268573 ±j | 0.9464479 | 17.6270624 |
|        |         |                             | 0.0116266 | 0.9935183 | 11.0466061    | -0.0058133 ±j | 0.9967369 | 85.7304539 |
| 1.10   | 65.339  | 0.3043794                   | 0.1069679 | 1.2282855 | -0.1521897 ±j | 0.2894930     | 1.0745127 |            |
|        |         |                             | 0.1737029 | 0.5293580 | 1.4271032     | -0.0868514 ±j | 0.7223675 | 4.1885890  |
|        |         |                             | 0.0688939 | 0.8586502 | 2.3804113     | -0.0344470 ±j | 0.9259933 | 13.4501532 |
|        |         |                             | 0.0169326 | 0.9903548 | 15.1062239    | -0.0084663 ±j | 0.9951297 | 58.7720664 |
| 1.15   | 72.655  | 0.2874093                   | 0.0937780 | 1.3469136 | -0.1437047 ±j | 0.2704199     | 1.0654905 |            |
|        |         |                             | 0.1780881 | 0.4884068 | 1.6072975     | -0.0890440 ±j | 0.6931651 | 3.9242439  |
|        |         |                             | 0.0782216 | 0.8341245 | 2.8200771     | -0.0391108 ±j | 0.9124664 | 11.6758533 |
|        |         |                             | 0.0205983 | 0.9881398 | 18.7925269    | -0.0102992 ±j | 0.9939989 | 48.2588838 |
| 1.20   | 78.603  | 0.2760717                   | 0.0856081 | 1.4702527 | -0.1380358 ±j | 0.2579810     | 1.0598286 |            |
|        |         |                             | 0.1804011 | 0.4610213 | 1.7895085     | -0.0902006 ±j | 0.6729674 | 3.7637543  |
|        |         |                             | 0.0847854 | 0.8163050 | 3.2528314     | -0.0423927 ±j | 0.9025009 | 10.6562713 |
|        |         |                             | 0.0233718 | 0.9864512 | 22.3835994    | -0.0116859 ±j | 0.9931338 | 42.4957573 |
| 1.25   | 83.711  | 0.2678125                   | 0.0799609 | 1.5984994 | -0.1339063 ±j | 0.2490582     | 1.0558638 |            |
|        |         |                             | 0.1817664 | 0.4411059 | 1.9759013     | -0.0908832 ±j | 0.6579104 | 3.6539092  |
|        |         |                             | 0.0897296 | 0.8025791 | 3.6885364     | -0.0448648 ±j | 0.8947437 | 9.9840880  |
|        |         |                             | 0.0255717 | 0.9851050 | 25.9769795    | -0.0127858 ±j | 0.9924422 | 38.8134500 |
| 1.30   | 88.235  | 0.2614737                   | 0.0757936 | 1.7317524 | -0.1307369 ±j | 0.2422840     | 1.0529030 |            |
|        |         |                             | 0.1826280 | 0.4258599 | 2.1675370     | -0.0913140 ±j | 0.6461592 | 3.5732708  |
|        |         |                             | 0.0936147 | 0.7916104 | 4.1319051     | -0.0468073 ±j | 0.8884928 | 9.5041178  |
|        |         |                             | 0.0273698 | 0.9840006 | 29.6189023    | -0.0136849 ±j | 0.9918736 | 36.2432156 |
| 1.35   | 92.325  | 0.2564336                   | 0.0725806 | 1.8700686 | -0.1282168 ±j | 0.2369411     | 1.0505955 |            |
|        |         |                             | 0.1831961 | 0.4137710 | 2.3650162     | -0.0915980 ±j | 0.6366952 | 3.5112674  |
|        |         |                             | 0.0967585 | 0.7826162 | 4.5855625     | -0.0483792 ±j | 0.8833321 | 9.1429290  |
|        |         |                             | 0.0288711 | 0.9830758 | 33.3349904    | -0.0144355 ±j | 0.9913967 | 34.3424172 |
| 1.40   | 96.075  | 0.2523214                   | 0.0700237 | 2.0134836 | -0.1261607 ±j | 0.2326095     | 1.0487416 |            |
|        |         |                             | 0.1835819 | 0.4039349 | 2.5687116     | -0.0917909 ±j | 0.6288953 | 3.4619910  |
|        |         |                             | 0.0993585 | 0.7750973 | 5.0511190     | -0.0496793 ±j | 0.8789933 | 8.8608022  |
|        |         |                             | 0.0301449 | 0.9822893 | 37.1409040    | -0.0150724 ±j | 0.9909905 | 32.8780413 |
| 1.45   | 99.549  | 0.2488994                   | 0.0679393 | 2.1620209 | -0.1244497 ±j | 0.2290232     | 1.0472173 |            |
|        |         |                             | 0.1838492 | 0.3957710 | 2.7788694     | -0.0919246 ±j | 0.6223510 | 3.4218435  |
|        |         |                             | 0.1015456 | 0.7687156 | 5.5296305     | -0.0507728 ±j | 0.8752929 | 8.6341928  |
|        |         |                             | 0.0312396 | 0.9816122 | 41.0468858    | -0.0156198 ±j | 0.9906403 | 31.7149725 |
| 1.50   | 102.793 | 0.2460068                   | 0.0662078 | 2.3156973 | -0.1230034 ±j | 0.2260042     | 1.0459413 |            |
|        |         |                             | 0.1840370 | 0.3888866 | 2.9956604     | -0.0920185 ±j | 0.6167814 | 3.3884920  |
|        |         |                             | 0.1034107 | 0.7632323 | 6.0218242     | -0.0517053 ±j | 0.8721002 | 8.4481771  |
|        |         |                             | 0.0321903 | 0.9810232 | 45.0599777    | -0.0160951 ±j | 0.9903354 | 30.7691225 |
| 1.70   | 114.055 | 0.2378674                   | 0.0614816 | 2.9819909 | -0.1189337 ±j | 0.2175692     | 1.0424078 |            |
|        |         |                             | 0.1843752 | 0.3696083 | 3.9311886     | -0.0921876 ±j | 0.6009241 | 3.2973758  |
|        |         |                             | 0.1087365 | 0.7473623 | 8.1360237     | -0.0543682 ±j | 0.8627899 | 7.9504232  |
|        |         |                             | 0.0349946 | 0.9792811 | 62.2665524    | -0.0174973 ±j | 0.9894316 | 28.2782300 |
| 2.00   | 127.570 | 0.2310719                   | 0.0576974 | 4.1367342 | -0.1155359 ±j | 0.2105918     | 1.0395161 |            |
|        |         |                             | 0.1844401 | 0.3536340 | 5.5450630     | -0.0922201 ±j | 0.5874772 | 3.2241970  |
|        |         |                             | 0.1132671 | 0.7336101 | 11.7666735    | -0.0566336 ±j | 0.8546360 | 7.5618607  |
|        |         |                             | 0.0374897 | 0.9777253 | 91.7615329    | -0.0187448 ±j | 0.9886222 | 26.3752450 |

| CASE A |         | Passband Ripple: Ap(dB)=3.0 |           |           |               |               |           |             |
|--------|---------|-----------------------------|-----------|-----------|---------------|---------------|-----------|-------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1            | P1            | Q1        |             |
| 9      | 1.05    | 63.583                      | 0.2408405 | 0.3011050 | 1.1114059     | -0.1204203 ±j | 0.5353540 | 2.2783972   |
|        |         |                             | 0.1097472 | 0.7066193 | 1.2054102     | -0.0548736 ±j | 0.8388136 | 7.6594820   |
|        |         |                             | 0.0388287 | 0.9210167 | 1.5942707     | -0.0194144 ±j | 0.9594998 | 24.7161456  |
|        |         |                             | 0.0091067 | 0.9948278 | 3.9936736     | -0.0045534 ±j | 0.9974002 | 109.5245204 |
|        |         |                             |           |           |               | -0.1645767    |           |             |
| 1.10   | 75.014  | 0.2300684                   | 0.2486420 | 1.2243475 | -0.1150342 ±j | 0.4851898     | 2.1673563 |             |
|        |         |                             | 0.1231045 | 0.6387295 | 1.3703136     | -0.0615522 ±j | 0.7968318 | 6.4920928   |
|        |         |                             | 0.0511146 | 0.8904708 | 1.9377187     | -0.0255573 ±j | 0.9433014 | 18.4614087  |
|        |         |                             | 0.0132968 | 0.9923195 | 5.2992478     | -0.0066484 ±j | 0.9961302 | 74.9167532  |
|        |         |                             |           |           |               | -0.1459708    |           |             |
| 1.15   | 83.245  | 0.2228071                   | 0.2216765 | 1.3416657 | -0.1114036 ±j | 0.4574557     | 2.1131521 |             |
|        |         |                             | 0.1298679 | 0.5987997 | 1.5336053     | -0.0649340 ±j | 0.7710922 | 5.9585267   |
|        |         |                             | 0.0588731 | 0.8703615 | 2.2599957     | -0.0294365 ±j | 0.9324671 | 15.8464961  |
|        |         |                             | 0.0161975 | 0.9905646 | 6.4899114     | -0.0080987 ±j | 0.9952382 | 61.4460261  |
|        |         |                             |           |           |               | -0.1361310    |           |             |
| 1.20   | 89.936  | 0.2175039                   | 0.2045587 | 1.4637563 | -0.1087520 ±j | 0.4390122     | 2.0794181 |             |
|        |         |                             | 0.1340582 | 0.5714361 | 1.6996171     | -0.0670291 ±j | 0.7529563 | 5.6388501   |
|        |         |                             | 0.0644267 | 0.8556083 | 2.5791043     | -0.0322134 ±j | 0.9244299 | 14.3572544  |
|        |         |                             | 0.0183950 | 0.9892271 | 7.6523927     | -0.0091975 ±j | 0.9945564 | 54.0689365  |
|        |         |                             |           |           |               | -0.1297389    |           |             |
| 1.25   | 95.682  | 0.2134254                   | 0.1925350 | 1.5907740 | -0.1067127 ±j | 0.4256141     | 2.0559319 |             |
|        |         |                             | 0.1369281 | 0.5512007 | 1.8699785     | -0.0684640 ±j | 0.7392654 | 5.4220349   |
|        |         |                             | 0.0686617 | 0.8441652 | 2.9015215     | -0.0343308 ±j | 0.9181430 | 13.3813346  |
|        |         |                             | 0.0201396 | 0.9881609 | 8.8171818     | -0.0100698 ±j | 0.9940118 | 49.3585001  |
|        |         |                             |           |           |               | -0.1251649    |           |             |
| 1.30   | 100.772 | 0.2101767                   | 0.1835597 | 1.7227963 | -0.1050883 ±j | 0.4153506     | 2.0384691 |             |
|        |         |                             | 0.1390193 | 0.5355168 | 2.0454918     | -0.0695097 ±j | 0.7284814 | 5.2639452   |
|        |         |                             | 0.0720209 | 0.8349720 | 3.2303598     | -0.0360104 ±j | 0.9130582 | 12.6875475  |
|        |         |                             | 0.0215667 | 0.9872863 | 9.9987492     | -0.0107833 ±j | 0.9935643 | 46.0721744  |
|        |         |                             |           |           |               | -0.1216982    |           |             |
| 1.35   | 105.374 | 0.2075222                   | 0.1765791 | 1.8598680 | -0.1037611 ±j | 0.4072011     | 2.0249069 |             |
|        |         |                             | 0.1406097 | 0.5229606 | 2.2266128     | -0.0703048 ±j | 0.7197345 | 5.1430326   |
|        |         |                             | 0.0747595 | 0.8274018 | 3.5673591     | -0.0373798 ±j | 0.9088479 | 12.1672255  |
|        |         |                             | 0.0227588 | 0.9865540 | 11.2051201    | -0.0113794 ±j | 0.9931891 | 43.6426591  |
|        |         |                             |           |           |               | -0.1189675    |           |             |
| 1.40   | 109.592 | 0.2053107                   | 0.1709856 | 2.0020170 | -0.1026553 ±j | 0.4005589     | 2.0140408 |             |
|        |         |                             | 0.1418579 | 0.5126652 | 2.4136247     | -0.0709289 ±j | 0.7124846 | 5.0473499   |
|        |         |                             | 0.0770385 | 0.8210513 | 3.9135894     | -0.0385192 ±j | 0.9052997 | 11.7618978  |
|        |         |                             | 0.0237708 | 0.9859313 | 12.4412023    | -0.0118854 ±j | 0.9928696 | 41.7714886  |
|        |         |                             |           |           |               | -0.1167557    |           |             |
| 1.45   | 113.500 | 0.2034395                   | 0.1664006 | 2.1492622 | -0.1017198 ±j | 0.3950363     | 2.0051280 |             |
|        |         |                             | 0.1428618 | 0.5040659 | 2.6067151     | -0.0714309 ±j | 0.7063735 | 4.9696696   |
|        |         |                             | 0.0789654 | 0.8156459 | 4.2697534     | -0.0394827 ±j | 0.9022677 | 11.4370512  |
|        |         |                             | 0.0246408 | 0.9853951 | 13.7102067    | -0.0123204 ±j | 0.9925942 | 40.2856655  |
|        |         |                             |           |           |               | -0.1149259    |           |             |
| 1.50   | 117.149 | 0.2018363                   | 0.1625740 | 2.3016164 | -0.1009181 ±j | 0.3903711     | 1.9976819 |             |
|        |         |                             | 0.1436852 | 0.4967760 | 2.8060141     | -0.0718426 ±j | 0.7011523 | 4.9053309   |
|        |         |                             | 0.0806158 | 0.8109899 | 4.6363361     | -0.0403079 ±j | 0.8996472 | 11.1708877  |
|        |         |                             | 0.0253966 | 0.9849287 | 15.0143415    | -0.0126983 ±j | 0.9923545 | 39.0775675  |
|        |         |                             |           |           |               | -0.1133866    |           |             |
| 1.70   | 129.820 | 0.1972214                   | 0.1520480 | 2.9622803 | -0.0986107 ±j | 0.3772584     | 1.9771350 |             |
|        |         |                             | 0.1458739 | 0.4761726 | 3.6668482     | -0.0729369 ±j | 0.6861872 | 4.7304752   |
|        |         |                             | 0.0853656 | 0.7974554 | 6.2125942     | -0.0426828 ±j | 0.8919829 | 10.4609266  |
|        |         |                             | 0.0276273 | 0.9835491 | 20.6082544    | -0.0138137 ±j | 0.9916443 | 35.8970667  |
|        |         |                             |           |           |               | -0.1090903    |           |             |
| 2.00   | 145.024 | 0.1932540                   | 0.1435317 | 4.1074418 | -0.0966270 ±j | 0.3663262     | 1.9604037 |             |
|        |         |                             | 0.1475504 | 0.4588864 | 5.1532091     | -0.0737752 ±j | 0.6733822 | 4.5910507   |
|        |         |                             | 0.0894504 | 0.7856561 | 8.9221914     | -0.0447252 ±j | 0.8852433 | 9.9090911   |
|        |         |                             | 0.0296137 | 0.9823172 | 30.2010593    | -0.0148068 ±j | 0.9910085 | 33.4682755  |
|        |         |                             |           |           |               | -0.1055412    |           |             |

| CASE A |         | Passband Ripple: Ap(dB)=3.0 |           |           |             |               |           |             |
|--------|---------|-----------------------------|-----------|-----------|-------------|---------------|-----------|-------------|
| n      | Ws      | As(dB)                      | A1        | B1        | C1          | P1            | Q1        |             |
| 10     | 1.05    | 71.988                      | 0.2769549 | 0.0871480 | 1.1096718   | -0.1384774 ±j | 0.2607144 | 1.0659078   |
|        |         |                             | 0.1714595 | 0.4531006 | 1.1814619   | -0.0857297 ±j | 0.6676459 | 3.9258694   |
|        |         |                             | 0.0777617 | 0.7764025 | 1.4386640   | -0.0388808 ±j | 0.8802788 | 11.3312493  |
|        |         |                             | 0.0294215 | 0.9376779 | 2.5336482   | -0.0147108 ±j | 0.9682260 | 32.9125433  |
|        |         |                             | 0.0073307 | 0.9957818 | 16.8596102  | -0.0036653 ±j | 0.9978819 | 136.1248385 |
| 1.10   | 84.689  | 84.689                      | 0.2497292 | 0.0693569 | 1.2215638   | -0.1248646 ±j | 0.2318743 | 1.0545699   |
|        |         |                             | 0.1724117 | 0.3861234 | 1.3338339   | -0.0862058 ±j | 0.6153795 | 3.6040963   |
|        |         |                             | 0.0909409 | 0.7159423 | 1.7140833   | -0.0454704 ±j | 0.8449111 | 9.3042172   |
|        |         |                             | 0.0394936 | 0.9125965 | 3.2619424   | -0.0197468 ±j | 0.9550950 | 24.1886982  |
|        |         |                             | 0.0107231 | 0.9937448 | 23.1838025  | -0.0053615 ±j | 0.9968531 | 92.9646290  |
| 1.15   | 93.834  | 93.834                      | 0.2348308 | 0.0606732 | 1.3379528   | -0.1174154 ±j | 0.2165337 | 1.0489227   |
|        |         |                             | 0.1715185 | 0.3501125 | 1.4860346   | -0.0857592 ±j | 0.5854552 | 3.4497917   |
|        |         |                             | 0.0981570 | 0.6792549 | 1.9755745   | -0.0490785 ±j | 0.8227066 | 8.3964378   |
|        |         |                             | 0.0459771 | 0.8959011 | 3.9305495   | -0.0229885 ±j | 0.9462413 | 20.5867858  |
|        |         |                             | 0.0130751 | 0.9923203 | 28.9230322  | -0.0065375 ±j | 0.9961313 | 76.1871798  |
| 1.20   | 101.269 | 101.269                     | 0.2249785 | 0.0553121 | 1.4591581   | -0.1124893 ±j | 0.2065387 | 1.0453671   |
|        |         |                             | 0.1703718 | 0.3266739 | 1.6414311   | -0.0851859 ±j | 0.5651701 | 3.3547460   |
|        |         |                             | 0.1028746 | 0.6536412 | 2.2359899   | -0.0514373 ±j | 0.8068428 | 7.8588990   |
|        |         |                             | 0.0506736 | 0.8835669 | 4.5854918   | -0.0253368 ±j | 0.9396409 | 18.5497528  |
|        |         |                             | 0.0148585 | 0.9912348 | 34.5122486  | -0.0074292 ±j | 0.9955800 | 67.0060054  |
| 1.25   | 107.654 | 107.654                     | 0.2178477 | 0.0516140 | 1.5853042   | -0.1089238 ±j | 0.1993730 | 1.0428716   |
|        |         |                             | 0.1692644 | 0.3099350 | 1.8012990   | -0.0846322 ±j | 0.5502476 | 3.2890442   |
|        |         |                             | 0.1062427 | 0.6344539 | 2.5000000   | -0.0531213 ±j | 0.7947528 | 7.4972348   |
|        |         |                             | 0.0542860 | 0.8739519 | 5.2430274   | -0.0271430 ±j | 0.9344598 | 17.2209074  |
|        |         |                             | 0.0162754 | 0.9903698 | 40.1039839  | -0.0081377 ±j | 0.9951400 | 61.1457927  |
| 1.30   | 113.310 | 113.310                     | 0.2123995 | 0.0488891 | 1.7164539   | -0.1061997 ±j | 0.1939349 | 1.0410050   |
|        |         |                             | 0.1682610 | 0.2972890 | 1.9662686   | -0.0841305 ±j | 0.5387124 | 3.2404539   |
|        |         |                             | 0.1087815 | 0.6194387 | 2.7698611   | -0.0543907 ±j | 0.7851626 | 7.2350950   |
|        |         |                             | 0.0571699 | 0.8661977 | 5.9108926   | -0.0285850 ±j | 0.9302584 | 16.2794940  |
|        |         |                             | 0.0174349 | 0.9896602 | 45.7705353  | -0.0087175 ±j | 0.9947784 | 57.0588986  |
| 1.35   | 118.422 | 118.422                     | 0.2080820 | 0.0467906 | 1.8526432   | -0.1040410 ±j | 0.1896472 | 1.0395484   |
|        |         |                             | 0.1673690 | 0.2873627 | 2.1366988   | -0.0836845 ±j | 0.5294900 | 3.2028756   |
|        |         |                             | 0.1107681 | 0.6073272 | 3.0468391   | -0.0553840 ±j | 0.7773415 | 7.0355291   |
|        |         |                             | 0.0595335 | 0.8597929 | 6.5933849   | -0.0297667 ±j | 0.9267723 | 15.5752779  |
|        |         |                             | 0.0184040 | 0.9890660 | 51.5519660  | -0.0092020 ±j | 0.9944754 | 54.0382400  |
| 1.40   | 123.109 | 123.109                     | 0.2045685 | 0.0451219 | 1.9938949   | -0.1022843 ±j | 0.1861716 | 1.0383770   |
|        |         |                             | 0.1665799 | 0.2793510 | 2.3128131   | -0.0832900 ±j | 0.5219327 | 3.1728708   |
|        |         |                             | 0.1123660 | 0.5973361 | 3.3317143   | -0.0561830 ±j | 0.7708305 | 6.8781935   |
|        |         |                             | 0.0615089 | 0.8544064 | 7.2931353   | -0.0307545 ±j | 0.9238293 | 15.0277568  |
|        |         |                             | 0.0192269 | 0.9885609 | 57.4727614  | -0.0096135 ±j | 0.9942175 | 51.7120039  |
| 1.45   | 127.451 | 127.451                     | 0.2016509 | 0.0437627 | 2.1402240   | -0.1008255 ±j | 0.1832946 | 1.0374130   |
|        |         |                             | 0.1658815 | 0.2727448 | 2.4947597   | -0.0829408 ±j | 0.5156216 | 3.1483299   |
|        |         |                             | 0.1136790 | 0.5889493 | 3.6250000   | -0.0568395 ±j | 0.7653225 | 6.7508535   |
|        |         |                             | 0.0631846 | 0.8498120 | 8.0118665   | -0.0315923 ±j | 0.9213110 | 14.5898274  |
|        |         |                             | 0.0199345 | 0.9881258 | 63.5489356  | -0.0099673 ±j | 0.9939952 | 49.8655493  |
| 1.50   | 131.506 | 131.506                     | 0.1991889 | 0.0426341 | 2.2916411   | -0.0995944 ±j | 0.1808730 | 1.0366055   |
|        |         |                             | 0.1652617 | 0.2672044 | 2.6826414   | -0.0826308 ±j | 0.5102710 | 3.1278766   |
|        |         |                             | 0.1147764 | 0.5818096 | 3.9270510   | -0.0573882 ±j | 0.7606025 | 6.6456565   |
|        |         |                             | 0.0646244 | 0.8458475 | 8.7507642   | -0.0323122 ±j | 0.9191319 | 14.2314717  |
|        |         |                             | 0.0205494 | 0.9877474 | 69.7914985  | -0.0102747 ±j | 0.9938017 | 48.3642911  |
| 1.70   | 145.585 | 145.585                     | 0.1922809 | 0.0395568 | 2.9483149   | -0.0961405 ±j | 0.1741087 | 1.0343666   |
|        |         |                             | 0.1633738 | 0.2518349 | 3.4947482   | -0.0816869 ±j | 0.4951385 | 3.0716779   |
|        |         |                             | 0.1177984 | 0.5614818 | 5.2271136   | -0.0588992 ±j | 0.7470025 | 6.3610447   |
|        |         |                             | 0.0687905 | 0.8342861 | 11.9220243  | -0.0343953 ±j | 0.9127448 | 13.2778877  |
|        |         |                             | 0.0223650 | 0.9866282 | 96.5555666  | -0.0111825 ±j | 0.9932287 | 44.4128438  |
| 2.00   | 162.478 | 162.478                     | 0.1865351 | 0.0370960 | 4.0866858   | -0.0932675 ±j | 0.1685147 | 1.0325314   |
|        |         |                             | 0.1616363 | 0.2392593 | 4.8979715   | -0.0808182 ±j | 0.4824186 | 3.0261854   |
|        |         |                             | 0.1202406 | 0.5442557 | 7.4641016   | -0.0601203 ±j | 0.7352831 | 6.1355038   |
|        |         |                             | 0.0724002 | 0.8241624 | 17.3634536  | -0.0362001 ±j | 0.9071119 | 12.5391055  |
|        |         |                             | 0.0239826 | 0.9856287 | 142.4309671 | -0.0119913 ±j | 0.9927159 | 41.3962179  |

| CASE A |         | Passband Ripple: Ap(dB)=3.0 |           |            |               |               |             |             |
|--------|---------|-----------------------------|-----------|------------|---------------|---------------|-------------|-------------|
| n      | Ws      | As(dB)                      | A1        | B1         | C1            | P1            | Q1          |             |
| 11     | 1.05    | 80.393                      | 0.2174409 | 0.2141385  | 1.1084015     | -0.1087204 ±j | 0.4497982   | 2.1281696   |
|        |         |                             | 0.1243559 | 0.5707445  | 1.1652129     | -0.0621779 ±j | 0.7529133   | 6.0751160   |
|        |         |                             | 0.0575969 | 0.8243670  | 1.3488607     | -0.0287985 ±j | 0.9074898   | 15.7638093  |
|        |         |                             | 0.0231019 | 0.9495165  | 1.9760810     | -0.0115509 ±j | 0.9743629   | 42.1797191  |
|        |         |                             | 0.0060300 | 0.9964959  | 5.6021835     | -0.0030150 ±j | 0.9982419   | 165.5473678 |
|        |         |                             |           |            |               | -0.1342737    |             |             |
| 1.10   | 94.364  | 0.2030019                   | 0.1743977 | 1.2195217  | -0.1015010 ±j | 0.4050868     | 2.0571706   |             |
|        |         | 0.1309759                   | 0.4994220 | 1.3088558  | -0.0654879 ±j | 0.7036571     | 5.3956339   |             |
|        |         | 0.0696397                   | 0.7714366 | 1.5834523  | -0.0348198 ±j | 0.8776242     | 12.6122709  |             |
|        |         | 0.0314789                   | 0.9285979 | 2.4791006  | -0.0157394 ±j | 0.9635093     | 30.6121918  |             |
|        |         | 0.0088328                   | 0.9948093 | 7.5378437  | -0.0044164 ±j | 0.9973915     | 112.9201674 |             |
|        |         |                             |           |            | -0.1191762    |               |             |             |
| 1.15   | 104.424 | 0.1942982                   | 0.1543731 | 1.3352275  | -0.0971491 ±j | 0.3807035     | 2.0221675   |             |
|        |         | 0.1335587                   | 0.4595557 | 1.4533340  | -0.0667794 ±j | 0.6746082     | 5.0757097   |             |
|        |         | 0.0765563                   | 0.7385503 | 1.8085794  | -0.0382781 ±j | 0.8585366     | 11.2255910  |             |
|        |         | 0.0369477                   | 0.9145592 | 2.9446236  | -0.0184739 ±j | 0.9561474     | 25.8832260  |             |
|        |         | 0.0107782                   | 0.9936303 | 9.2991673  | -0.0053891 ±j | 0.9967955     | 92.4838925  |             |
|        |         |                             |           |            | -0.1111813    |               |             |             |
| 1.20   | 112.602 | 0.1882553                   | 0.1417970 | 1.4557817  | -0.0941277 ±j | 0.3646053     | 2.0002594   |             |
|        |         | 0.1348259                   | 0.4330281 | 1.6013465  | -0.0674130 ±j | 0.6545866     | 4.8807282   |             |
|        |         | 0.0812209                   | 0.7152602 | 2.0399626  | -0.0406104 ±j | 0.8447550     | 10.4127258  |             |
|        |         | 0.0409441                   | 0.9041338 | 3.4024453  | -0.0204721 ±j | 0.9506391     | 23.2233455  |             |
|        |         | 0.0122544                   | 0.9927321 | 11.0168385 | -0.0061272 ±j | 0.9963406     | 81.3064080  |             |
|        |         |                             |           |            | -0.1059840    |               |             |             |
| 1.25   | 119.625 | 0.1837460                   | 0.1330252 | 1.5812870  | -0.0918730 ±j | 0.3529654     | 1.9849472   |             |
|        |         | 0.1355134                   | 0.4137992 | 1.7539211  | -0.0677567 ±j | 0.6396938     | 4.7469268   |             |
|        |         | 0.0846286                   | 0.6976387 | 2.2631658  | -0.0423143 ±j | 0.8341751     | 9.8695701   |             |
|        |         | 0.0440368                   | 0.8959766 | 3.8631607  | -0.0220184 ±j | 0.9463043     | 21.4947468  |             |
|        |         | 0.0134277                   | 0.9920163 | 12.7367378 | -0.0067138 ±j | 0.9959775     | 74.1752551  |             |
|        |         |                             |           |            | -0.1022633    |               |             |             |
| 1.30   | 125.847 | 0.1802267                   | 0.1265101 | 1.7117951  | -0.0901133 ±j | 0.3440780     | 1.9735292   |             |
|        |         | 0.1359046                   | 0.3991131 | 1.9115674  | -0.0679523 ±j | 0.6280889     | 4.6485123   |             |
|        |         | 0.0872441                   | 0.6837450 | 2.4979196  | -0.0436220 ±j | 0.8257373     | 9.4778802   |             |
|        |         | 0.0465178                   | 0.8893791 | 4.3318290  | -0.0232589 ±j | 0.9427821     | 20.2733115  |             |
|        |         | 0.0143882                   | 0.9914291 | 14.4806247 | -0.0071941 ±j | 0.9956794     | 69.2030563  |             |
|        |         |                             |           |            | -0.0994425    |               |             |             |
| 1.35   | 131.471 | 0.1773933                   | 0.1214621 | 1.8473359  | -0.0886966 ±j | 0.3370386     | 1.9646414   |             |
|        |         | 0.1361301                   | 0.3874888 | 2.0745762  | -0.0680651 ±j | 0.6187536     | 4.5727277   |             |
|        |         | 0.0893210                   | 0.6724721 | 2.7391978  | -0.0446605 ±j | 0.8188269     | 9.1808648   |             |
|        |         | 0.0485586                   | 0.8839173 | 4.8112671  | -0.0242793 ±j | 0.9398552     | 19.3615235  |             |
|        |         | 0.0151911                   | 0.9909375 | 16.2605612 | -0.0075956 ±j | 0.9954295     | 65.5288722  |             |
|        |         |                             |           |            | -0.0972199    |               |             |             |
| 1.40   | 136.626 | 0.1750592                   | 0.1174293 | 1.9879279  | -0.0875296 ±j | 0.3313124     | 1.9575075   |             |
|        |         | 0.1362577                   | 0.3780439 | 2.2431285  | -0.0681288 ±j | 0.6110665     | 4.5124265   |             |
|        |         | 0.0910123                   | 0.6631285 | 2.9876021  | -0.0455061 ±j | 0.8130545     | 8.9474437   |             |
|        |         | 0.0502694                   | 0.8793154 | 5.3032020  | -0.0251347 ±j | 0.9373812     | 18.6538709  |             |
|        |         | 0.0158732                   | 0.9905195 | 18.0839213 | -0.0079366 ±j | 0.9952168     | 62.7000897  |             |
|        |         |                             |           |            | -0.0954195    |               |             |             |
| 1.45   | 141.403 | 0.1731018                   | 0.1141316 | 2.1335836  | -0.0865509 ±j | 0.3265586     | 1.9516472   |             |
|        |         | 0.1363249                   | 0.3702134 | 2.4173448  | -0.0681624 ±j | 0.6046216     | 4.4632482   |             |
|        |         | 0.0924165                   | 0.6552542 | 3.2435289  | -0.0462083 ±j | 0.8081578     | 8.7590151   |             |
|        |         | 0.0517247                   | 0.8753838 | 5.8087659  | -0.0258624 ±j | 0.9352619     | 18.0884387  |             |
|        |         | 0.0164598                   | 0.9901595 | 19.9555287 | -0.0082299 ±j | 0.9950336     | 60.4545145  |             |
|        |         |                             |           |            | -0.0939297    |               |             |             |
| 1.50   | 145.863 | 0.1714368                   | 0.1113849 | 2.2843118  | -0.0857184 ±j | 0.3225481     | 1.9467449   |             |
|        |         | 0.1363539                   | 0.3636165 | 2.5973085  | -0.0681770 ±j | 0.5991397     | 4.4223608   |             |
|        |         | 0.0936008                   | 0.6485285 | 3.5072526  | -0.0468004 ±j | 0.8039516     | 8.6036926   |             |
|        |         | 0.0529777                   | 0.8719867 | 6.3287388  | -0.0264889 ±j | 0.9334265     | 17.6263138  |             |
|        |         | 0.0169696                   | 0.9898465 | 21.8787000 | -0.0084848 ±j | 0.9948741     | 58.6291168  |             |
|        |         |                             |           |            | -0.0926763    |               |             |             |
| 1.70   | 161.349 | 0.1667016                   | 0.1038550 | 2.9380530  | -0.0833508 ±j | 0.3113000     | 1.9331872   |             |
|        |         | 0.1362984                   | 0.3451723 | 3.3756369  | -0.0681492 ±j | 0.5835478     | 4.3104960   |             |
|        |         | 0.0969161                   | 0.6292674 | 4.6433716  | -0.0484580 ±j | 0.7917823     | 8.1850592   |             |
|        |         | 0.0566177                   | 0.8620564 | 8.5619394  | -0.0283088 ±j | 0.9280383     | 16.3989457  |             |
|        |         | 0.0184754                   | 0.9889204 | 30.1261720 | -0.0092377 ±j | 0.9944019     | 53.8254157  |             |
|        |         |                             |           |            | -0.0891772    |               |             |             |
| 2.00   | 179.932 | 0.1626932                   | 0.0977905 | 4.0714332  | -0.0813466 ±j | 0.3019490     | 1.9221130   |             |
|        |         | 0.1360955                   | 0.3299214 | 4.7212543  | -0.0680477 ±j | 0.5703428     | 4.2204767   |             |
|        |         | 0.0996590                   | 0.6128148 | 6.5999975  | -0.0498295 ±j | 0.7812374     | 7.8550318   |             |
|        |         | 0.0597884                   | 0.8533321 | 12.3963998 | -0.0298942 ±j | 0.9232759     | 15.4504875  |             |
|        |         | 0.0198175                   | 0.9880934 | 44.2665611 | -0.0099088 ±j | 0.9939795     | 50.1590679  |             |
|        |         |                             |           |            | -0.0862859    |               |             |             |

| CASE A |         | Passband Ripple: Ap(dB)=3.0 |           |             |               |               |             |             |
|--------|---------|-----------------------------|-----------|-------------|---------------|---------------|-------------|-------------|
| n      | Ws      | As(dB)                      | A1        | B1          | C1            | P1            | Q1          |             |
| 12     | 1.10    | 104.039                     | 0.2109639 | 0.0485031   | 1.2179786     | -0.1054820 ±j | 0.1933304   | 1.0439425   |
|        |         |                             | 0.1623452 | 0.2892908   | 1.2909254     | -0.0811726 ±j | 0.5316971   | 3.3130490   |
|        |         |                             | 0.1015788 | 0.5882786   | 1.4996665     | -0.0507894 ±j | 0.7653098   | 7.5507227   |
|        |         |                             | 0.0549552 | 0.8123056   | 2.0872157     | -0.0274776 ±j | 0.9008610   | 16.4002739  |
|        |         |                             | 0.0257429 | 0.9405428   | 4.3499304     | -0.0128715 ±j | 0.9697304   | 37.6730763  |
|        |         |                             | 0.0074102 | 0.9956331   | 33.0577896    | -0.0037051 ±j | 0.9978073   | 134.6535248 |
| 1.15   | 115.013 | 0.1979365                   | 0.0423814 | 1.3331670   | -0.0989682 ±j | 0.1805179     | 1.0400683   |             |
|        |         | 0.1586312                   | 0.2594929 | 1.4297858   | -0.0793156 ±j | 0.5031918     | 3.2112512   |             |
|        |         | 0.1058459                   | 0.5479691 | 1.7009576   | -0.0529230 ±j | 0.7383551     | 6.9936515   |             |
|        |         | 0.0613121                   | 0.7831012 | 2.4494590   | -0.0306560 ±j | 0.8843989     | 14.4332154  |             |
|        |         | 0.0303791                   | 0.9285999 | 5.2979222   | -0.0151895 ±j | 0.9635192     | 31.7204867  |             |
|        |         | 0.0090400                   | 0.9946345 | 41.3060302  | -0.0045200 ±j | 0.9973034     | 110.3225164 |             |
| 1.20   | 123.936 | 0.1893654                   | 0.0386084 | 1.4532283   | -0.0946827 ±j | 0.1721731     | 1.0376245   |             |
|        |         | 0.1557541                   | 0.2404123 | 1.5724303   | -0.0778770 ±j | 0.4840945     | 3.1480303   |             |
|        |         | 0.1083814                   | 0.5206424 | 1.9034206   | -0.0541907 ±j | 0.7195177     | 6.6575569   |             |
|        |         | 0.0656933                   | 0.7621849 | 2.8072245   | -0.0328467 ±j | 0.8724139     | 13.2895127  |             |
|        |         | 0.0338142                   | 0.9196924 | 6.2244021   | -0.0169071 ±j | 0.9588569     | 28.3610029  |             |
|        |         | 0.0102833                   | 0.9938809 | 49.3373729  | -0.0051416 ±j | 0.9969225     | 96.9473856  |             |
| 1.25   | 131.597 | 0.1831820                   | 0.0360087 | 1.5782485   | -0.0915910 ±j | 0.1661920     | 1.0359072   |             |
|        |         | 0.1534671                   | 0.2269323 | 1.7197065   | -0.0767335 ±j | 0.4701534     | 3.1040806   |             |
|        |         | 0.1100592                   | 0.5005816 | 2.1098820   | -0.0550296 ±j | 0.7053746     | 6.4285185   |             |
|        |         | 0.0689423                   | 0.7462370 | 3.1681544   | -0.0344711 ±j | 0.8631621     | 12.5300454  |             |
|        |         | 0.0364680                   | 0.9127052 | 7.1532769   | -0.0182340 ±j | 0.9551820     | 26.1970877  |             |
|        |         | 0.0112682                   | 0.9932757 | 57.3715316  | -0.0056341 ±j | 0.9966162     | 88.4461357  |             |
| 1.30   | 138.384 | 0.1784684                   | 0.0340946 | 1.7082709   | -0.0892342 ±j | 0.1616536     | 1.0346216   |             |
|        |         | 0.1516056                   | 0.2168277 | 1.8720353   | -0.0758028 ±j | 0.4594362     | 3.0714399   |             |
|        |         | 0.1112460                   | 0.4851164 | 2.3217202   | -0.0556230 ±j | 0.6942784     | 6.2609264   |             |
|        |         | 0.0714675                   | 0.7335868 | 3.5359122   | -0.0357337 ±j | 0.8557511     | 11.9844306  |             |
|        |         | 0.0386221                   | 0.9070394 | 8.0959007   | -0.0193110 ±j | 0.9521904     | 24.6591031  |             |
|        |         | 0.0120784                   | 0.9927841 | 65.5126430  | -0.0060392 ±j | 0.9963672     | 82.4931681  |             |
| 1.35   | 144.519 | 0.1747395                   | 0.0326213 | 1.8433207   | -0.0873697 ±j | 0.1580755     | 1.0336177   |             |
|        |         | 0.1500612                   | 0.2089435 | 2.0296574   | -0.0750306 ±j | 0.4509034     | 3.0461133   |             |
|        |         | 0.1121250                   | 0.4727865 | 2.5397132   | -0.0560625 ±j | 0.6853054     | 6.1323934   |             |
|        |         | 0.0734908                   | 0.7232765 | 3.9125428   | -0.0367454 ±j | 0.8496625     | 11.5722945  |             |
|        |         | 0.0403845                   | 0.9023425 | 9.0585736   | -0.0201922 ±j | 0.9497025     | 23.5218458  |             |
|        |         | 0.0127529                   | 0.9923685 | 73.8184125  | -0.0063765 ±j | 0.9961565     | 78.1136932  |             |
| 1.40   | 150.143 | 0.1717090                   | 0.0314504 | 1.9834134   | -0.0858545 ±j | 0.1551756     | 1.0328098   |             |
|        |         | 0.1487595                   | 0.2026099 | 2.1927230   | -0.0743798 ±j | 0.4439342     | 3.0258368   |             |
|        |         | 0.1127988                   | 0.4627102 | 2.7643424   | -0.0563994 ±j | 0.6778859     | 6.0304556   |             |
|        |         | 0.0751520                   | 0.7146979 | 4.2993023   | -0.0375760 ±j | 0.8445626     | 11.2491787  |             |
|        |         | 0.0418711                   | 0.8983786 | 10.0451492  | -0.0209356 ±j | 0.9475971     | 22.6368148  |             |
|        |         | 0.0133271                   | 0.9920167 | 82.3241078  | -0.0066636 ±j | 0.9959781     | 74.7347999  |             |
| 1.45   | 155.354 | 0.1691951                   | 0.0304970 | 2.1285596   | -0.0845976 ±j | 0.1527751     | 1.0321447   |             |
|        |         | 0.1476483                   | 0.1974075 | 2.3613317   | -0.0738241 ±j | 0.4381295     | 3.0092159   |             |
|        |         | 0.1133291                   | 0.4543166 | 2.9959256   | -0.0566646 ±j | 0.6716440     | 5.9475461   |             |
|        |         | 0.0765406                   | 0.7074455 | 4.6970152   | -0.0382703 ±j | 0.8402267     | 10.9889090  |             |
|        |         | 0.0431387                   | 0.8949879 | 11.0581496  | -0.0215694 ±j | 0.9457921     | 21.9301227  |             |
|        |         | 0.0138212                   | 0.9917140 | 91.0527944  | -0.0069106 ±j | 0.9958244     | 72.0523122  |             |
| 1.50   | 160.220 | 0.1670756                   | 0.0297056 | 2.2787664   | -0.0835378 ±j | 0.1507548     | 1.0315874   |             |
|        |         | 0.1466893                   | 0.1930582 | 2.5355530   | -0.0733446 ±j | 0.4332191     | 2.9953376   |             |
|        |         | 0.1137556                   | 0.4472171 | 3.2346828   | -0.0568778 ±j | 0.6663198     | 5.8787713   |             |
|        |         | 0.0777184                   | 0.7012348 | 5.1062498   | -0.0388592 ±j | 0.8364955     | 10.7747606  |             |
|        |         | 0.0442320                   | 0.8920553 | 12.0993095  | -0.0221160 ±j | 0.9442278     | 21.3530276  |             |
|        |         | 0.0142506                   | 0.9914507 | 100.0203299 | -0.0071253 ±j | 0.9956907     | 69.8718878  |             |
| 1.70   | 177.114 | 0.1611375                   | 0.0275488 | 2.9302881   | -0.0805687 ±j | 0.1451119     | 1.0300411   |             |
|        |         | 0.1438955                   | 0.1810590 | 3.2893923   | -0.0719477 ±j | 0.4193835     | 2.9570794   |             |
|        |         | 0.1148458                   | 0.4272308 | 4.2640673   | -0.0574229 ±j | 0.6511017     | 5.6913609   |             |
|        |         | 0.0810497                   | 0.6833649 | 6.8651328   | -0.0405249 ±j | 0.8256650     | 10.1994053  |             |
|        |         | 0.0474172                   | 0.8834666 | 16.5660270  | -0.0237086 ±j | 0.9396300     | 19.8225491  |             |
|        |         | 0.0155193                   | 0.9906718 | 138.4661013 | -0.0077597 ±j | 0.9952947     | 64.1346520  |             |
| 2.00   | 197.385 | 0.1562079                   | 0.0258252 | 4.0598914   | -0.0781039 ±j | 0.1404458     | 1.0287724   |             |
|        |         | 0.1414571                   | 0.1713124 | 4.5932605   | -0.0707286 ±j | 0.4078111     | 2.9259688   |             |
|        |         | 0.1156286                   | 0.4105505 | 6.0382667   | -0.0578143 ±j | 0.6381285     | 5.5413789   |             |
|        |         | 0.0838461                   | 0.6680030 | 9.8873550   | -0.0419231 ±j | 0.8162386     | 9.7477893   |             |
|        |         | 0.0502029                   | 0.8759017 | 24.2272012  | -0.0251015 ±j | 0.9355595     | 18.6422680  |             |
|        |         | 0.0166505                   | 0.9899763 | 204.3626509 | -0.0083252 ±j | 0.9949407     | 59.7566443  |             |

## APPENDIX II

## TABLES OF IMPORTANT PARAMETERS FOR PASSIVE REALIZATIONS

$$H(s) = \frac{\prod_{i=1}^{n/2} (s^2 + c_i)}{s^n + \sum_{j=0}^{n-1} A_j s^j}$$

example for  $n = 12$

$$H(s) = \frac{\prod_{i=1}^6 (s^2 + c_i)}{A_0 + A_1 s^1 + A_2 s^2 + \dots + A_{11} s^{11} + s^{12}}$$

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.1$ |           |                 |                 |           |          |          |  |
|--------|------|---------------------------------------|-----------|-----------------|-----------------|-----------|----------|----------|--|
| n      | Ws   | As(dB)                                | C1        | AO<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8 | A4<br>A9 |  |
| 2      | 1.05 | 0.343                                 | 1.4386640 | 1.3990303       | 0.1508135       |           |          |          |  |
|        | 1.10 | 0.559                                 | 1.7140833 | 1.6258769       | 0.2589655       |           |          |          |  |
|        | 1.15 | 0.802                                 | 1.9755745 | 1.8221534       | 0.3656858       |           |          |          |  |
|        | 1.20 | 1.075                                 | 2.2359899 | 1.9986240       | 0.4725369       |           |          |          |  |
|        | 1.25 | 1.376                                 | 2.5000000 | 2.1585102       | 0.5789248       |           |          |          |  |
|        | 1.30 | 1.703                                 | 2.7698611 | 2.3031394       | 0.6837765       |           |          |          |  |
|        | 1.35 | 2.053                                 | 3.0468391 | 2.4333244       | 0.7859884       |           |          |          |  |
|        | 1.40 | 2.423                                 | 3.3317143 | 2.5498094       | 0.8845975       |           |          |          |  |
|        | 1.45 | 2.810                                 | 3.6250000 | 2.6534120       | 0.9788494       |           |          |          |  |
|        | 1.50 | 3.210                                 | 3.9270510 | 2.7450465       | 1.0682132       |           |          |          |  |
|        | 1.70 | 4.888                                 | 5.2271136 | 3.0119431       | 1.3729001       |           |          |          |  |
|        | 2.00 | 7.418                                 | 7.4641016 | 3.2140923       | 1.6868869       |           |          |          |  |
| 3      | 1.05 | 1.748                                 | 1.2054102 | 3.2826436       | 1.4193116       | 2.9026725 |          |          |  |
|        | 1.10 | 3.374                                 | 1.3703136 | 2.8365346       | 1.6486700       | 2.4116751 |          |          |  |
|        | 1.15 | 5.051                                 | 1.5336053 | 2.5921873       | 1.8151308       | 2.1823237 |          |          |  |
|        | 1.20 | 6.691                                 | 1.6996171 | 2.4314215       | 1.9409141       | 2.0576345 |          |          |  |
|        | 1.25 | 8.257                                 | 1.8699785 | 2.3157600       | 2.0383593       | 1.9847374 |          |          |  |
|        | 1.30 | 9.736                                 | 2.0454918 | 2.2279031       | 2.1154296       | 1.9402969 |          |          |  |
|        | 1.35 | 11.129                                | 2.2266128 | 2.1586510       | 2.1775020       | 1.9125572 |          |          |  |
|        | 1.40 | 12.440                                | 2.4136247 | 2.1025673       | 2.2283019       | 1.8950853 |          |          |  |
|        | 1.45 | 13.678                                | 2.6067151 | 2.0561950       | 2.2704672       | 1.8841468 |          |          |  |
|        | 1.50 | 14.848                                | 2.8060141 | 2.0172142       | 2.3059033       | 1.8774745 |          |          |  |
|        | 1.70 | 18.981                                | 3.6668482 | 1.9086453       | 2.4037107       | 1.8713820 |          |          |  |
|        | 2.00 | 24.010                                | 5.1532091 | 1.8193306       | 2.4820002       | 1.8804820 |          |          |  |



| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.1$ |                         |                 |                 |           |           |           |
|--------|------|---------------------------------------|-------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)                                | C1                      | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 4      | 1.05 | 6.397                                 | 1.1536336<br>3.3125181  | 1.8508723       | 1.4822580       | 2.8780944 | 1.3123483 |           |
|        | 1.10 | 10.721                                | 1.2909254<br>4.3499304  | 1.6533079       | 1.7995999       | 2.7778503 | 1.5410995 |           |
|        | 1.15 | 14.161                                | 1.4297858<br>5.2979222  | 1.5007513       | 1.9262981       | 2.7126026 | 1.6278833 |           |
|        | 1.20 | 17.051                                | 1.5724303<br>6.2244021  | 1.3903317       | 1.9870989       | 2.6737129 | 1.6706022 |           |
|        | 1.25 | 19.566                                | 1.7197065<br>7.1532769  | 1.3081425       | 2.0194457       | 2.6499280 | 1.6954720 |           |
|        | 1.30 | 21.809                                | 1.8720353<br>8.0959007  | 1.2449302       | 2.0376979       | 2.6349413 | 1.7117453 |           |
|        | 1.35 | 23.843                                | 2.0296574<br>9.0585736  | 1.1949278       | 2.0483009       | 2.6252879 | 1.7233279 |           |
|        | 1.40 | 25.711                                | 2.1927230<br>10.0451492 | 1.1544513       | 2.0544804       | 2.6189895 | 1.7320941 |           |
|        | 1.45 | 27.444                                | 2.3613317<br>11.0581496 | 1.1210588       | 2.0579838       | 2.6148676 | 1.7390361 |           |
|        | 1.50 | 29.064                                | 2.5355530<br>12.0993095 | 1.0930740       | 2.0598156       | 2.6121931 | 1.7447219 |           |
|        | 1.70 | 34.691                                | 3.2893923<br>16.5660270 | 1.0157230       | 2.0596223       | 2.6087141 | 1.7602812 |           |
|        | 2.00 | 41.447                                | 4.5932605<br>24.2272012 | 0.9529442       | 2.0536782       | 2.6104006 | 1.7733949 |           |
| 5      | 1.05 | 13.841                                | 1.1334220<br>1.7737385  | 1.3173786       | 1.8794136       | 3.1068870 | 2.8637647 | 1.7228909 |
|        | 1.10 | 20.050                                | 1.2593204<br>2.1930925  | 1.0268282       | 1.8610135       | 2.8331899 | 2.8724522 | 1.6905622 |
|        | 1.15 | 24.594                                | 1.3881033<br>2.5834170  | 0.8819766       | 1.8191524       | 2.7180069 | 2.8604930 | 1.6888340 |
|        | 1.20 | 28.303                                | 1.5211268<br>2.9683674  | 0.7920082       | 1.7790993       | 2.6525514 | 2.8478775 | 1.6920281 |
|        | 1.25 | 31.492                                | 1.6589139<br>3.3563960  | 0.7298733       | 1.7441199       | 2.6096131 | 2.8371192 | 1.6960545 |
|        | 1.30 | 34.318                                | 1.8017262<br>3.7515494  | 0.6841206       | 1.7141007       | 2.5789528 | 2.8282915 | 1.6999668 |
|        | 1.35 | 36.874                                | 1.9497131<br>4.1560845  | 0.6489359       | 1.6883405       | 2.5558028 | 2.8210744 | 1.7035343 |
|        | 1.40 | 39.217                                | 2.1029685<br>4.5713865  | 0.6210105       | 1.6661237       | 2.5376220 | 2.8151372 | 1.7067243 |
|        | 1.45 | 41.388                                | 2.2615546<br>4.9983644  | 0.5983059       | 1.6468385       | 2.5229221 | 2.8102081 | 1.7095619 |
|        | 1.50 | 43.415                                | 2.4255147<br>5.4376446  | 0.5794907       | 1.6299865       | 2.5107678 | 2.8060759 | 1.7120870 |
|        | 1.70 | 50.454                                | 3.1356145<br>7.3252003  | 0.5283935       | 1.5799664       | 2.4776835 | 2.7947947 | 1.7198032 |
|        | 2.00 | 58.901                                | 4.3649509<br>10.5677323 | 0.4878087       | 1.5354162       | 2.4510161 | 2.7860096 | 1.7269419 |

| CASE A |      |        | Passband Ripple: $A_p(\text{dB})=0.1$ |                        |                        |           |           |           |
|--------|------|--------|---------------------------------------|------------------------|------------------------|-----------|-----------|-----------|
| n      | Ws   | As(dB) | C1                                    | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 6      | 1.05 | 22.088 | 1.1233258<br>1.4386640<br>6.5287683   | 0.8392283<br>1.6438454 | 1.6283790              | 3.1630762 | 3.2929301 | 3.3121327 |
|        | 1.10 | 29.686 | 1.2433620<br>1.7140833<br>8.8264550   | 0.6238700<br>1.6623683 | 1.4933439              | 2.8406868 | 3.2000684 | 3.2086207 |
|        | 1.15 | 35.170 | 1.3669587<br>1.9755745<br>10.9158033  | 0.5200006<br>1.6701375 | 1.3960384              | 2.6771018 | 3.1287922 | 3.1565372 |
|        | 1.20 | 39.630 | 1.4950350<br>2.2359899<br>12.9526713  | 0.4570573<br>1.6753046 | 1.3244238              | 2.5724406 | 3.0765169 | 3.1233245 |
|        | 1.25 | 43.461 | 1.6279471<br>2.5000000<br>14.9917591  | 0.4143857<br>1.6792656 | 1.2695372              | 2.4978820 | 3.0368175 | 3.0997739 |
|        | 1.30 | 46.854 | 1.7658735<br>2.7698611<br>17.0590037  | 0.3834173<br>1.6824837 | 1.2260969              | 2.4413577 | 3.0056638 | 3.0820272 |
|        | 1.35 | 49.921 | 1.9089166<br>3.0468391<br>19.1687817  | 0.3598792<br>1.6851787 | 1.1908514              | 2.3967258 | 2.9805639 | 3.0681100 |
|        | 1.40 | 52.734 | 2.0571405<br>3.3317143<br>21.3298812  | 0.3413770<br>1.6874790 | 1.1616887              | 2.3604547 | 2.9599125 | 3.0568809 |
|        | 1.45 | 55.339 | 2.2105880<br>3.6250000<br>23.5480505  | 0.3264555<br>1.6894689 | 1.1371735              | 2.3303366 | 2.9426300 | 3.0476237 |
|        | 1.50 | 57.772 | 2.3692888<br>3.9270510<br>25.8272420  | 0.3141753<br>1.6912081 | 1.1162937              | 2.3049046 | 2.9279631 | 3.0398618 |
|        | 1.70 | 66.219 | 3.0569811<br>5.2271136<br>35.6008780  | 0.2812324<br>1.6964059 | 1.0568918              | 2.2333477 | 2.8864711 | 3.0183479 |
|        | 2.00 | 76.355 | 4.2481552<br>7.4641016<br>52.3568408  | 0.2555148<br>1.7011213 | 1.0067351              | 2.1734427 | 2.8516516 | 3.0007906 |
| 7      | 1.05 | 30.470 | 1.1175213<br>1.3083409<br>2.7143721   | 0.5256577<br>3.5962978 | 1.3811997<br>1.6550949 | 2.7719513 | 3.9831911 | 3.9074600 |
|        | 1.10 | 39.357 | 1.2341277<br>1.5239435<br>3.5147693   | 0.3708066<br>3.4943247 | 1.1739773<br>1.6596350 | 2.4108457 | 3.6754970 | 3.7156318 |
|        | 1.15 | 45.758 | 1.3546897<br>1.7321918<br>4.2484927   | 0.2996947<br>3.4346941 | 1.0522389<br>1.6638132 | 2.2221983 | 3.4933227 | 3.6111629 |
|        | 1.20 | 50.963 | 1.4798722<br>1.9413408<br>4.9666973   | 0.2577848<br>3.3943023 | 0.9701640<br>1.6671665 | 2.0995351 | 3.3690654 | 3.5413388 |
|        | 1.25 | 55.432 | 1.6099341<br>2.1544332<br>5.6874343   | 0.2299221<br>3.3647240 | 0.9104999<br>1.6698971 | 2.0114479 | 3.2776346 | 3.4902625 |
|        | 1.30 | 59.391 | 1.7450051<br>2.3729509<br>6.4192876   | 0.2100001<br>3.3419787 | 0.8649737<br>1.6721656 | 1.9444241 | 3.2070566 | 3.4508895 |
|        | 1.35 | 62.970 | 1.8851599<br>2.5977295<br>7.1670237   | 0.1950365<br>3.3238854 | 0.8290280<br>1.6740821 | 1.8914367 | 3.1507309 | 3.4194608 |
|        | 1.40 | 66.251 | 2.0304452<br>2.8292857<br>7.9335602   | 0.1833884<br>3.3091278 | 0.7999111<br>1.6757233 | 1.8483803 | 3.1046581 | 3.3937329 |
|        | 1.45 | 69.290 | 2.1808921<br>3.0679607<br>8.7208069   | 0.1740708<br>3.2968559 | 0.7758500<br>1.6771444 | 1.8126589 | 3.0662464 | 3.3722631 |
|        | 1.50 | 72.129 | 2.3365223<br>3.3139902<br>9.5300781   | 0.1664555<br>3.2864917 | 0.7556445<br>1.6783862 | 1.7825338 | 3.0337298 | 3.3540711 |
|        | 1.70 | 81.984 | 3.0111362<br>4.3744590<br>13.0029293  | 0.1462761<br>3.2573968 | 0.6995367<br>1.6820914 | 1.6980764 | 2.9420208 | 3.3026672 |
|        | 2.00 | 93.809 | 4.1800429<br>6.2017764<br>18.9610948  | 0.1307924<br>3.2332162 | 0.6536625<br>1.6854397 | 1.6278775 | 2.8652315 | 3.2595117 |

| CASE A |         | Passband Ripple: $A_p(\text{dB})=0.1$ |            |                 |                 |           |           |           |
|--------|---------|---------------------------------------|------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB)                                | C1         | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 8      | 1.05    | 38.872                                | 1.1138641  | 0.3358501       | 1.0486930       | 2.5039998 | 3.8032933 | 5.0890238 |
|        |         |                                       | 1.2431181  | 4.4066905       | 3.9184926       | 1.6504301 |           |           |
|        |         |                                       | 1.9061395  |                 |                 |           |           |           |
|        | 1.10    | 49.032                                | 11.0466061 |                 |                 |           |           |           |
|        |         |                                       | 1.2282855  | 0.2254050       | 0.8389576       | 2.0875131 | 3.3808524 | 4.6580089 |
|        |         |                                       | 1.4271032  | 4.2028097       | 3.7918748       | 1.6554480 |           |           |
|        | 1.15    | 56.348                                | 2.3804113  |                 |                 |           |           |           |
|        |         |                                       | 15.1062239 |                 |                 |           |           |           |
|        |         |                                       | 1.3469136  | 0.1767207       | 0.7256028       | 1.8704546 | 3.1415252 | 4.4183747 |
|        | 1.20    | 62.296                                | 1.6072975  | 4.0841548       | 3.7199360       | 1.6588356 |           |           |
|        |         |                                       | 2.8200771  |                 |                 |           |           |           |
|        |         |                                       | 18.7925269 |                 |                 |           |           |           |
|        | 1.25    | 67.403                                | 1.4702527  | 0.1487716       | 0.6526251       | 1.7307275 | 2.9814880 | 4.2581046 |
|        |         |                                       | 1.7895085  | 4.0033220       | 3.6713308       | 1.6614315 |           |           |
|        |         |                                       | 3.2528314  |                 |                 |           |           |           |
|        | 1.30    | 71.928                                | 22.3835994 |                 |                 |           |           |           |
|        |         |                                       | 1.5984994  | 0.1305410       | 0.6011960       | 1.6314581 | 2.8651181 | 4.1411916 |
|        |         |                                       | 1.9759013  | 3.9437170       | 3.6356660       | 1.6635165 |           |           |
|        | 1.35    | 76.018                                | 3.6885364  |                 |                 |           |           |           |
|        |         |                                       | 25.9769795 |                 |                 |           |           |           |
|        |         |                                       | 1.7317524  | 0.1176962       | 0.5628405       | 1.5566774 | 2.7760188 | 4.0513583 |
|        | 1.40    | 79.768                                | 2.1675370  | 3.8975773       | 3.6081590       | 1.6652383 |           |           |
|        |         |                                       | 4.1319051  |                 |                 |           |           |           |
|        |         |                                       | 29.6189023 |                 |                 |           |           |           |
|        | 1.45    | 83.242                                | 1.8700686  | 0.1081615       | 0.5330887       | 1.4980847 | 2.7053433 | 3.9798658 |
|        |         |                                       | 2.3650162  | 3.8606543       | 3.5862121       | 1.6666882 |           |           |
|        |         |                                       | 4.5855625  |                 |                 |           |           |           |
|        | 1.50    | 86.485                                | 33.3349904 |                 |                 |           |           |           |
|        |         |                                       | 2.0134836  | 0.1008110       | 0.5093301       | 1.4508499 | 2.6478086 | 3.9214958 |
|        |         |                                       | 2.5687116  | 3.8303780       | 3.5682613       | 1.6679270 |           |           |
|        | 1.55    | 89.748                                | 5.0511190  |                 |                 |           |           |           |
|        |         |                                       | 37.1409040 |                 |                 |           |           |           |
|        |         |                                       | 2.1620209  | 0.0949789       | 0.4899258       | 1.4119358 | 2.6000275 | 3.8728972 |
|        | 1.60    | 93.000                                | 2.7788694  | 3.8050817       | 3.5532959       | 1.6689979 |           |           |
|        |         |                                       | 5.5296305  |                 |                 |           |           |           |
|        |         |                                       | 41.0468858 |                 |                 |           |           |           |
|        | 1.65    | 96.250                                | 2.3156973  | 0.0902452       | 0.4737905       | 1.3793214 | 2.5597108 | 3.8317990 |
|        |         |                                       | 2.9956604  | 3.7836274       | 3.5406279       | 1.6699326 |           |           |
|        |         |                                       | 6.0218242  |                 |                 |           |           |           |
|        | 1.70    | 99.500                                | 45.0599777 |                 |                 |           |           |           |
|        |         |                                       | 2.9819909  | 0.0778541       | 0.4297489       | 1.2889419 | 2.4466521 | 3.7160767 |
|        |         |                                       | 3.9311886  | 3.7229154       | 3.5049091       | 1.6727149 |           |           |
|        | 1.75    | 102.250                               | 8.1360237  |                 |                 |           |           |           |
|        |         |                                       | 62.2665524 |                 |                 |           |           |           |
|        |         |                                       | 4.1367342  | 0.0685092       | 0.3945769       | 1.2150918 | 2.3527332 | 3.6193855 |
| 2.00   | 111.263 |                                       | 5.5450630  | 3.6718500       | 3.4750269       | 1.6752216 |           |           |
|        |         |                                       | 11.7666735 |                 |                 |           |           |           |
|        |         |                                       | 91.7615329 |                 |                 |           |           |           |

| CASE A |         |            | Passband Ripple: Ap(dB)=0.1 |                 |                 |           |           |           |
|--------|---------|------------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB)     | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 9      | 1.05    | 47.276     | 1.1114059                   | 0.2097217       | 0.8052803       | 2.0212570 | 3.8129189 | 5.0952303 |
|        |         |            | 1.2054102                   | 6.2421797       | 4.9331745       | 4.2336177 | 1.6490642 |           |
|        |         |            | 1.5942707                   |                 |                 |           |           |           |
|        |         |            | 3.9936736                   |                 |                 |           |           |           |
|        | 1.10    | 58.707     | 1.2243475                   | 0.1339013       | 0.6063457       | 1.6164996 | 3.2336818 | 4.5243046 |
|        |         |            | 1.3703136                   | 5.7190930       | 4.6962446       | 4.0898268 | 1.6527468 |           |
|        |         |            | 1.9377187                   |                 |                 |           |           |           |
|        |         |            | 5.2992478                   |                 |                 |           |           |           |
|        | 1.15    | 66.937     | 1.3416657                   | 0.1018349       | 0.5060322       | 1.4098819 | 2.9204721 | 4.2093839 |
|        |         |            | 1.5336053                   | 5.4242269       | 4.5601471       | 4.0071717 | 1.6553909 |           |
|        |         |            | 2.2599957                   |                 |                 |           |           |           |
|        |         |            | 6.4899114                   |                 |                 |           |           |           |
| 1.20   | 73.629  | 1.4637563  | 0.0839041                   | 0.4439832       | 1.2791656       | 2.7163412 | 4.0003653 |           |
|        |         | 1.6996171  | 5.2264665                   | 4.4675739       | 3.9510614       | 1.6574276 |           |           |
|        |         | 2.5791043  |                             |                 |                 |           |           |           |
|        |         | 7.6523927  |                             |                 |                 |           |           |           |
| 1.25   | 79.375  | 1.5907740  | 0.0724291                   | 0.4014441       | 1.1876117       | 2.5705000 | 3.8488468 |           |
|        |         | 1.8699785  | 5.0821214                   | 4.3992993       | 3.9097632       | 1.6590629 |           |           |
|        |         | 2.9015215  |                             |                 |                 |           |           |           |
|        |         | 8.8171818  |                             |                 |                 |           |           |           |
| 1.30   | 84.465  | 1.7227963  | 0.0644623                   | 0.3703649       | 1.1194520       | 2.4603055 | 3.7330192 |           |
|        |         | 2.0454918  | 4.9712149                   | 4.3464217       | 3.8778370       | 1.6604120 |           |           |
|        |         | 3.2303598  |                             |                 |                 |           |           |           |
|        |         | 9.9987492  |                             |                 |                 |           |           |           |
| 1.35   | 89.067  | 1.8598680  | 0.0586178                   | 0.3466429       | 1.0665731       | 2.3738091 | 3.6412296 |           |
|        |         | 2.2266128  | 4.8829729                   | 4.3040838       | 3.8523156       | 1.6615466 |           |           |
|        |         | 3.5673591  |                             |                 |                 |           |           |           |
|        |         | 11.2051201 |                             |                 |                 |           |           |           |
| 1.40   | 93.285  | 2.0020170  | 0.0541557                   | 0.3279448       | 1.0243014       | 2.3039971 | 3.5665544 |           |
|        |         | 2.4136247  | 4.8109495                   | 4.2693499       | 3.8314076       | 1.6625151 |           |           |
|        |         | 3.9135894  |                             |                 |                 |           |           |           |
|        |         | 12.4412023 |                             |                 |                 |           |           |           |
| 1.45   | 97.193  | 2.1492622  | 0.0506440                   | 0.3128377       | 0.9897266       | 2.2464350 | 3.5045675 |           |
|        |         | 2.6067151  | 4.7510013                   | 4.2403164       | 3.8139528       | 1.6633516 |           |           |
|        |         | 4.2697534  |                             |                 |                 |           |           |           |
|        |         | 13.7102067 |                             |                 |                 |           |           |           |
| 1.50   | 100.842 | 2.3016164  | 0.0478134                   | 0.3003894       | 0.9609298       | 2.1981615 | 3.4522834 |           |
|        |         | 2.8060141  | 4.7003201                   | 4.2156830       | 3.7991598       | 1.6640812 |           |           |
|        |         | 4.6363361  |                             |                 |                 |           |           |           |
|        |         | 15.0143415 |                             |                 |                 |           |           |           |
| 1.70   | 113.513 | 2.9622803  | 0.0404939                   | 0.2669485       | 0.8820334       | 2.0642613 | 3.3057536 |           |
|        |         | 3.6668482  | 4.5576983                   | 4.1459245       | 3.7573560       | 1.6662498 |           |           |
|        |         | 6.2125942  |                             |                 |                 |           |           |           |
|        |         | 20.6082544 |                             |                 |                 |           |           |           |
| 2.00   | 128.717 | 4.1074418  | 0.0350683                   | 0.2408237       | 0.8186105       | 1.9547206 | 3.1841290 |           |
|        |         | 5.1532091  | 4.4386404                   | 4.0871907       | 3.7222689       | 1.6681998 |           |           |
|        |         | 8.9221914  |                             |                 |                 |           |           |           |
|        |         | 30.2010593 |                             |                 |                 |           |           |           |

| CASE A |      |         | Passband Ripple: Ap(dB)=0.1                                      |                        |                        |                        |                        |                        |  |
|--------|------|---------|------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|--|
| n      | Ws   | As(dB)  | C1                                                               | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9               |  |
| 10     | 1.05 | 55.681  | 1.1096718<br>1.1814619<br>1.4386640<br>2.5336482<br>16.8596102   | 0.1340023<br>6.5256930 | 0.5773158<br>7.5111394 | 1.6869096<br>5.4541373 | 3.2966539<br>4.5510758 | 5.5126291<br>1.6476934 |  |
|        | 1.10 | 68.382  | 1.2215638<br>1.3338339<br>1.7140833<br>3.2619424<br>23.1838025   | 0.0813961<br>5.8117222 | 0.4114497<br>6.8739883 | 1.2859255<br>5.1895986 | 2.6848607<br>4.3892021 | 4.6884609<br>1.6507284 |  |
|        | 1.15 | 77.527  | 1.3379528<br>1.4860346<br>1.9755745<br>3.9305495<br>28.9230322   | 0.0600490<br>5.4153456 | 0.3322441<br>6.5163390 | 1.0880620<br>5.0369345 | 2.3647254<br>4.2960112 | 4.2470484<br>1.6528706 |  |
|        | 1.20 | 84.962  | 1.4591581<br>1.6414311<br>2.2359899<br>4.5854918<br>34.5122486   | 0.0484223<br>5.1519431 | 0.2848414<br>6.2767660 | 0.9659046<br>4.9329401 | 2.1602490<br>4.2326325 | 3.9599799<br>1.6545153 |  |
|        | 1.25 | 91.347  | 1.5853042<br>1.8012990<br>2.5000000<br>5.2430274<br>40.1039839   | 0.0411225<br>4.9609521 | 0.2530915<br>6.1020167 | 0.8819289<br>4.8561773 | 2.0162723<br>4.1859132 | 3.7550105<br>1.6558335 |  |
|        | 1.30 | 97.002  | 1.7164539<br>1.9662686<br>2.7698611<br>5.9108926<br>45.7705353   | 0.0361284<br>4.8149512 | 0.2303009<br>5.9678112 | 0.8203325<br>4.7966907 | 1.9087056<br>4.1497505 | 3.6001646<br>1.6569197 |  |
|        | 1.35 | 102.115 | 1.8526432<br>2.1366988<br>3.0468391<br>6.5933849<br>51.5519660   | 0.0325077<br>4.6992605 | 0.2131468<br>5.8610703 | 0.7731215<br>4.7490393 | 1.8250354<br>4.1208120 | 3.4786189<br>1.6578324 |  |
|        | 1.40 | 106.802 | 1.9938949<br>2.3128131<br>3.3317143<br>7.2931353<br>57.4727614   | 0.0297701<br>4.6051511 | 0.1997790<br>5.7739741 | 0.7357602<br>4.7099318 | 1.7580101<br>4.0970832 | 3.3805116<br>1.6586108 |  |
|        | 1.45 | 111.144 | 2.1402240<br>2.4947597<br>3.6250000<br>8.0118665<br>63.5489356   | 0.0276331<br>4.5270413 | 0.1890805<br>5.7014989 | 0.7054620<br>4.6772323 | 1.7030951<br>4.0772580 | 3.2996121<br>1.6592828 |  |
|        | 1.50 | 115.199 | 2.2916411<br>2.6826414<br>3.9270510<br>8.7507642<br>69.7914985   | 0.0259224<br>4.4611655 | 0.1803355<br>5.6402408 | 0.6804115<br>4.6494812 | 1.6572910<br>4.0604447 | 3.2317607<br>1.6598685 |  |
|        | 1.70 | 129.278 | 2.9483149<br>3.4947482<br>5.2271136<br>11.9220243<br>96.5555666  | 0.0215525<br>4.2765862 | 0.1571727<br>5.4679258 | 0.6126752<br>4.5708573 | 1.5314731<br>4.0128723 | 3.0435165<br>1.6616079 |  |
|        | 2.00 | 146.170 | 4.0866858<br>4.8979715<br>7.4641016<br>17.3634536<br>142.4309671 | 0.0183688<br>4.1234346 | 0.1394306<br>5.3241676 | 0.5592264<br>4.5046158 | 1.4299538<br>3.9728707 | 2.8894654<br>1.6631698 |  |

| CASE A    |         |            | Passband Ripple: Ap(dB)=0.1 |                 |                 |           |           |           |
|-----------|---------|------------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n         | Ws      | As(dB)     | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 11        | 1.05    | 64.086     | 1.1084015                   | 0.0836724       | 0.4228773       | 1.2925817 | 2.9897905 | 5.0097246 |
|           |         |            | 1.1652129                   | 7.5767333       | 8.1308141       | 8.8786900 | 5.9767201 | 4.8687473 |
|           |         |            | 1.3488607                   | 1.6467088       |                 |           |           |           |
|           |         |            | 1.9760810                   |                 |                 |           |           |           |
|           |         |            | 5.6021835                   |                 |                 |           |           |           |
|           | 1.10    | 78.057     | 1.2195217                   | 0.0483528       | 0.2849695       | 0.9416015 | 2.3218114 | 4.1089725 |
|           |         |            | 1.3088558                   | 6.4671397       | 7.2500355       | 8.1200288 | 5.6836873 | 4.6893702 |
|           |         |            | 1.5834523                   | 1.6492121       |                 |           |           |           |
|           |         |            | 2.4791006                   |                 |                 |           |           |           |
|           |         |            | 7.5378437                   |                 |                 |           |           |           |
|           | 1.15    | 88.117     | 1.3352275                   | 0.0346030       | 0.2225303       | 0.7742639 | 1.9861207 | 3.6383116 |
|           |         |            | 1.4533340                   | 5.8712527       | 6.7617712       | 7.6941504 | 5.5145048 | 4.5858895 |
| 1.8085794 |         |            | 1.6509800                   |                 |                 |           |           |           |
| 2.9446236 |         |            |                             |                 |                 |           |           |           |
| 9.2991673 |         |            |                             |                 |                 |           |           |           |
| 1.20      | 96.295  | 1.4557817  | 0.0273092                   | 0.1863562       | 0.6733666       | 1.7770832 | 3.3372937 |           |
|           |         | 1.6013465  | 5.4834809                   | 6.4374042       | 7.4089833       | 5.3991886 | 4.5154206 |           |
|           |         | 2.0339626  | 1.6523356                   |                 |                 |           |           |           |
|           |         | 3.4024453  |                             |                 |                 |           |           |           |
|           |         | 11.0168385 |                             |                 |                 |           |           |           |
| 1.25      | 103.318 | 1.5812870  | 0.0228163                   | 0.1626778       | 0.6052267       | 1.6325770 | 3.1250225 |           |
|           |         | 1.7539211  | 5.2065397                   | 6.2022422       | 7.2010520       | 5.3140290 | 4.4634235 |           |
|           |         | 2.2631658  | 1.6534210                   |                 |                 |           |           |           |
|           |         | 3.8631607  |                             |                 |                 |           |           |           |
|           |         | 12.7367378 |                             |                 |                 |           |           |           |
| 1.30      | 109.540 | 1.7117951  | 0.0197875                   | 0.1459755       | 0.5559400       | 1.5261389 | 2.9662177 |           |
|           |         | 1.9115674  | 4.9972928                   | 6.0224935       | 7.0414118       | 5.2480106 | 4.4231433 |           |
|           |         | 2.4979196  | 1.6543145                   |                 |                 |           |           |           |
|           |         | 4.3318290  |                             |                 |                 |           |           |           |
|           |         | 14.4806247 |                             |                 |                 |           |           |           |
| 1.35      | 115.163 | 1.8473359  | 0.0176175                   | 0.1335770       | 0.5185906       | 1.4442873 | 2.8425468 |           |
|           |         | 2.0745762  | 4.8330297                   | 5.8800734       | 6.9144740       | 5.1951112 | 4.3908886 |           |
|           |         | 2.7391978  | 1.6550649                   |                 |                 |           |           |           |
|           |         | 4.8112671  |                             |                 |                 |           |           |           |
|           |         | 16.2605612 |                             |                 |                 |           |           |           |
| 1.40      | 120.319 | 1.9879279  | 0.0159925                   | 0.1240237       | 0.4893109       | 1.3793341 | 2.7433774 |           |
|           |         | 2.2431285  | 4.7004327                   | 5.7642299       | 6.8109211       | 5.1516860 | 4.3644258 |           |
|           |         | 2.9876021  | 1.6557046                   |                 |                 |           |           |           |
|           |         | 5.3032020  |                             |                 |                 |           |           |           |
|           |         | 18.0839213 |                             |                 |                 |           |           |           |
| 1.45      | 125.095 | 2.1335836  | 0.0147343                   | 0.1164498       | 0.4657549       | 1.3265372 | 2.6620544 |           |
|           |         | 2.4173448  | 4.5910864                   | 5.6680878       | 6.7247682       | 5.1153687 | 4.3423058 |           |
|           |         | 3.2435289  | 1.6562564                   |                 |                 |           |           |           |
|           |         | 5.8087659  |                             |                 |                 |           |           |           |
|           |         | 19.9555287 |                             |                 |                 |           |           |           |
| 1.50      | 129.556 | 2.2843118  | 0.0137341                   | 0.1103081       | 0.4464113       | 1.2827968 | 2.5941710 |           |
|           |         | 2.5973085  | 4.4993714                   | 5.5870091       | 6.6519615       | 5.0845420 | 4.3235385 |           |
|           |         | 3.5072526  | 1.6567373                   |                 |                 |           |           |           |
|           |         | 6.3287388  |                             |                 |                 |           |           |           |
|           |         | 21.8787000 |                             |                 |                 |           |           |           |
| 1.70      | 145.042 | 2.9380530  | 0.0112100                   | 0.0942669       | 0.3947386       | 1.1640890 | 2.4074375 |           |
|           |         | 3.3756369  | 4.2448966                   | 5.3598606       | 6.4472239       | 4.9971765 | 4.2703964 |           |
|           |         | 4.6433716  | 1.6581642                   |                 |                 |           |           |           |
|           |         | 8.5619394  |                             |                 |                 |           |           |           |
|           |         | 30.1261720 |                             |                 |                 |           |           |           |
| 2.00      | 163.624 | 4.0714332  | 0.0094026                   | 0.0822187       | 0.3546615       | 1.0699203 | 2.2564521 |           |
|           |         | 4.7212543  | 4.0366152                   | 5.1714245       | 6.2764924       | 4.9235381 | 4.2256620 |           |
|           |         | 6.5999975  | 1.6594443                   |                 |                 |           |           |           |
|           |         | 12.3963998 |                             |                 |                 |           |           |           |
|           |         | 44.2665611 |                             |                 |                 |           |           |           |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB})=0.1$                                         |                                     |                                      |                        |                         |                        |
|--------|------|---------|-------------------------------------------------------------------------------|-------------------------------------|--------------------------------------|------------------------|-------------------------|------------------------|
| n      | Ws   | As(dB)  | C1                                                                            | A0<br>A5<br>A10                     | A1<br>A6<br>A11                      | A2<br>A7               | A3<br>A8                | A4<br>A9               |
| 12     | 1.05 | 72.491  | 1.1074426<br>1.1536336<br>1.2918984<br>1.6991591<br>3.3125181<br>23.9660912   | 0.0534628<br>7.1852278<br>5.1868993 | 0.2937959<br>10.0561193<br>1.6459697 | 1.0247677<br>9.9013302 | 2.4312152<br>10.3491905 | 4.8651759<br>6.4994899 |
|        | 1.10 | 87.732  | 1.2179786<br>1.2909254<br>1.4996665<br>2.0872157<br>4.3499304<br>33.0577896   | 0.0293928<br>5.9290048<br>4.9901194 | 0.1878141<br>8.6004059<br>1.6480438  | 0.7103237<br>8.8381035 | 1.8088485<br>9.4578054  | 3.8137982<br>6.1782201 |
|        | 1.15 | 98.706  | 1.3331670<br>1.4297858<br>1.7009576<br>2.4494590<br>5.2979222<br>41.3060302   | 0.0204044<br>5.2702218<br>4.8764937 | 0.1420620<br>7.8190934<br>1.6495269  | 0.5663495<br>8.2485668 | 1.5067069<br>8.9578734  | 3.2839249<br>5.9926464 |
|        | 1.20 | 107.628 | 1.4532283<br>1.5724303<br>1.9034206<br>2.8072245<br>6.2244021<br>49.3373729   | 0.0157606<br>4.8480917<br>4.7990519 | 0.1163287<br>7.3106843<br>1.6506638  | 0.4818386<br>7.8569125 | 1.3227037<br>8.6232708  | 2.9529241<br>5.8660991 |
|        | 1.25 | 115.290 | 1.5782485<br>1.7197065<br>2.1098820<br>3.1681544<br>7.1532769<br>57.3715316   | 0.0129542<br>4.5500191<br>4.7418717 | 0.0998374<br>6.9475829<br>1.6515729  | 0.4258841<br>7.5729717 | 1.1975626<br>8.3793719  | 2.7234977<br>5.7726111 |
|        | 1.30 | 122.077 | 1.7082709<br>1.8720353<br>2.3217202<br>3.5359122<br>8.0959007<br>65.5126430   | 0.0110901<br>4.3267959<br>4.6975538 | 0.0883916<br>6.6732345<br>1.6523213  | 0.3860306<br>7.3559477 | 1.1065524<br>8.1921685  | 2.5541389<br>5.7001185 |
|        | 1.35 | 128.212 | 1.8433207<br>2.0296574<br>2.5397132<br>3.9125428<br>9.0585736<br>73.8184125   | 0.0097701<br>4.1528124<br>4.6620498 | 0.0800041<br>6.4578614<br>1.6529491  | 0.3562025<br>7.1839986 | 1.0372792<br>8.0433450  | 2.4236598<br>5.6420180 |
|        | 1.40 | 133.836 | 1.9834134<br>2.1927230<br>2.7643424<br>4.2993023<br>10.0451492<br>82.3241078  | 0.0087913<br>4.0132008<br>4.6329108 | 0.0736093<br>6.2840054<br>1.6534842  | 0.3330579<br>7.0441421 | 0.9827725<br>7.9219612  | 2.3199557<br>5.5943154 |
|        | 1.45 | 139.047 | 2.1285596<br>2.3613317<br>2.9959256<br>4.6970152<br>11.0581496<br>91.0527944  | 0.0080396<br>3.8986461<br>4.6085469 | 0.0685841<br>6.1406343<br>1.6539462  | 0.3145977<br>6.9280773 | 0.9387832<br>7.8209913  | 2.2355465<br>5.5544168 |
|        | 1.50 | 143.913 | 2.2787664<br>2.5355530<br>3.2346828<br>5.1062498<br>12.0993095<br>100.0203299 | 0.0074461<br>3.8029720<br>4.5878689 | 0.0645395<br>6.0203769<br>1.6543478  | 0.2995497<br>6.8301971 | 0.9025616<br>7.7356714  | 2.1655332<br>5.5205430 |
|        | 1.70 | 160.807 | 2.9302881<br>3.2893923<br>4.2640673<br>6.8651328<br>16.5660270<br>138.4661013 | 0.0059664<br>3.5395463<br>4.5292886 | 0.0541138<br>5.6867027<br>1.6555400  | 0.2598730<br>6.5560009 | 0.8053276<br>7.4958097  | 1.9751141<br>5.4245246 |
|        | 2.00 | 181.078 | 4.0598914<br>4.5932605<br>6.0382667<br>9.8873550<br>24.2272012<br>204.3626509 | 0.0049251<br>3.3262614<br>4.4799411 | 0.0464272<br>5.4135875<br>1.6566088  | 0.2296618<br>6.3285603 | 0.7293763<br>7.2958601  | 1.8235832<br>5.3435684 |

| CASE A |      | Passband Ripple: Ap(dB)=0.2 |           |                 |                 |           |          |          |
|--------|------|-----------------------------|-----------|-----------------|-----------------|-----------|----------|----------|
| n      | Ws   | As(dB)                      | C1        | AO<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8 | A4<br>A9 |
| 2      | 1.05 | 0.667                       | 1.4386640 | 1.3633013       | 0.2020056       |           |          |          |
|        | 1.10 | 1.065                       | 1.7140833 | 1.5516318       | 0.3369623       |           |          |          |
|        | 1.15 | 1.494                       | 1.9755745 | 1.7022121       | 0.4620370       |           |          |          |
|        | 1.20 | 1.954                       | 2.2359899 | 1.8271765       | 0.5795678       |           |          |          |
|        | 1.25 | 2.440                       | 2.5000000 | 1.9316044       | 0.6894256       |           |          |          |
|        | 1.30 | 2.947                       | 2.7698611 | 2.0187581       | 0.7912308       |           |          |          |
|        | 1.35 | 3.469                       | 3.0468391 | 2.0912292       | 0.8848026       |           |          |          |
|        | 1.40 | 4.000                       | 3.3317143 | 2.1512491       | 0.9702261       |           |          |          |
|        | 1.45 | 4.535                       | 3.6250000 | 2.2007744       | 1.0478103       |           |          |          |
|        | 1.50 | 5.071                       | 3.9270510 | 2.2415116       | 1.1180197       |           |          |          |
|        | 1.70 | 7.170                       | 5.2271136 | 2.3428282       | 1.3365637       |           |          |          |
|        | 2.00 | 10.062                      | 7.4641016 | 2.3982853       | 1.5357824       |           |          |          |
| 3      | 1.05 | 3.016                       | 1.2054102 | 2.3077797       | 1.3641233       | 2.1364394 |          |          |
|        | 1.10 | 5.285                       | 1.3703136 | 1.9941540       | 1.5317415       | 1.8480334 |          |          |
|        | 1.15 | 7.364                       | 1.5336053 | 1.8223718       | 1.6412438       | 1.7233203 |          |          |
|        | 1.20 | 9.254                       | 1.6996171 | 1.7093495       | 1.7182766       | 1.6593792 |          |          |
|        | 1.25 | 10.977                      | 1.8699785 | 1.6280366       | 1.7750501       | 1.6238637 |          |          |
|        | 1.30 | 12.557                      | 2.0454918 | 1.5662710       | 1.8183615       | 1.6033195 |          |          |
|        | 1.35 | 14.017                      | 2.2266128 | 1.5175851       | 1.8523125       | 1.5912707 |          |          |
|        | 1.40 | 15.374                      | 2.4136247 | 1.4781568       | 1.8795195       | 1.5842936 |          |          |
|        | 1.45 | 16.643                      | 2.6067151 | 1.4455560       | 1.9017248       | 1.5804540 |          |          |
|        | 1.50 | 17.836                      | 2.8060141 | 1.4181515       | 1.9201302       | 1.5786033 |          |          |
|        | 1.70 | 22.014                      | 3.6668482 | 1.3418249       | 1.9697477       | 1.5802271 |          |          |
|        | 2.00 | 27.062                      | 5.1532091 | 1.2790344       | 2.0082095       | 1.5892112 |          |          |



| CASE A |      |        | Passband Ripple: $A_p(\text{dB})=0.2$ |                 |                 |           |           |           |
|--------|------|--------|---------------------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB) | C1                                    | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 4      | 1.05 | 8.922  | 1.1536336<br>3.3125181                | 1.3999314       | 1.3544917       | 2.4729802 | 1.2467722 |           |
|        | 1.10 | 13.591 | 1.2909254<br>4.3499304                | 1.2018017       | 1.5150224       | 2.3600057 | 1.3790963 |           |
|        | 1.15 | 17.137 | 1.4297858<br>5.2979222                | 1.0777882       | 1.5670937       | 2.3002015 | 1.4270596 |           |
|        | 1.20 | 20.068 | 1.5724303<br>6.2244021                | 0.9937236       | 1.5869009       | 2.2652293 | 1.4509576 |           |
|        | 1.25 | 22.602 | 1.7197065<br>7.1532769                | 0.9329163       | 1.5941342       | 2.2430566 | 1.4652614 |           |
|        | 1.30 | 24.855 | 1.8720353<br>8.0959007                | 0.8868312       | 1.5957645       | 2.2281450 | 1.4749086 |           |
|        | 1.35 | 26.894 | 2.0296574<br>9.0585736                | 0.8506798       | 1.5947271       | 2.2176616 | 1.4819679 |           |
|        | 1.40 | 28.766 | 2.1927230<br>10.0451492               | 0.8215637       | 1.5923994       | 2.2100318 | 1.4874369 |           |
|        | 1.45 | 30.501 | 2.3613317<br>11.0581496               | 0.7976217       | 1.5894750       | 2.2043222 | 1.4918503 |           |
|        | 1.50 | 32.122 | 2.5355530<br>12.0993095               | 0.7776004       | 1.5863189       | 2.1999504 | 1.4955189 |           |
| 4      | 1.70 | 37.751 | 3.2893923<br>16.5660270               | 0.7224090       | 1.5741741       | 2.1898722 | 1.5057764 |           |
|        | 2.00 | 44.508 | 4.5932605<br>24.2272012               | 0.6777132       | 1.5604706       | 2.1839233 | 1.5145920 |           |
| 5      | 1.05 | 16.810 | 1.1334220<br>1.7737385                | 0.9261498       | 1.5503183       | 2.4394903 | 2.5634586 | 1.4664825 |
|        | 1.10 | 23.089 | 1.2593204<br>2.1930925                | 0.7218856       | 1.4896364       | 2.2447052 | 2.5335025 | 1.4526491 |
|        | 1.15 | 27.647 | 1.3881033<br>2.5834170                | 0.6200514       | 1.4353034       | 2.1561124 | 2.5061260 | 1.4535588 |
|        | 1.20 | 31.360 | 1.5211268<br>2.9683674                | 0.5568014       | 1.3914606       | 2.1028827 | 2.4849310 | 1.4565387 |
|        | 1.25 | 34.551 | 1.6589139<br>3.3563960                | 0.5131190       | 1.3559687       | 2.0664868 | 2.4684820 | 1.4596698 |
|        | 1.30 | 37.378 | 1.8017262<br>3.7515494                | 0.4809537       | 1.3268101       | 2.0396660 | 2.4554685 | 1.4625527 |
|        | 1.35 | 39.934 | 1.9497131<br>4.1560845                | 0.4562180       | 1.3024928       | 2.0189144 | 2.4449682 | 1.4651188 |
|        | 1.40 | 42.277 | 2.1029685<br>4.5713865                | 0.4365857       | 1.2819404       | 2.0023012 | 2.4363461 | 1.4673837 |
|        | 1.45 | 44.448 | 2.2615546<br>4.9983644                | 0.4206239       | 1.2643672       | 1.9886611 | 2.4291583 | 1.4693827 |
|        | 1.50 | 46.476 | 2.4255147<br>5.4376446                | 0.4073963       | 1.2491900       | 1.9772427 | 2.4230877 | 1.4711522 |
| 5      | 1.70 | 53.515 | 3.1356145<br>7.3252003                | 0.3714737       | 1.2049717       | 1.9455299 | 2.4061282 | 1.4765237 |
|        | 2.00 | 61.961 | 4.3649509<br>10.5677323               | 0.3429416       | 1.1664529       | 1.9193415 | 2.3922376 | 1.4814614 |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.2$ |            |                 |                 |           |           |           |  |
|--------|------|---------------------------------------|------------|-----------------|-----------------|-----------|-----------|-----------|--|
| n      | Ws   | As(dB)                                | C1         | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |  |
| 6      | 1.05 | 25.135                                | 1.1233258  | 0.5977654       | 1.2646219       | 2.5519704 | 2.7070499 | 2.9546646 |  |
|        |      |                                       | 1.4386640  | 1.4254890       |                 |           |           |           |  |
|        |      |                                       | 6.5287683  |                 |                 |           |           |           |  |
|        | 1.10 | 32.745                                | 1.2433620  | 0.4437954       | 1.1369987       | 2.2871543 | 2.6040269 | 2.8532345 |  |
|        |      |                                       | 1.7140833  | 1.4364984       |                 |           |           |           |  |
|        |      |                                       | 8.8264550  |                 |                 |           |           |           |  |
|        | 1.15 | 38.230                                | 1.3669587  | 0.3698349       | 1.0533588       | 2.1490504 | 2.5348443 | 2.7990696 |  |
|        |      |                                       | 1.9755745  | 1.4416201       |                 |           |           |           |  |
|        |      |                                       | 10.9158033 |                 |                 |           |           |           |  |
|        | 1.20 | 42.691                                | 1.4950350  | 0.3250523       | 0.9938837       | 2.0593857 | 2.4856066 | 2.7634179 |  |
|        |      |                                       | 2.2359899  | 1.4451577       |                 |           |           |           |  |
|        |      |                                       | 12.9526713 |                 |                 |           |           |           |  |
|        | 1.25 | 46.521                                | 1.6279471  | 0.2947001       | 0.9491430       | 1.9948843 | 2.4486008 | 2.7376250 |  |
|        |      |                                       | 2.5000000  | 1.4479053       |                 |           |           |           |  |
|        |      |                                       | 14.9917591 |                 |                 |           |           |           |  |
|        | 1.30 | 49.915                                | 1.7658735  | 0.2726746       | 0.9141534       | 1.9459265 | 2.4196740 | 2.7179082 |  |
|        |      |                                       | 2.7698611  | 1.4501480       |                 |           |           |           |  |
|        |      |                                       | 17.0590037 |                 |                 |           |           |           |  |
|        | 1.35 | 52.982                                | 1.9089166  | 0.2559343       | 0.8860015       | 1.9070797 | 2.3963975 | 2.7022747 |  |
|        |      |                                       | 3.0468391  | 1.4520291       |                 |           |           |           |  |
|        |      |                                       | 19.1687817 |                 |                 |           |           |           |  |
|        | 1.40 | 55.794                                | 2.0571405  | 0.2427758       | 0.8628534       | 1.8754561 | 2.3772473 | 2.6895479 |  |
|        |      |                                       | 3.3317143  | 1.4536350       |                 |           |           |           |  |
|        |      |                                       | 21.3298812 |                 |                 |           |           |           |  |
| 7      | 1.45 | 58.400                                | 2.2105880  | 0.2321640       | 0.8434885       | 1.8491706 | 2.3612129 | 2.6789773 |  |
|        |      |                                       | 3.6250000  | 1.4550239       |                 |           |           |           |  |
|        |      |                                       | 23.5480505 |                 |                 |           |           |           |  |
|        | 1.50 | 60.832                                | 2.3692888  | 0.2234307       | 0.8270591       | 1.8269623 | 2.3475945 | 2.6700571 |  |
|        |      |                                       | 3.9270510  | 1.4562372       |                 |           |           |           |  |
|        |      |                                       | 25.8272420 |                 |                 |           |           |           |  |
|        | 1.70 | 69.280                                | 3.0569811  | 0.2000028       | 0.7806156       | 1.7644568 | 2.3089881 | 2.6450407 |  |
|        |      |                                       | 5.2271136  | 1.4598592       |                 |           |           |           |  |
|        |      |                                       | 35.6008780 |                 |                 |           |           |           |  |
|        | 2.00 | 79.415                                | 4.2481552  | 0.1817132       | 0.7417136       | 1.7121657 | 2.2764654 | 2.6242697 |  |
|        |      |                                       | 7.4641016  | 1.4631381       |                 |           |           |           |  |
|        |      |                                       | 52.3568408 |                 |                 |           |           |           |  |
|        | 1.05 | 33.529                                | 1.1175213  | 0.3695504       | 1.0695660       | 2.1428109 | 3.3245665 | 3.2093758 |  |
|        |      |                                       | 1.3083409  | 3.2539335       | 1.4302929       |           |           |           |  |
|        |      |                                       | 2.7143721  |                 |                 |           |           |           |  |
|        | 1.10 | 42.418                                | 1.2341277  | 0.2606862       | 0.8960365       | 1.8586421 | 3.0406415 | 3.0441817 |  |
|        |      |                                       | 1.5239435  | 3.1458781       | 1.4338423       |           |           |           |  |
|        |      |                                       | 3.5147693  |                 |                 |           |           |           |  |
|        | 1.15 | 48.819                                | 1.3546897  | 0.2106928       | 0.7974730       | 1.7082258 | 2.8759908 | 2.9520472 |  |
|        |      |                                       | 1.7321918  | 3.0830375       | 1.4368383       |           |           |           |  |
|        |      |                                       | 4.2484927  |                 |                 |           |           |           |  |
|        | 1.20 | 54.023                                | 1.4798722  | 0.1812291       | 0.7320566       | 1.6100209 | 2.7644938 | 2.8899143 |  |
|        |      |                                       | 1.9413408  | 3.0403283       | 1.4392119       |           |           |           |  |
|        |      |                                       | 4.9666973  |                 |                 |           |           |           |  |
|        | 1.25 | 58.493                                | 1.6099341  | 0.1616410       | 0.6849502       | 1.5394103 | 2.6827445 | 2.8442466 |  |
|        |      |                                       | 2.1544332  | 3.0089171       | 1.4411363       |           |           |           |  |
|        |      |                                       | 5.6874343  |                 |                 |           |           |           |  |
|        | 1.30 | 62.452                                | 1.7450051  | 0.1476352       | 0.6492369       | 1.4856778 | 2.6197740 | 2.8089345 |  |
|        |      |                                       | 2.3729509  | 2.9846625       | 1.4427314       |           |           |           |  |
|        |      |                                       | 6.4192876  |                 |                 |           |           |           |  |
|        | 1.35 | 66.030                                | 1.8851599  | 0.1371155       | 0.6211713       | 1.4432135 | 2.5695913 | 2.7806845 |  |
|        |      |                                       | 2.5977295  | 2.9652970       | 1.4440771       |           |           |           |  |
|        |      |                                       | 7.1670237  |                 |                 |           |           |           |  |
|        | 1.40 | 69.311                                | 2.0304452  | 0.1289266       | 0.5985193       | 1.4087273 | 2.5285860 | 2.7575191 |  |
|        |      |                                       | 2.8292857  | 2.9494499       | 1.4452282       |           |           |           |  |
|        |      |                                       | 7.9335602  |                 |                 |           |           |           |  |
|        | 1.45 | 72.351                                | 2.1808921  | 0.1223760       | 0.5798539       | 1.3801343 | 2.4944268 | 2.7381607 |  |
|        |      |                                       | 3.0679607  | 2.9362337       | 1.4462241       |           |           |           |  |
|        |      |                                       | 8.7208069  |                 |                 |           |           |           |  |
|        | 1.50 | 75.189                                | 2.3365223  | 0.1170223       | 0.5642157       | 1.3560366 | 2.4655289 | 2.7217389 |  |
|        |      |                                       | 3.3139902  | 2.9250431       | 1.4470939       |           |           |           |  |
|        |      |                                       | 9.5300781  |                 |                 |           |           |           |  |
|        | 1.70 | 85.044                                | 3.0111362  | 0.1028357       | 0.5209585       | 1.2885723 | 2.3841169 | 2.6752420 |  |
|        |      |                                       | 4.3744590  | 2.8934754       | 1.4496856       |           |           |           |  |
|        |      |                                       | 13.0029293 |                 |                 |           |           |           |  |
|        | 2.00 | 96.869                                | 4.1800429  | 0.0919503       | 0.4857674       | 1.2326280 | 2.3160532 | 2.6360956 |  |
|        |      |                                       | 6.2017764  | 2.8670495       | 1.4520239       |           |           |           |  |
|        |      |                                       | 18.9610948 |                 |                 |           |           |           |  |

| CASE A |      | Passband Ripple: Ap(dB)=0.2 |                                                    |                        |                        |                        |           |           |
|--------|------|-----------------------------|----------------------------------------------------|------------------------|------------------------|------------------------|-----------|-----------|
| n      | Ws   | As(dB)                      | C1                                                 | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8  | A4<br>A9  |
| 8      | 1.05 | 41.932                      | 1.1138641<br>1.2431181<br>1.9061395<br>11.0466061  | 0.2388528<br>3.6496641 | 0.7849042<br>3.5744266 | 1.9675277<br>1.4273964 | 3.0052423 | 4.3038357 |
|        | 1.10 | 52.093                      | 1.2282855<br>1.4271032<br>2.3804113<br>15.1062239  | 0.1603007<br>3.4690300 | 0.6215698<br>3.4452275 | 1.6315232<br>1.4308869 | 2.6549006 | 3.9168437 |
|        | 1.15 | 59.408                      | 1.3469136<br>1.6072975<br>2.8200771<br>18.7925269  | 0.1256777<br>3.3640844 | 0.5349051<br>3.3711792 | 1.4561235<br>1.4332739 | 2.4582580 | 3.7011370 |
|        | 1.20 | 65.357                      | 1.4702527<br>1.7895085<br>3.2528314<br>22.3835994  | 0.1058012<br>3.2925041 | 0.4796069<br>3.3209064 | 1.3433671<br>1.4351034 | 2.3272559 | 3.5568976 |
|        | 1.25 | 70.464                      | 1.5984994<br>1.9759013<br>3.6885364<br>25.9769795  | 0.0928363<br>3.2396494 | 0.4408518<br>3.2838885 | 1.2634068<br>1.4365715 | 2.2322085 | 3.4517441 |
|        | 1.30 | 74.989                      | 1.7317524<br>2.1675370<br>4.1319051<br>29.6189023  | 0.0837015<br>3.1986856 | 0.4120588<br>3.2552583 | 1.2032803<br>1.4377829 | 2.1595469 | 3.3709998 |
|        | 1.35 | 79.079                      | 1.8700686<br>2.3650162<br>4.5855625<br>33.3349904  | 0.0769207<br>3.1658706 | 0.3897876<br>3.2323626 | 1.1562468<br>1.4388021 | 2.1019782 | 3.3067794 |
|        | 1.40 | 82.828                      | 2.0134836<br>2.5687116<br>5.0511190<br>37.1409040  | 0.0716933<br>3.1389388 | 0.3720414<br>3.2135992 | 1.1183856<br>1.4396724 | 2.0551581 | 3.2543753 |
|        | 1.45 | 86.302                      | 2.1620209<br>2.7788694<br>5.5296305<br>41.0468858  | 0.0675457<br>3.1164198 | 0.3575728<br>3.1979300 | 1.0872340<br>1.4404244 | 2.0163061 | 3.2107644 |
|        | 1.50 | 89.546                      | 2.3156973<br>2.9956604<br>6.0218242<br>45.0599777  | 0.0641792<br>3.0973084 | 0.3455588<br>3.1846467 | 1.0611550<br>1.4410803 | 1.9835459 | 3.1738998 |
|        | 1.70 | 100.809                     | 2.9819909<br>3.9311886<br>8.1360237<br>62.2665524  | 0.0553671<br>3.0431611 | 0.3128444<br>3.1470912 | 0.9890381<br>1.4430313 | 1.8917906 | 3.0701794 |
|        | 2.00 | 114.323                     | 4.1367342<br>5.5450630<br>11.7666735<br>91.7615329 | 0.0487214<br>2.9975389 | 0.2867998<br>3.1155476 | 0.9302903<br>1.4447868 | 1.8157027 | 2.9836150 |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB})=0.2$             |                        |                        |                        |                        |           |
|--------|------|---------|---------------------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------|
| n      | Ws   | As(dB)  | C1                                                | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9  |
| 9      | 1.05 | 50.337  | 1.1114059<br>1.2054102<br>1.5942707<br>3.9936736  | 0.1474395<br>5.3546636 | 0.6077012<br>4.1045279 | 1.5350128<br>3.8912530 | 3.0707503<br>1.4263161 | 4.0651622 |
|        | 1.10 | 61.768  | 1.2243475<br>1.3703136<br>1.9377187<br>5.2992478  | 0.0941359<br>4.8773739 | 0.4534645<br>3.8971627 | 1.2218941<br>3.7449822 | 2.5854017<br>1.4289340 | 3.5941700 |
|        | 1.15 | 69.998  | 1.3416657<br>1.5336053<br>2.2599957<br>6.4899114  | 0.0715925<br>4.6091965 | 0.3767408<br>3.7776426 | 1.0622578<br>3.6606138 | 2.3250217<br>1.4308030 | 3.3344584 |
|        | 1.20 | 76.690  | 1.4637563<br>1.6996171<br>2.5791043<br>7.6523927  | 0.0589866<br>4.4296295 | 0.3296088<br>3.6962037 | 0.9614817<br>3.6031850 | 2.1560348<br>1.4322401 | 3.1622687 |
|        | 1.25 | 82.436  | 1.5907740<br>1.8699785<br>2.9015215<br>8.8171818  | 0.0509195<br>4.2987109 | 0.2974365<br>3.6360680 | 0.8910386<br>3.5608260 | 2.0356496<br>1.4333928 | 3.0375738 |
|        | 1.30 | 87.526  | 1.7227963<br>2.0454918<br>3.2303598<br>9.9987492  | 0.0453186<br>4.1982069 | 0.2740028<br>3.5894504 | 0.8386852<br>3.5280229 | 1.9448872<br>1.4343429 | 2.9423347 |
|        | 1.35 | 92.127  | 1.8598680<br>2.2266128<br>3.5673591<br>11.2051201 | 0.0412098<br>4.1182968 | 0.2561569<br>3.5520968 | 0.7981283<br>3.5017626 | 1.8737678<br>1.4351415 | 2.8669169 |
|        | 1.40 | 96.346  | 2.0020170<br>2.4136247<br>3.9135894<br>12.4412023 | 0.0380728<br>4.0531113 | 0.2421154<br>3.5214329 | 0.7657472<br>3.4802229 | 1.8164485<br>1.4358228 | 2.8056001 |
|        | 1.45 | 100.253 | 2.1492622<br>2.6067151<br>4.2697534<br>13.7102067 | 0.0356040<br>3.9988809 | 0.2307867<br>3.4957879 | 0.7392904<br>3.4622217 | 1.7692440<br>1.4364110 | 2.7547302 |
|        | 1.50 | 103.903 | 2.3016164<br>2.8060141<br>4.6363361<br>15.0143415 | 0.0336140<br>3.9530527 | 0.2214626<br>3.4740197 | 0.7172753<br>3.4469516 | 1.7296975<br>1.4369237 | 2.7118436 |
|        | 1.70 | 116.574 | 2.9622803<br>3.6668482<br>6.2125942<br>20.6082544 | 0.0284682<br>3.8241847 | 0.1964636<br>3.4123245 | 0.6570603<br>3.4037267 | 1.6202061<br>1.4384470 | 2.5917576 |
|        | 2.00 | 131.777 | 4.1074418<br>5.1532091<br>8.9221914<br>30.2010593 | 0.0246539<br>3.7167229 | 0.1769842<br>3.3603194 | 0.6087699<br>3.3673578 | 1.5308670<br>1.4398154 | 2.4922106 |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB})=0.2$                            |                        |                        |                        |                        |                        |
|--------|------|---------|------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| n      | Ws   | As(dB)  | C1                                                               | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9               |
| 10     | 1.05 | 58.742  | 1.1096718<br>1.1814619<br>1.4386640<br>2.5336482<br>16.8596102   | 0.0952979<br>5.2539320 | 0.4249452<br>6.5150114 | 1.3010209<br>4.5564653 | 2.5479509<br>4.2094022 | 4.5111760<br>1.4253423 |
|        | 1.10 | 71.443  | 1.2215638<br>1.3338339<br>1.7140833<br>3.2619424<br>23.1838025   | 0.0578861<br>4.6600464 | 0.3007997<br>5.9306214 | 0.9859549<br>4.3252397 | 2.0637658<br>4.0456091 | 3.8128036<br>1.4274881 |
|        | 1.15 | 80.588  | 1.3379528<br>1.4860346<br>1.9755745<br>3.9305495<br>28.9230322   | 0.0427047<br>4.3310586 | 0.2420648<br>5.6032127 | 0.8311292<br>4.1915966 | 1.8117448<br>3.9510435 | 3.4402880<br>1.4290018 |
|        | 1.20 | 88.023  | 1.4591581<br>1.6414311<br>2.2359899<br>4.5854918<br>34.5122486   | 0.0344363<br>4.1127230 | 0.2070806<br>5.3842005 | 0.7358644<br>4.1004569 | 1.6512661<br>3.8866047 | 3.1987547<br>1.4301626 |
|        | 1.25 | 94.407  | 1.5853042<br>1.8012990<br>2.5000000<br>5.2430274<br>40.1039839   | 0.0292449<br>3.9545632 | 0.1837196<br>5.2246167 | 0.6705487<br>4.0331265 | 1.5385145<br>3.8390336 | 3.0266937<br>1.4310923 |
|        | 1.30 | 100.063 | 1.7164539<br>1.9662686<br>2.7698611<br>5.9108926<br>45.7705353   | 0.0256933<br>3.8337526 | 0.1669866<br>5.1021595 | 0.6227406<br>3.9809148 | 1.4544174<br>3.8021676 | 2.8969450<br>1.4318579 |
|        | 1.35 | 105.176 | 1.8526432<br>2.1366988<br>3.0468391<br>6.5933849<br>51.5519660   | 0.0231184<br>3.7380832 | 0.1544122<br>5.0048280 | 0.5861606<br>3.9390685 | 1.3890908<br>3.7726372 | 2.7952500<br>1.4325008 |
|        | 1.40 | 109.863 | 1.9938949<br>2.3128131<br>3.3317143<br>7.2931353<br>57.4727614   | 0.0211715<br>3.6603017 | 0.1446255<br>4.9254540 | 0.5572535<br>3.9047100 | 1.3368182<br>3.7484029 | 2.7132667<br>1.4330490 |
|        | 1.45 | 114.205 | 2.1402240<br>2.4947597<br>3.6250000<br>8.0118665<br>63.5489356   | 0.0196517<br>3.5957734 | 0.1368009<br>4.8594358 | 0.5338394<br>3.8759705 | 1.2940306<br>3.7281409 | 2.6457336<br>1.4335219 |
|        | 1.50 | 118.260 | 2.2916411<br>2.6826414<br>3.9270510<br>8.7507642<br>69.7914985   | 0.0184351<br>3.5413734 | 0.1304103<br>4.8036580 | 0.5145004<br>3.8515724 | 1.2583705<br>3.7109465 | 2.5891435<br>1.4339341 |
|        | 1.70 | 132.338 | 2.9483149<br>3.4947482<br>5.2271136<br>11.9220243<br>96.5555666  | 0.0153274<br>3.3890580 | 0.1135073<br>4.6468733 | 0.4623025<br>3.7824073 | 1.1605578<br>3.6622403 | 2.4323947<br>1.4351574 |
|        | 2.00 | 149.231 | 4.0866858<br>4.8979715<br>7.4641016<br>17.3634536<br>142.4309671 | 0.0130633<br>3.2628076 | 0.1005840<br>4.5162062 | 0.4212183<br>3.7240872 | 1.0817957<br>3.6212182 | 2.3044099<br>1.4362550 |

| CASE A    |         |            | Passband Ripple: Ap(dB)=0.2 |                 |                 |           |           |           |
|-----------|---------|------------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n         | Ws      | As(dB)     | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 11        | 1.05    | 67.147     | 1.1084015                   | 0.0588238       | 0.3147439       | 0.9688329 | 2.3549558 | 3.9170063 |
|           |         |            | 1.1652129                   | 6.2879060       | 6.5915600       | 7.7754720 | 5.0092551 | 4.5277148 |
|           |         |            | 1.3488607                   | 1.4246316       |                 |           |           |           |
|           |         |            | 1.9760810                   |                 |                 |           |           |           |
|           |         |            | 5.6021835                   |                 |                 |           |           |           |
|           | 1.10    | 81.118     | 1.2195217                   | 0.0339932       | 0.2107303       | 0.7023544 | 1.8168938 | 3.1976345 |
|           |         |            | 1.3088558                   | 5.3344687       | 5.8563305       | 7.0751806 | 4.7537046 | 4.3467341 |
|           |         |            | 1.5834523                   | 1.4264037       |                 |           |           |           |
|           |         |            | 2.4791006                   |                 |                 |           |           |           |
|           |         |            | 7.5378437                   |                 |                 |           |           |           |
|           | 1.15    | 91.177     | 1.3352275                   | 0.0243268       | 0.1640182       | 0.5757919 | 1.5481684 | 2.8229795 |
|           |         |            | 1.4533340                   | 4.8247726       | 5.4493433       | 6.6829318 | 4.6059593 | 4.2421189 |
| 1.8085794 |         |            | 1.4276532                   |                 |                 |           |           |           |
| 2.9446236 |         |            |                             |                 |                 |           |           |           |
| 9.2991673 |         |            |                             |                 |                 |           |           |           |
| 1.20      | 99.356  | 1.4557817  | 0.0191990                   | 0.1370701       | 0.4996974       | 1.3814627 | 2.5839231 |           |
|           |         | 1.6013465  | 4.4940592                   | 5.1792579       | 6.4206572       | 4.5051667 | 4.1707779 |           |
|           |         | 2.0339626  | 1.4286103                   |                 |                 |           |           |           |
|           |         | 3.4024453  |                             |                 |                 |           |           |           |
|           |         | 11.0168385 |                             |                 |                 |           |           |           |
| 1.25      | 106.379 | 1.5812870  | 0.0160404                   | 0.1194789       | 0.4484188       | 1.2665321 | 2.4156440 |           |
|           |         | 1.7539211  | 4.2583764                   | 4.9836095       | 6.2296192       | 4.4306851 | 4.1180811 |           |
|           |         | 2.2631658  | 1.4293761                   |                 |                 |           |           |           |
|           |         | 3.8631607  |                             |                 |                 |           |           |           |
|           |         | 12.7367378 |                             |                 |                 |           |           |           |
| 1.30      | 112.600 | 1.7117951  | 0.0139111                   | 0.1070943       | 0.4113909       | 1.1820544 | 2.2899266 |           |
|           |         | 1.9115674  | 4.0806020                   | 4.8341615       | 6.0830693       | 4.3729158 | 4.0772240 |           |
|           |         | 2.4979196  | 1.4300063                   |                 |                 |           |           |           |
|           |         | 4.3318290  |                             |                 |                 |           |           |           |
|           |         | 14.4806247 |                             |                 |                 |           |           |           |
| 1.35      | 118.224 | 1.8473359  | 0.0123855                   | 0.0979143       | 0.3833693       | 1.1171987 | 2.1921344 |           |
|           |         | 2.0745762  | 3.9412352                   | 4.7158136       | 5.9666177       | 4.3266077 | 4.0444842 |           |
|           |         | 2.7391978  | 1.4305352                   |                 |                 |           |           |           |
|           |         | 4.8112671  |                             |                 |                 |           |           |           |
|           |         | 16.2605612 |                             |                 |                 |           |           |           |
| 1.40      | 123.380 | 1.9879279  | 0.0112431                   | 0.0908490       | 0.3614267       | 1.0658029 | 2.1137912 |           |
|           |         | 2.2431285  | 3.8288619                   | 4.6195939       | 5.8716715       | 4.2885807 | 4.0176074 |           |
|           |         | 2.9876021  | 1.4309859                   |                 |                 |           |           |           |
|           |         | 5.3032020  |                             |                 |                 |           |           |           |
|           |         | 18.0839213 |                             |                 |                 |           |           |           |
| 1.45      | 128.156 | 2.1335836  | 0.0103586                   | 0.0852528       | 0.3437901       | 1.0240741 | 2.0495981 |           |
|           |         | 2.4173448  | 3.7362811                   | 4.5397693       | 5.7927158       | 4.2567691 | 3.9951299 |           |
|           |         | 3.2435289  | 1.4313747                   |                 |                 |           |           |           |
|           |         | 5.8087659  |                             |                 |                 |           |           |           |
|           |         | 19.9555287 |                             |                 |                 |           |           |           |
| 1.50      | 132.616 | 2.2843118  | 0.0096554                   | 0.0807182       | 0.3293188       | 0.9895368 | 1.9960506 |           |
|           |         | 2.5973085  | 3.6586917                   | 4.4724741       | 5.7260179       | 4.2297603 | 3.9760509 |           |
|           |         | 3.5072526  | 1.4317134                   |                 |                 |           |           |           |
|           |         | 6.3287388  |                             |                 |                 |           |           |           |
|           |         | 21.8787000 |                             |                 |                 |           |           |           |
| 1.70      | 148.103 | 2.9380530  | 0.0078809                   | 0.0688896       | 0.2907156       | 0.8959680 | 1.8489347 |           |
|           |         | 3.3756369  | 3.4437245                   | 4.2840561       | 5.5385926       | 4.1531820 | 3.9219824 |           |
|           |         | 4.6433716  | 1.4327179                   |                 |                 |           |           |           |
|           |         | 8.5619394  |                             |                 |                 |           |           |           |
|           |         | 30.1261720 |                             |                 |                 |           |           |           |
| 2.00      | 166.685 | 4.0714332  | 0.0066103                   | 0.0600206       | 0.2608334       | 0.8219214 | 1.7301912 |           |
|           |         | 4.7212543  | 3.2681414                   | 4.1278862       | 5.3824545       | 4.0885964 | 3.8764153 |           |
|           |         | 6.5999975  | 1.4336185                   |                 |                 |           |           |           |
|           |         | 12.3963998 |                             |                 |                 |           |           |           |
|           |         | 44.2665611 |                             |                 |                 |           |           |           |

| CASE A |         |           | Passband Ripple: Ap(dB)=0.2 |                 |                 |           |           |           |
|--------|---------|-----------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB)    | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 12     | 1.05    | 75.552    | 1.1074426                   | 0.0380209       | 0.2141739       | 0.7799309 | 1.8513539 | 3.8935451 |
|        |         |           | 1.1536336                   | 5.6720708       | 8.4436649       | 8.0728833 | 9.1383480 | 5.4620920 |
|        |         |           | 1.2918984                   | 4.8462938       | 1.4240811       |           |           |           |
|        |         |           |                             | 1.6991591       |                 |           |           |           |
|        |         |           |                             | 3.3125181       |                 |           |           |           |
|        |         |           |                             | 23.9660912      |                 |           |           |           |
|        | 1.10    | 90.793    | 1.2179786                   | 0.0209031       | 0.1362202       | 0.5376021 | 1.3704542 | 3.0333401 |
|        |         |           | 1.2909254                   | 4.6598864       | 7.1797417       | 7.1824048 | 8.3113853 | 5.1824086 |
|        |         |           | 1.4996665                   | 4.6482189       | 1.4255691       |           |           |           |
|        |         |           |                             | 2.0872157       |                 |           |           |           |
|        |         |           |                             | 4.3499304       |                 |           |           |           |
|        |         |           |                             | 33.0577896      |                 |           |           |           |
| 1.15   | 101.767 | 1.3331670 | 0.0145109                   | 0.1027705       | 0.4271977       | 1.1380677 | 2.6020156 |           |
|        |         | 1.4297858 | 4.1307389                   | 6.5040771       | 6.6892675       | 7.8484935 | 5.0206284 |           |
|        |         | 1.7009576 | 4.5336438                   | 1.4266182       |                 |           |           |           |
|        |         |           | 2.4494590                   |                 |                 |           |           |           |
|        |         |           | 5.2979222                   |                 |                 |           |           |           |
|        |         |           | 41.3060302                  |                 |                 |           |           |           |
| 1.20   | 110.689 | 1.4532283 | 0.0112084                   | 0.0840164       | 0.3626087       | 0.9969545 | 2.3334912 |           |
|        |         | 1.5724303 | 3.7923904                   | 6.0656038       | 6.3619662       | 7.5391117 | 4.9102282 |           |
|        |         | 1.9034206 | 4.4554717                   | 1.4274210       |                 |           |           |           |
|        |         |           | 2.8072245                   |                 |                 |           |           |           |
|        |         |           | 6.2244021                   |                 |                 |           |           |           |
|        |         |           | 49.3373729                  |                 |                 |           |           |           |
| 1.25   | 118.350 | 1.5782485 | 0.0092126                   | 0.0720225       | 0.3199487       | 0.9011839 | 2.1478344 |           |
|        |         | 1.7197065 | 3.5538541                   | 5.7530794       | 6.1248555       | 7.3138323 | 4.8286308 |           |
|        |         | 2.1098820 | 4.3977071                   | 1.4280630       |                 |           |           |           |
|        |         |           | 3.1681544                   |                 |                 |           |           |           |
|        |         |           | 7.1532769                   |                 |                 |           |           |           |
|        |         |           | 57.3715316                  |                 |                 |           |           |           |
| 1.30   | 125.137 | 1.7082709 | 0.0078869                   | 0.0637103       | 0.2896210       | 0.8316457 | 2.0110507 |           |
|        |         | 1.8720353 | 3.3754363                   | 5.5173127       | 5.9437274       | 7.1410569 | 4.7653313 |           |
|        |         | 2.3217202 | 4.3529066                   | 1.4285907       |                 |           |           |           |
|        |         |           | 3.5359122                   |                 |                 |           |           |           |
|        |         |           | 8.0959007                   |                 |                 |           |           |           |
|        |         |           | 65.5126430                  |                 |                 |           |           |           |
| 1.35   | 131.272 | 1.8433207 | 0.0069482                   | 0.0576258       | 0.2669563       | 0.7787848 | 1.9058342 |           |
|        |         | 2.0296574 | 3.2365171                   | 5.3324658       | 5.8002929       | 7.0037981 | 4.7145879 |           |
|        |         | 2.5397132 | 4.3169993                   | 1.4290345       |                 |           |           |           |
|        |         |           | 3.9125428                   |                 |                 |           |           |           |
|        |         |           | 9.0585736                   |                 |                 |           |           |           |
|        |         |           | 73.8184125                  |                 |                 |           |           |           |
| 1.40   | 136.897 | 1.9834134 | 0.0062521                   | 0.0529908       | 0.2493911       | 0.7372355 | 1.8223147 |           |
|        |         | 2.1927230 | 3.1251325                   | 5.1834030       | 5.6836687       | 6.8919009 | 4.6729088 |           |
|        |         | 2.7643424 | 4.2875136                   | 1.4294109       |                 |           |           |           |
|        |         |           | 4.2993023                   |                 |                 |           |           |           |
|        |         |           | 10.0451492                  |                 |                 |           |           |           |
|        |         |           | 82.3241078                  |                 |                 |           |           |           |
| 1.45   | 142.107 | 2.1285596 | 0.0057175                   | 0.0493510       | 0.2353951       | 0.7037333 | 1.7544084 |           |
|        |         | 2.3613317 | 3.0338037                   | 5.0605868       | 5.5869178       | 6.7988649 | 4.6380415 |           |
|        |         | 2.9959256 | 4.2628507                   | 1.4297361       |                 |           |           |           |
|        |         |           | 4.6970152                   |                 |                 |           |           |           |
|        |         |           | 11.0581496                  |                 |                 |           |           |           |
|        |         |           | 91.0527944                  |                 |                 |           |           |           |
| 1.50   | 146.973 | 2.2787664 | 0.0052954                   | 0.0464233       | 0.2239959       | 0.6761680 | 1.6981360 |           |
|        |         | 2.5355530 | 2.9575752                   | 4.9576507       | 5.5053527       | 6.7202830 | 4.6084366 |           |
|        |         | 3.2346828 | 4.2419134                   | 1.4300194       |                 |           |           |           |
|        |         |           | 5.1062498                   |                 |                 |           |           |           |
|        |         |           | 12.0993095                  |                 |                 |           |           |           |
|        |         |           | 100.0203299                 |                 |                 |           |           |           |
| 1.70   | 163.868 | 2.9302881 | 0.0042431                   | 0.0388837       | 0.1939842       | 0.6022700 | 1.5453387 |           |
|        |         | 3.2893923 | 2.7479175                   | 4.6724217       | 5.2769794       | 6.4995146 | 4.5244875 |           |
|        |         | 4.2640673 | 4.1825618                   | 1.4308595       |                 |           |           |           |
|        |         |           | 6.8651328                   |                 |                 |           |           |           |
|        |         |           | 16.5660270                  |                 |                 |           |           |           |
|        |         |           | 138.4661013                 |                 |                 |           |           |           |
| 2.00   | 184.139 | 4.0598914 | 0.0035026                   | 0.0333321       | 0.1711789       | 0.5446551 | 1.4240259 |           |
|        |         | 4.5932605 | 2.5784281                   | 4.4394037       | 5.0876911       | 6.3156601 | 4.4536732 |           |
|        |         | 6.0382667 | 4.1325211                   | 1.4316120       |                 |           |           |           |
|        |         |           | 9.8873550                   |                 |                 |           |           |           |
|        |         |           | 24.2272012                  |                 |                 |           |           |           |
|        |         |           | 204.3626509                 |                 |                 |           |           |           |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.5$ |           |                 |                 |           |          |          |  |
|--------|------|---------------------------------------|-----------|-----------------|-----------------|-----------|----------|----------|--|
| n      | Ws   | As(dB)                                | C1        | AO<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8 | A4<br>A9 |  |
| 2      | 1.05 | 1.553                                 | 1.4386640 | 1.2743412       | 0.2751653       |           |          |          |  |
|        | 1.10 | 2.354                                 | 1.7140833 | 1.3846530       | 0.4298725       |           |          |          |  |
|        | 1.15 | 3.144                                 | 1.9755745 | 1.4570556       | 0.5557066       |           |          |          |  |
|        | 1.20 | 3.929                                 | 2.2359899 | 1.5067570       | 0.6609881       |           |          |          |  |
|        | 1.25 | 4.702                                 | 2.5000000 | 1.5412040       | 0.7498065       |           |          |          |  |
|        | 1.30 | 5.459                                 | 2.7698611 | 1.5650010       | 0.8250785       |           |          |          |  |
|        | 1.35 | 6.197                                 | 3.0468391 | 1.5812422       | 0.8891361       |           |          |          |  |
|        | 1.40 | 6.914                                 | 3.3317143 | 1.5920793       | 0.9438940       |           |          |          |  |
|        | 1.45 | 7.609                                 | 3.6250000 | 1.5990339       | 0.9909287       |           |          |          |  |
|        | 1.50 | 8.282                                 | 3.9270510 | 1.6031929       | 1.0315340       |           |          |          |  |
|        | 1.70 | 10.758                                | 5.2271136 | 1.6046247       | 1.1481760       |           |          |          |  |
|        | 2.00 | 13.922                                | 7.4641016 | 1.5917857       | 1.2450405       |           |          |          |  |
| 3      | 1.05 | 5.558                                 | 1.2054102 | 1.4342459       | 1.2583916       | 1.4502589 |          |          |  |
|        | 1.10 | 8.546                                 | 1.3703136 | 1.2393329       | 1.3454329       | 1.3201569 |          |          |  |
|        | 1.15 | 10.976                                | 1.5336053 | 1.1325732       | 1.3945680       | 1.2687906 |          |          |  |
|        | 1.20 | 13.057                                | 1.6996171 | 1.0623317       | 1.4259842       | 1.2442453 |          |          |  |
|        | 1.25 | 14.890                                | 1.8699785 | 1.0117971       | 1.4475691       | 1.2315670 |          |          |  |
|        | 1.30 | 16.538                                | 2.0454918 | 0.9734108       | 1.4631437       | 1.2248820 |          |          |  |
|        | 1.35 | 18.041                                | 2.2266128 | 0.9431534       | 1.4747961       | 1.2214739 |          |          |  |
|        | 1.40 | 19.427                                | 2.4136247 | 0.9186494       | 1.4837636       | 1.2199499 |          |          |  |
|        | 1.45 | 20.716                                | 2.6067151 | 0.8983885       | 1.4908235       | 1.2195430 |          |          |  |
|        | 1.50 | 21.923                                | 2.8060141 | 0.8813571       | 1.4964875       | 1.2198085 |          |          |  |
|        | 1.70 | 26.128                                | 3.6668482 | 0.8339214       | 1.5108064       | 1.2235391 |          |          |  |
|        | 2.00 | 31.188                                | 5.1532091 | 0.7948982       | 1.5207641       | 1.2299965 |          |          |  |



| CASE A |      | Passband Ripple: Ap(dB)=0.5 |                         |                 |                 |           |           |           |
|--------|------|-----------------------------|-------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)                      | C1                      | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 4      | 1.05 | 12.698                      | 1.1536336<br>3.3125181  | 0.9382667       | 1.0876037       | 2.0210069 | 1.0599755 |           |
|        | 1.10 | 17.604                      | 1.2909254<br>4.3499304  | 0.7837391       | 1.1337351       | 1.9190199 | 1.1195652 |           |
|        | 1.15 | 21.216                      | 1.4297858<br>5.2979222  | 0.6975170       | 1.1387697       | 1.8675952 | 1.1410869 |           |
|        | 1.20 | 24.173                      | 1.5724303<br>6.2244021  | 0.6412257       | 1.1344471       | 1.8363496 | 1.1522015 |           |
|        | 1.25 | 26.719                      | 1.7197065<br>7.1532769  | 0.6011810       | 1.1276450       | 1.8153028 | 1.1591360 |           |
|        | 1.30 | 28.977                      | 1.8720353<br>8.0959007  | 0.5710925       | 1.1204272       | 1.8001546 | 1.1639919 |           |
|        | 1.35 | 31.020                      | 2.0296574<br>9.0585736  | 0.5476058       | 1.1134921       | 1.7887335 | 1.1676561 |           |
|        | 1.40 | 32.894                      | 2.1927230<br>10.0451492 | 0.5287467       | 1.1070699       | 1.7798206 | 1.1705638 |           |
|        | 1.45 | 34.630                      | 2.3613317<br>11.0581496 | 0.5132690       | 1.1012134       | 1.7726776 | 1.1729534 |           |
|        | 1.50 | 36.251                      | 2.5355530<br>12.0993095 | 0.5003426       | 1.0959062       | 1.7668303 | 1.1749671 |           |
|        | 1.70 | 41.882                      | 3.2893923<br>16.5660270 | 0.4647665       | 1.0792600       | 1.7512856 | 1.1807044 |           |
|        | 2.00 | 48.639                      | 4.5932605<br>24.2272012 | 0.4359934       | 1.0634790       | 1.7392829 | 1.1857133 |           |
| 5      | 1.05 | 20.886                      | 1.1334220<br>1.7737385  | 0.5755864       | 1.1892888       | 1.7434526 | 2.2156188 | 1.1509280 |
|        | 1.10 | 27.207                      | 1.2593204<br>2.1930925  | 0.4486396       | 1.1071526       | 1.6137359 | 2.1572388 | 1.1470527 |
|        | 1.15 | 31.774                      | 1.3881033<br>2.5834170  | 0.3853514       | 1.0504008       | 1.5497305 | 2.1185527 | 1.1486240 |
|        | 1.20 | 35.490                      | 1.5211268<br>2.9683674  | 0.3460426       | 1.0086291       | 1.5092841 | 2.0909583 | 1.1507504 |
|        | 1.25 | 38.681                      | 1.6589139<br>3.3563960  | 0.3188948       | 0.9764311       | 1.4806751 | 2.0701926 | 1.1527553 |
|        | 1.30 | 41.509                      | 1.8017262<br>3.7515494  | 0.2989045       | 0.9507846       | 1.4590822 | 2.0539626 | 1.1545306 |
|        | 1.35 | 44.065                      | 1.9497131<br>4.1560845  | 0.2835317       | 0.9298506       | 1.4420814 | 2.0409164 | 1.1560813 |
|        | 1.40 | 46.409                      | 2.1029685<br>4.5713865  | 0.2713306       | 0.9124353       | 1.4282914 | 2.0301998 | 1.1574354 |
|        | 1.45 | 48.580                      | 2.2615546<br>4.9983644  | 0.2614106       | 0.8977248       | 1.4168549 | 2.0212435 | 1.1586225 |
|        | 1.50 | 50.607                      | 2.4255147<br>5.4376446  | 0.2531899       | 0.8851420       | 1.4072055 | 2.0136517 | 1.1596687 |
|        | 1.70 | 57.646                      | 3.1356145<br>7.3252003  | 0.2308646       | 0.8490564       | 1.3800759 | 1.9922283 | 1.1628249 |
|        | 2.00 | 66.093                      | 4.3649509<br>10.5677323 | 0.2131324       | 0.8182289       | 1.3573603 | 1.9743288 | 1.1657085 |

| CASE A |            |                                      | Passband Ripple: $A_p(\text{dB})=0.5$ |                                      |                                     |                        |           |           |           |
|--------|------------|--------------------------------------|---------------------------------------|--------------------------------------|-------------------------------------|------------------------|-----------|-----------|-----------|
| n      | $\omega_s$ | $A_s(\text{dB})$                     | C1                                    | A0<br>A5<br>A10                      | A1<br>A6<br>A11                     | A2<br>A7               | A3<br>A8  | A4<br>A9  |           |
| 6      | 1.05       | 29.259                               | 1.1233258<br>1.4386640<br>6.5287683   | 0.3848186<br>1.1335645               | 0.8787979                           | 1.9447353              | 2.0199498 | 2.5676585 |           |
|        |            |                                      | 1.2433620<br>1.7140833<br>8.8264550   | 0.2855505<br>1.1391520               | 0.7745664                           | 1.7349336              | 1.9243965 | 2.4670532 |           |
|        |            |                                      | 1.3669587<br>1.9755745<br>10.9158033  | 0.2379344<br>1.1420389               | 0.7108565                           | 1.6227515              | 1.8647354 | 2.4109086 |           |
|        | 1.20       | 46.822                               | 1.4950350<br>2.2359899<br>12.9526713  | 0.2091171<br>1.1440986               | 0.6668400                           | 1.5491044              | 1.8230556 | 2.3731641 |           |
|        |            |                                      | 1.6279471<br>2.5000000<br>14.9917591  | 0.1895887<br>1.1457150               | 0.6342712                           | 1.4959235              | 1.7919376 | 2.3455031 |           |
|        | 1.30       | 54.046                               | 1.7658735<br>2.7698611<br>17.0590037  | 0.1754184<br>1.1470387               | 0.6090779                           | 1.4553064              | 1.7676751 | 2.3241677 |           |
|        |            |                                      | 1.9089166<br>3.0468391<br>19.1687817  | 0.1646488<br>1.1481498               | 0.5889666                           | 1.4231042              | 1.7481682 | 2.3071351 |           |
|        | 1.40       | 59.926                               | 2.0571405<br>3.3317143<br>21.3298812  | 0.1561835<br>1.1490984               | 0.5725279                           | 1.3968781              | 1.7321205 | 2.2931935 |           |
|        |            |                                      | 2.2105880<br>3.6250000<br>23.5480505  | 0.1493566<br>1.1499183               | 0.5588399                           | 1.3750789              | 1.7186798 | 2.2815615 |           |
|        | 1.50       | 64.964                               | 2.3692888<br>3.9270510<br>25.8272420  | 0.1437382<br>1.1506341               | 0.5472705                           | 1.3566654              | 1.7072590 | 2.2717076 |           |
|        |            |                                      | 3.0569811<br>5.2271136<br>35.6008780  | 0.1286665<br>1.1527679               | 0.5147692                           | 1.3048925              | 1.6748422 | 2.2438802 |           |
|        | 7          | 2.00                                 | 83.547                                | 4.2481552<br>7.4641016<br>52.3568408 | 0.1169004<br>1.1546952              | 0.4877616              | 1.2616803 | 1.6474713 | 2.2205432 |
|        |            |                                      |                                       | 1.1175213<br>1.3083409<br>2.7143721  | 0.2296693<br>2.8777246<br>1.1349000 | 0.7657059<br>1.4938582 | 1.4938582 | 2.6411736 | 2.4021563 |
| 1.10   |            | 46.549                               | 1.2341277<br>1.5239435<br>3.5147693   | 0.1620121<br>2.7650045<br>1.1371904  | 0.6309158<br>1.1371904              | 1.2904968              | 2.3898599 | 2.2709106 |           |
|        |            |                                      | 1.3546897<br>1.7321918<br>4.2484927   | 0.1309420<br>2.6995871<br>1.1390036  | 0.5568938<br>1.1390036              | 1.1817489              | 2.2467656 | 2.1963963 |           |
|        |            |                                      | 1.4798722<br>1.9413408<br>4.9666973   | 0.1126308<br>2.6549964<br>1.1404245  | 0.5085661<br>1.1404245              | 1.1105747              | 2.1505642 | 2.1458183 |           |
| 1.25   |            | 62.624                               | 1.6099341<br>2.1544332<br>5.6874343   | 0.1004571<br>2.6220941<br>1.1415719  | 0.4741169<br>1.1415719              | 1.0593889              | 2.0803121 | 2.1085159 |           |
|        |            |                                      | 1.7450051<br>2.3729509<br>6.4192876   | 0.0917528<br>2.5966120<br>1.1425209  | 0.4481824<br>1.1425209              | 1.0204607              | 2.0263403 | 2.0796089 |           |
| 1.35   |            | 70.162                               | 1.8851599<br>2.5977295<br>7.1570237   | 0.0852150<br>2.5762130<br>1.1433202  | 0.4279069<br>1.1433202              | 0.9897227              | 1.9834116 | 2.0564469 |           |
|        |            |                                      | 2.0304452<br>2.8292857<br>7.9335602   | 0.0801257<br>2.5594819<br>1.1440033  | 0.4116078<br>1.1440033              | 0.9647832              | 1.9483859 | 2.0374310 |           |
| 1.45   |            | 76.482                               | 2.1808921<br>3.0679607<br>8.7208069   | 0.0760546<br>2.5455004<br>1.1445938  | 0.3982199<br>1.1445938              | 0.9441249              | 1.9192432 | 2.0215249 |           |
|        |            |                                      | 2.3365223<br>3.3139902<br>9.5300781   | 0.0727274<br>2.5336409<br>1.1451090  | 0.3870326<br>1.1451090              | 0.9267299              | 1.8946140 | 2.0080209 |           |
| 1.70   | 89.176     | 3.0111362<br>4.3744590<br>13.0029293 | 0.0639107<br>2.5000758<br>1.1466425   | 0.3562222<br>1.1466425               | 0.8781179                           | 1.8253509              | 1.9697325 |           |           |
|        |            | 4.1800429<br>6.2017764<br>18.9610948 | 0.0571455<br>2.4718417<br>1.1480235   | 0.3312996<br>1.1480235               | 0.8379201                           | 1.7675875              | 1.9374359 |           |           |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=0.5$ |                                                    |                        |                        |                        |           |           |  |
|--------|------|---------------------------------------|----------------------------------------------------|------------------------|------------------------|------------------------|-----------|-----------|--|
| n      | Ws   | As(dB)                                | C1                                                 | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8  | A4<br>A9  |  |
| 8      | 1.05 | 46.063                                | 1.1138641<br>1.2431181<br>1.9061395<br>11.0466061  | 0.1536626<br>2.7569616 | 0.5248517<br>3.1974335 | 1.4457610<br>1.1333480 | 2.1472921 | 3.4889092 |  |
|        | 1.10 | 56.224                                | 1.2282855<br>1.4271032<br>2.3804113<br>15.1062239  | 0.1031254<br>2.6105749 | 0.4110314<br>3.0660213 | 1.1897451<br>1.1354116 | 1.8838408 | 3.1506143 |  |
|        | 1.15 | 63.540                                | 1.3469136<br>1.6072975<br>2.8200771<br>18.7925269  | 0.0808514<br>2.5255998 | 0.3517603<br>2.9902250 | 1.0562502<br>1.1368364 | 1.7372686 | 2.9620853 |  |
|        | 1.20 | 69.488                                | 1.4702527<br>1.7895085<br>3.2528314<br>22.3835994  | 0.0680644<br>2.4675808 | 0.3142936<br>2.9385809 | 0.9706912<br>1.1379281 | 1.6400063 | 2.8362218 |  |
|        | 1.25 | 74.595                                | 1.5984994<br>1.9759013<br>3.6885364<br>25.9769795  | 0.0597237<br>2.4246941 | 0.2881893<br>2.9004542 | 0.9101981<br>1.1388031 | 1.5696121 | 2.7446082 |  |
|        | 1.30 | 79.120                                | 1.7317524<br>2.1675370<br>4.1319051<br>29.6189023  | 0.0538471<br>2.3914250 | 0.2688744<br>2.8709057 | 0.8648301<br>1.1395244 | 1.5158933 | 2.6743561 |  |
|        | 1.35 | 83.210                                | 1.8700686<br>2.3650162<br>4.5855625<br>33.3349904  | 0.0494849<br>2.3647532 | 0.2539800<br>2.8472357 | 0.8294224<br>1.1401308 | 1.4733920 | 2.6185456 |  |
|        | 1.40 | 86.960                                | 2.0134836<br>2.5687116<br>5.0511190<br>37.1409040  | 0.0461220<br>2.3428490 | 0.2421399<br>2.8278098 | 0.8009761<br>1.1406482 | 1.4388655 | 2.5730490 |  |
|        | 1.45 | 90.434                                | 2.1620209<br>2.7788694<br>5.5296305<br>41.0468858  | 0.0434537<br>2.3245235 | 0.2325049<br>2.8115676 | 0.7776110<br>1.1410950 | 1.4102424 | 2.5352189 |  |
|        | 1.50 | 93.677                                | 2.3156973<br>2.9956604<br>6.0218242<br>45.0599777  | 0.0412880<br>2.3089636 | 0.2245169<br>2.7977839 | 0.7580798<br>1.1414845 | 1.3861270 | 2.5032645 |  |
|        | 1.70 | 104.940                               | 2.9819909<br>3.9311886<br>8.1360237<br>62.2665524  | 0.0356190<br>2.2648401 | 0.2028221<br>2.7587369 | 0.7042167<br>1.1426419 | 1.3186843 | 2.4134808 |  |
|        | 2.00 | 118.455                               | 4.1367342<br>5.5450630<br>11.7666735<br>91.7615329 | 0.0313436<br>2.2276179 | 0.1856096<br>2.7258475 | 0.6605099<br>1.1436821 | 1.2628761 | 2.3386932 |  |

| CASE A |      |         | Passband Ripple: Ap(dB)=0.5                       |                        |                        |                        |                        |           |
|--------|------|---------|---------------------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------|
| n      | Ws   | As(dB)  | C1                                                | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9  |
| 9      | 1.05 | 54.468  | 1.1114059<br>1.2054102<br>1.5942707<br>3.9936736  | 0.0916312<br>4.4246702 | 0.4220386<br>3.1180976 | 1.0470949<br>3.5155929 | 2.3312783<br>1.1326403 | 2.9404872 |
|        | 1.10 | 65.899  | 1.2243475<br>1.3703136<br>1.9377187<br>5.2992478  | 0.0585039<br>3.9996323 | 0.3115091<br>2.9515848 | 0.8287238<br>3.3672873 | 1.9445146<br>1.1342152 | 2.5865819 |
|        | 1.15 | 74.129  | 1.3416657<br>1.5336053<br>2.2599597<br>6.4899114  | 0.0444935<br>3.7618511 | 0.2573780<br>2.8553529 | 0.7176756<br>3.2815083 | 1.7389835<br>1.1353338 | 2.3916898 |
|        | 1.20 | 80.821  | 1.4637563<br>1.6996171<br>2.5791043<br>7.6523927  | 0.0366592<br>3.6030352 | 0.2243915<br>2.7896913 | 0.6477743<br>3.2229960 | 1.6063085<br>1.1361924 | 2.2626803 |
|        | 1.25 | 86.567  | 1.5907740<br>1.8699785<br>2.9015215<br>8.8171818  | 0.0316456<br>3.4874533 | 0.2019906<br>2.7411595 | 0.5990341<br>3.1797669 | 1.5121463<br>1.1368801 | 2.1693818 |
|        | 1.30 | 91.657  | 1.7227963<br>2.0454918<br>3.2303598<br>9.9987492  | 0.0281647<br>3.3988464 | 0.1857334<br>2.7035100 | 0.5628855<br>3.1462455 | 1.4413577<br>1.1374465 | 2.0982031 |
|        | 1.35 | 96.259  | 1.8598680<br>2.2266128<br>3.5673591<br>11.2051201 | 0.0256112<br>3.3284747 | 0.1733865<br>2.6733247 | 0.5349306<br>3.1193806 | 1.3860162<br>1.1379223 | 2.0418918 |
|        | 1.40 | 100.477 | 2.0020170<br>2.4136247<br>3.9135894<br>12.4412023 | 0.0236616<br>3.2711237 | 0.1636924<br>2.6485336 | 0.5126439<br>3.0973246 | 1.3414975<br>1.1383279 | 1.9961461 |
|        | 1.45 | 104.385 | 2.1492622<br>2.6067151<br>4.2697534<br>13.7102067 | 0.0221273<br>3.2234487 | 0.1558845<br>2.6277918 | 0.4944576<br>3.0788772 | 1.3048929<br>1.1386780 | 1.9582206 |
|        | 1.50 | 108.034 | 2.3016164<br>2.8060141<br>4.6363361<br>15.0143415 | 0.0208905<br>3.1831875 | 0.1494673<br>2.6101795 | 0.4793408<br>3.0632179 | 1.2742681<br>1.1389830 | 1.9262663 |
|        | 1.70 | 120.705 | 2.9622803<br>3.6668482<br>6.2125942<br>20.6082544 | 0.0176925<br>3.0701124 | 0.1323029<br>2.5602323 | 0.4380739<br>3.0188346 | 1.1896838<br>1.1398885 | 1.8368903 |
|        | 2.00 | 135.909 | 4.1074418<br>5.1532091<br>8.9221914<br>30.2010593 | 0.0153220<br>2.9759831 | 0.1189705<br>2.5180937 | 0.4050700<br>2.9814230 | 1.1209028<br>1.1407011 | 1.7629183 |

| CASE A |      |         | Passband Ripple: Ap(dB)=0.5                                      |                        |                        |                        |                        |                        |
|--------|------|---------|------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| n      | Ws   | As(dB)  | C1                                                               | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9               |
| 10     | 1.05 | 62.873  | 1.1096718<br>1.1814619<br>1.4386640<br>2.5336482<br>16.8596102   | 0.0613074<br>3.8415039 | 0.2789207<br>5.4657858 | 0.9325874<br>3.4779469 | 1.7746851<br>3.8343545 | 3.5027498<br>1.1320504 |
|        | 1.10 | 75.574  | 1.2215638<br>1.3338339<br>1.7140833<br>3.2619424<br>23.1838025   | 0.0372395<br>3.3911762 | 0.1959180<br>4.9407075 | 0.7011888<br>3.2925322 | 1.4283171<br>3.6689731 | 2.9358924<br>1.1333370 |
|        | 1.15 | 84.719  | 1.3379528<br>1.4860346<br>1.9755745<br>3.9305495<br>28.9230322   | 0.0274730<br>3.1423606 | 0.1570464<br>4.6474542 | 0.5881796<br>3.1852223 | 1.2491029<br>3.5732734 | 2.6353285<br>1.1342426 |
|        | 1.20 | 92.154  | 1.4591581<br>1.6414311<br>2.2359899<br>4.5854918<br>34.5122486   | 0.0221537<br>2.9775016 | 0.1340159<br>4.4517182 | 0.5189658<br>3.1119728 | 1.1353892<br>3.5079622 | 2.4412627<br>1.1349363 |
|        | 1.25 | 98.539  | 1.5853042<br>1.8012990<br>2.5000000<br>5.2430274<br>40.1039839   | 0.0188139<br>2.8582254 | 0.1186894<br>4.3093281 | 0.4716784<br>3.0578221 | 1.0556974<br>3.4596913 | 2.3034506<br>1.1354914 |
|        | 1.30 | 104.194 | 1.7164539<br>1.9662686<br>2.7698611<br>5.9108926<br>45.7705353   | 0.0165291<br>2.7672043 | 0.1077379<br>4.2002050 | 0.4371621<br>3.0158084 | 0.9963747<br>3.4222482 | 2.1997848<br>1.1359482 |
|        | 1.35 | 109.307 | 1.8526432<br>2.1366988<br>3.0468391<br>6.5933849<br>51.5519660   | 0.0148726<br>2.6951823 | 0.0995230<br>4.1135621 | 0.4108113<br>2.9821212 | 0.9503657<br>3.3922326 | 2.1186961<br>1.1363315 |
|        | 1.40 | 113.994 | 1.9938949<br>2.3128131<br>3.3317143<br>7.2931353<br>57.4727614   | 0.0136201<br>2.6366660 | 0.0931385<br>4.0429661 | 0.3900262<br>2.9544522 | 0.9135985<br>3.3675843 | 2.0534335<br>1.1366583 |
|        | 1.45 | 118.336 | 2.1402240<br>2.4947597<br>3.6250000<br>8.0118665<br>63.5489356   | 0.0126424<br>2.5881478 | 0.0880398<br>3.9842917 | 0.3732168<br>2.9313012 | 0.8835358<br>3.3469647 | 1.9997493<br>1.1369401 |
|        | 1.50 | 122.391 | 2.2916411<br>2.6826414<br>3.9270510<br>8.7507642<br>69.7914985   | 0.0118598<br>2.5472651 | 0.0838795<br>3.9347498 | 0.3593512<br>2.9116425 | 0.8585046<br>3.3294585 | 1.9548181<br>1.1371856 |
|        | 1.70 | 136.470 | 2.9483149<br>3.4947482<br>5.2271136<br>11.9220243<br>96.5555666  | 0.0098605<br>2.4328997 | 0.0728929<br>3.7956507 | 0.3220134<br>2.8558877 | 0.7899613<br>3.2798258 | 1.8306312<br>1.1379138 |
|        | 2.00 | 153.362 | 4.0866858<br>4.8979715<br>7.4641016<br>17.3634536<br>142.4309671 | 0.0084039<br>2.3382265 | 0.0645110<br>3.6799077 | 0.2927204<br>2.8088454 | 0.7348988<br>3.2379709 | 1.7295405<br>1.1385666 |

| CASE A |         |            | Passband Ripple: Ap(dB)=0.5 |                 |                 |           |           |           |
|--------|---------|------------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB)     | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 11     | 1.05    | 71.278     | 1.1084015                   | 0.0365580       | 0.2149115       | 0.6506114 | 1.7370295 | 2.7670463 |
|        |         |            | 1.1652129                   | 4.9769612       | 4.8594749       | 6.6080441 | 3.8381548 | 4.1532085 |
|        |         |            | 1.3488607                   | 1.1316169       |                 |           |           |           |
|        |         |            | 1.9760810                   |                 |                 |           |           |           |
|        |         |            | 5.6021835                   |                 |                 |           |           |           |
|        | 1.10    | 85.249     | 1.2195217                   | 0.0211262       | 0.1427344       | 0.4689314 | 1.3286904 | 2.2463529 |
|        |         |            | 1.3088558                   | 4.1883517       | 4.2993241       | 5.9732342 | 3.6336257 | 3.9709018 |
|        |         |            | 1.5834523                   | 1.1326794       |                 |           |           |           |
|        |         |            | 2.4791006                   |                 |                 |           |           |           |
|        |         |            | 7.5378437                   |                 |                 |           |           |           |
|        | 1.15    | 95.309     | 1.3352275                   | 0.0151187       | 0.1106375       | 0.3830569 | 1.1263931 | 1.9762607 |
|        |         |            | 1.4533340                   | 3.7693607       | 3.9898396       | 5.6188055 | 3.5152387 | 3.8653507 |
|        |         |            | 1.8085794                   | 1.1334272       |                 |           |           |           |
|        |         |            | 2.9446236                   |                 |                 |           |           |           |
|        |         |            | 9.2991673                   |                 |                 |           |           |           |
|        | 1.20    | 103.487    | 1.4557817                   | 0.0119319       | 0.0922169       | 0.3316026 | 1.0015192 | 1.8044052 |
|        |         |            | 1.6013465                   | 3.4985813       | 3.7847360       | 5.3823185 | 3.4344153 | 3.7932915 |
|        |         |            | 2.0339626                   | 1.1339994       |                 |           |           |           |
|        |         |            | 3.4024453                   |                 |                 |           |           |           |
|        |         |            | 11.0168385                  |                 |                 |           |           |           |
| 1.25   | 110.510 | 1.5812870  | 0.0099689                   | 0.0802327       | 0.2970172       | 0.9157352 | 1.6836853 |           |
|        |         | 1.7539211  | 3.3061741                   | 3.6363132       | 5.2103322       | 3.3746584 | 3.7400192 |           |
|        |         | 2.2631658  | 1.1344569                   |                 |                 |           |           |           |
|        |         | 3.8631607  |                             |                 |                 |           |           |           |
|        |         | 12.7367378 |                             |                 |                 |           |           |           |
| 1.30   | 116.732 | 1.7117951  | 0.0086455                   | 0.0718159       | 0.2720933       | 0.8528537 | 1.5936478 |           |
|        |         | 1.9115674  | 3.1613728                   | 3.5230322       | 5.0785580       | 3.3282910 | 3.6986881 |           |
|        |         | 2.4979196  | 1.1348331                   |                 |                 |           |           |           |
|        |         | 4.3318290  |                             |                 |                 |           |           |           |
|        |         | 14.4806247 |                             |                 |                 |           |           |           |
| 1.35   | 122.355 | 1.8473359  | 0.0076974                   | 0.0655883       | 0.2532617       | 0.8046836 | 1.5237044 |           |
|        |         | 2.0745762  | 3.0480642                   | 3.4333855       | 4.9739506       | 3.2911105 | 3.6655500 |           |
|        |         | 2.7391978  | 1.1351488                   |                 |                 |           |           |           |
|        |         | 4.8112671  |                             |                 |                 |           |           |           |
|        |         | 16.2605612 |                             |                 |                 |           |           |           |
| 1.40   | 127.511 | 1.9879279  | 0.0069874                   | 0.0608021       | 0.2385349       | 0.7665791 | 1.4677341 |           |
|        |         | 2.2431285  | 2.9568412                   | 3.3605420       | 4.8887311       | 3.2605706 | 3.6383336 |           |
|        |         | 2.9876021  | 1.1354176                   |                 |                 |           |           |           |
|        |         | 5.3032020  |                             |                 |                 |           |           |           |
|        |         | 18.0839213 |                             |                 |                 |           |           |           |
| 1.45   | 132.287 | 2.1335836  | 0.0064377                   | 0.0570154       | 0.2267110       | 0.7356881 | 1.4219165 |           |
|        |         | 2.4173448  | 2.8817819                   | 3.3001396       | 4.8179127       | 3.2350166 | 3.6155630 |           |
|        |         | 3.2435289  | 1.1356495                   |                 |                 |           |           |           |
|        |         | 5.8087659  |                             |                 |                 |           |           |           |
|        |         | 19.9555287 |                             |                 |                 |           |           |           |
| 1.50   | 136.748 | 2.2843118  | 0.0060007                   | 0.0539501       | 0.2170182       | 0.7101537 | 1.3837282 |           |
|        |         | 2.5973085  | 2.8189458                   | 3.2492393       | 4.7581242       | 3.2133165 | 3.5962285 |           |
|        |         | 3.5072526  | 1.1358514                   |                 |                 |           |           |           |
|        |         | 6.3287388  |                             |                 |                 |           |           |           |
|        |         | 21.8787000 |                             |                 |                 |           |           |           |
| 1.70   | 152.234 | 2.9380530  | 0.0048978                   | 0.0459668       | 0.1912042       | 0.6411318 | 1.2789628 |           |
|        |         | 3.3756369  | 2.6451963                   | 3.1068330       | 4.5902929       | 3.1517688 | 3.5414014 |           |
|        |         | 4.6433716  | 1.1364500                   |                 |                 |           |           |           |
|        |         | 8.5619394  |                             |                 |                 |           |           |           |
|        |         | 30.1261720 |                             |                 |                 |           |           |           |
| 2.00   | 170.816 | 4.0714332  | 0.0041082                   | 0.0399938       | 0.1712673       | 0.5866834 | 1.1945764 |           |
|        |         | 4.7212543  | 2.5036720                   | 2.9889272       | 4.4506865       | 3.0998348 | 3.4951533 |           |
|        |         | 6.5999975  | 1.1369863                   |                 |                 |           |           |           |
|        |         | 12.3963998 |                             |                 |                 |           |           |           |
|        |         | 44.2665611 |                             |                 |                 |           |           |           |

| CASE A |         |        | Passband Ripple: Ap(dB)=0.5 |                 |                 |           |           |           |
|--------|---------|--------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB) | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 12     | 1.10    | 94.924 | 1.2179786                   | 0.0134475       | 0.0879091       | 0.3758949 | 0.9324798 | 2.2684187 |
|        |         |        | 1.2909254                   | 3.3127631       | 5.7303689       | 5.3107824 | 7.0973938 | 3.9748409 |
|        |         |        | 1.4996665                   | 4.2730142       | 1.1321829       |           |           |           |
|        |         |        | 2.0872157                   |                 |                 |           |           |           |
|        |         |        | 4.3499304                   |                 |                 |           |           |           |
|        |         |        | 33.0577896                  |                 |                 |           |           |           |
| 1.15   | 105.898 |        | 1.3331670                   | 0.0093352       | 0.0661231       | 0.2973831 | 0.7715771 | 1.9360871 |
|        |         |        | 1.4297858                   | 2.9271138       | 5.1664253       | 4.9341067 | 6.6759825 | 3.8453763 |
|        |         |        | 1.7009576                   | 4.1576458       | 1.1328034       |           |           |           |
|        |         |        | 2.4494590                   |                 |                 |           |           |           |
|        |         |        | 5.2979222                   |                 |                 |           |           |           |
|        |         |        | 41.3060302                  |                 |                 |           |           |           |
| 1.20   | 114.820 |        | 1.4532283                   | 0.0072106       | 0.0539529       | 0.2516560 | 0.6742069 | 1.7301404 |
|        |         |        | 1.5724303                   | 2.6811528       | 4.8018184       | 4.6844281 | 6.3949084 | 3.7569998 |
|        |         |        | 1.9034206                   | 4.0788741       | 1.1332853       |           |           |           |
|        |         |        | 2.8072245                   |                 |                 |           |           |           |
|        |         |        | 6.2244021                   |                 |                 |           |           |           |
|        |         |        | 49.3373729                  |                 |                 |           |           |           |
| 1.25   | 122.482 |        | 1.5782485                   | 0.0059267       | 0.0461880       | 0.2215504 | 0.6082854 | 1.5882218 |
|        |         |        | 1.7197065                   | 2.5080667       | 4.5426394       | 4.5037002 | 6.1905329 | 3.6916395 |
|        |         |        | 2.1098820                   | 4.0206245       | 1.1336661       |           |           |           |
|        |         |        | 3.1681544                   |                 |                 |           |           |           |
|        |         |        | 7.1532769                   |                 |                 |           |           |           |
|        |         |        | 57.3715316                  |                 |                 |           |           |           |
| 1.30   | 129.269 |        | 1.7082709                   | 0.0050738       | 0.0408158       | 0.2002002 | 0.5605122 | 1.4839352 |
|        |         |        | 1.8720353                   | 2.3787994       | 4.3475392       | 4.3657568 | 6.0339823 | 3.6409329 |
|        |         |        | 2.3217202                   | 3.9754299       | 1.1339832       |           |           |           |
|        |         |        | 3.5359122                   |                 |                 |           |           |           |
|        |         |        | 8.0959007                   |                 |                 |           |           |           |
|        |         |        | 65.5126430                  |                 |                 |           |           |           |
| 1.35   | 135.404 |        | 1.8433207                   | 0.0044699       | 0.0368883       | 0.1842752 | 0.5242507 | 1.4038799 |
|        |         |        | 2.0296574                   | 2.2782634       | 4.1948285       | 4.2565710 | 5.9097176 | 3.6002611 |
|        |         |        | 2.5397132                   | 3.9391864       | 1.1342460       |           |           |           |
|        |         |        | 3.9125428                   |                 |                 |           |           |           |
|        |         |        | 9.0585736                   |                 |                 |           |           |           |
|        |         |        | 73.8184125                  |                 |                 |           |           |           |
| 1.40   | 141.028 |        | 1.9834134                   | 0.0040221       | 0.0338996       | 0.1719529 | 0.4957849 | 1.3404435 |
|        |         |        | 2.1927230                   | 2.1977378       | 4.0718614       | 4.1678471 | 5.8085006 | 3.5668562 |
|        |         |        | 2.7643424                   | 3.9094182       | 1.1344711       |           |           |           |
|        |         |        | 4.2993023                   |                 |                 |           |           |           |
|        |         |        | 10.0451492                  |                 |                 |           |           |           |
|        |         |        | 82.3241078                  |                 |                 |           |           |           |
| 1.45   | 146.239 |        | 2.1285596                   | 0.0036782       | 0.0315544       | 0.1621472 | 0.4728561 | 1.2889395 |
|        |         |        | 2.3613317                   | 2.1317660       | 3.9706655       | 4.0942715 | 5.7243977 | 3.5389042 |
|        |         |        | 2.9959256                   | 3.8845105       | 1.1346652       |           |           |           |
|        |         |        | 4.6970152                   |                 |                 |           |           |           |
|        |         |        | 11.0581496                  |                 |                 |           |           |           |
|        |         |        | 91.0527944                  |                 |                 |           |           |           |
| 1.50   | 151.105 |        | 2.2787664                   | 0.0034066       | 0.0296693       | 0.1541697 | 0.4540075 | 1.2463118 |
|        |         |        | 2.5355530                   | 2.0767425       | 3.8859382       | 4.0322696 | 5.6534031 | 3.5151701 |
|        |         |        | 3.2346828                   | 3.8633611       | 1.1348352       |           |           |           |
|        |         |        | 5.1062498                   |                 |                 |           |           |           |
|        |         |        | 12.0993095                  |                 |                 |           |           |           |
|        |         |        | 100.0203299                 |                 |                 |           |           |           |
| 1.70   | 167.999 |        | 2.9302881                   | 0.0027297       | 0.0248202       | 0.1332066 | 0.4035561 | 1.1308135 |
|        |         |        | 3.2893923                   | 1.9255966       | 3.6515860       | 3.8587736 | 5.4541408 | 3.4478386 |
|        |         |        | 4.2640673                   | 3.8033753       | 1.1353352       |           |           |           |
|        |         |        | 6.8651328                   |                 |                 |           |           |           |
|        |         |        | 16.5660270                  |                 |                 |           |           |           |
|        |         |        | 138.4661013                 |                 |                 |           |           |           |
| 2.00   | 188.270 |        | 4.0598914                   | 0.0022533       | 0.0212551       | 0.1173193 | 0.3643082 | 1.0393931 |
|        |         |        | 4.5932605                   | 1.8036320       | 3.4606245       | 3.7151085 | 5.2884326 | 3.3910234 |
|        |         |        | 6.0382667                   | 3.7527671       | 1.1357837       |           |           |           |
|        |         |        | 9.8873550                   |                 |                 |           |           |           |
|        |         |        | 24.2272012                  |                 |                 |           |           |           |
|        |         |        | 204.3626509                 |                 |                 |           |           |           |

| CASE A |      | Passband Ripple: Ap(dB)=1.0 |           |                 |                 |           |          |          |
|--------|------|-----------------------------|-----------|-----------------|-----------------|-----------|----------|----------|
| n      | Ws   | As(dB)                      | C1        | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8 | A4<br>A9 |
| 2      | 1.05 | 2.816                       | 1.4386640 | 1.1672218       | 0.3141664       |           |          |          |
|        | 1.10 | 4.025                       | 1.7140833 | 1.2099342       | 0.4582576       |           |          |          |
|        | 1.15 | 5.126                       | 1.9755745 | 1.2286108       | 0.5619915       |           |          |          |
|        | 1.20 | 6.150                       | 2.2359899 | 1.2358199       | 0.6411310       |           |          |          |
|        | 1.25 | 7.112                       | 2.5000000 | 1.2369152       | 0.7033182       |           |          |          |
|        | 1.30 | 8.018                       | 2.7698611 | 1.2346478       | 0.7532000       |           |          |          |
|        | 1.35 | 8.875                       | 3.0468391 | 1.2305468       | 0.7938715       |           |          |          |
|        | 1.40 | 9.687                       | 3.3317143 | 1.2254971       | 0.8274948       |           |          |          |
|        | 1.45 | 10.459                      | 3.6250000 | 1.2200214       | 0.8556278       |           |          |          |
|        | 1.50 | 11.194                      | 3.9270510 | 1.2144311       | 0.8794183       |           |          |          |
|        | 1.70 | 13.828                      | 5.2271136 | 1.1936113       | 0.9456448       |           |          |          |
|        | 2.00 | 17.095                      | 7.4641016 | 1.1700773       | 0.9989416       |           |          |          |
| 3      | 1.05 | 8.134                       | 1.2054102 | 0.9845755       | 1.1629654       | 1.0788121 |          |          |
|        | 1.10 | 11.480                      | 1.3703136 | 0.8507724       | 1.2018049       | 1.0114629 |          |          |
|        | 1.15 | 14.057                      | 1.5336053 | 0.7774844       | 1.2202596       | 0.9863258 |          |          |
|        | 1.20 | 16.209                      | 1.6996171 | 0.7292653       | 1.2304325       | 0.9749216 |          |          |
|        | 1.25 | 18.082                      | 1.8699785 | 0.6945745       | 1.2364721       | 0.9694150 |          |          |
|        | 1.30 | 19.754                      | 2.0454918 | 0.6682233       | 1.2402089       | 0.9668112 |          |          |
|        | 1.35 | 21.272                      | 2.2266128 | 0.6474523       | 1.2425703       | 0.9657522 |          |          |
|        | 1.40 | 22.668                      | 2.4136247 | 0.6306308       | 1.2440697       | 0.9655533 |          |          |
|        | 1.45 | 23.964                      | 2.6067151 | 0.6167222       | 1.2450101       | 0.9658434 |          |          |
|        | 1.50 | 25.176                      | 2.8060141 | 0.6050306       | 1.2455787       | 0.9664113 |          |          |
|        | 1.70 | 29.390                      | 3.6668482 | 0.5724671       | 1.2460099       | 0.9695915 |          |          |
|        | 2.00 | 34.454                      | 5.1532091 | 0.5456786       | 1.2449721       | 0.9740259 |          |          |



| CASE A |      |        | Passband Ripple: Ap(dB)=1.0 |                 |                 |           |           |           |
|--------|------|--------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB) | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 4      | 1.05 | 15.840 | 1.1536336<br>3.3125181      | 0.6921654       | 0.8610366       | 1.7548054 | 0.8757772 |           |
|        | 1.10 | 20.832 | 1.2909254<br>4.3499304      | 0.5725316       | 0.8679778       | 1.6637303 | 0.9074267 |           |
|        | 1.15 | 24.467 | 1.4297858<br>5.2979222      | 0.5082176       | 0.8593383       | 1.6167996 | 0.9190801 |           |
|        | 1.20 | 27.432 | 1.5724303<br>6.2244021      | 0.4667410       | 0.8489719       | 1.5872188 | 0.9252886 |           |
|        | 1.25 | 29.982 | 1.7197065<br>7.1532769      | 0.4373964       | 0.8392294       | 1.5665716 | 0.9292753 |           |
|        | 1.30 | 32.242 | 1.8720353<br>8.0959007      | 0.4154103       | 0.8305487       | 1.5512290 | 0.9321325 |           |
|        | 1.35 | 34.286 | 2.0296574<br>9.0585736      | 0.3982761       | 0.8229227       | 1.5393320 | 0.9343268 |           |
|        | 1.40 | 36.160 | 2.1927230<br>10.0451492     | 0.3845316       | 0.8162370       | 1.5298168 | 0.9360908 |           |
|        | 1.45 | 37.897 | 2.3613317<br>11.0581496     | 0.3732587       | 0.8103617       | 1.5220252 | 0.9375541 |           |
|        | 1.50 | 39.518 | 2.5355530<br>12.0993095     | 0.3638481       | 0.8051778       | 1.5155253 | 0.9387957 |           |
|        | 1.70 | 45.149 | 3.2893923<br>16.5660270     | 0.3379618       | 0.7895441       | 1.4976354 | 0.9423649 |           |
|        | 2.00 | 51.906 | 4.5932605<br>24.2272012     | 0.3170348       | 0.7753381       | 1.4831116 | 0.9455027 |           |
| 5      | 1.05 | 24.135 | 1.1334220<br>1.7737385      | 0.3951263       | 0.9765996       | 1.3156878 | 1.9993536 | 0.9212833 |
|        | 1.10 | 30.470 | 1.2593204<br>2.1930925      | 0.3079804       | 0.8917965       | 1.2198990 | 1.9296353 | 0.9200924 |
|        | 1.15 | 35.040 | 1.3881033<br>2.5834170      | 0.2645345       | 0.8379581       | 1.1705453 | 1.8864348 | 0.9214097 |
|        | 1.20 | 38.757 | 1.5211268<br>2.9683674      | 0.2375500       | 0.7997737       | 1.1386033 | 1.8562533 | 0.9228818 |
|        | 1.25 | 41.949 | 1.6589139<br>3.3563960      | 0.2189136       | 0.7709714       | 1.1156707 | 1.8337219 | 0.9242125 |
|        | 1.30 | 44.776 | 1.8017262<br>3.7515494      | 0.2051908       | 0.7483578       | 1.0981893 | 1.8161649 | 0.9253710 |
|        | 1.35 | 47.333 | 1.9497131<br>4.1560845      | 0.1946378       | 0.7300898       | 1.0843297 | 1.8020627 | 0.9263742 |
|        | 1.40 | 49.676 | 2.1029685<br>4.5713865      | 0.1862620       | 0.7150111       | 1.0730308 | 1.7904744 | 0.9272457 |
|        | 1.45 | 51.847 | 2.2615546<br>4.9983644      | 0.1794521       | 0.7023524       | 1.0636251 | 1.7807806 | 0.9280073 |
|        | 1.50 | 53.875 | 2.4255147<br>5.4376446      | 0.1738088       | 0.6915782       | 1.0556665 | 1.7725538 | 0.9286769 |
|        | 1.70 | 60.914 | 3.1356145<br>7.3252003      | 0.1584830       | 0.6609332       | 1.0331949 | 1.7492666 | 0.9306907 |
|        | 2.00 | 69.360 | 4.3649509<br>10.5677323     | 0.1463103       | 0.6350259       | 1.0142939 | 1.7296971 | 0.9325243 |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB}) = 1.0$ |                                     |                        |                        |           |           |           |
|--------|------|---------|-----------------------------------------|-------------------------------------|------------------------|------------------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                                      | A0<br>A5<br>A10                     | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8  | A4<br>A9  |           |
| 6      | 1.05 | 32.523  | 1.1233258<br>1.4386640<br>6.5287683     | 0.2799823<br>0.9121807              | 0.6469184              | 1.6088246              | 1.5601135 | 2.3367141 |           |
|        | 1.10 | 40.142  | 1.2433620<br>1.7140833<br>8.8264550     | 0.2076500<br>0.9154935              | 0.5637872              | 1.4288584              | 1.4784959 | 2.2362015 |           |
|        | 1.15 | 45.628  | 1.3669587<br>1.9755745<br>10.9158033    | 0.1730172<br>0.9173044              | 0.5145667              | 1.3315274              | 1.4288311 | 2.1791221 |           |
|        | 1.20 | 50.089  | 1.4950350<br>2.2359899<br>12.9526713    | 0.1520609<br>0.9186163              | 0.4810447              | 1.2673732              | 1.3943788 | 2.1404467 |           |
|        | 1.25 | 53.920  | 1.6279471<br>2.5000000<br>14.9917591    | 0.1378602<br>0.9196505              | 0.4564523              | 1.2209819              | 1.3687244 | 2.1119709 |           |
|        | 1.30 | 57.313  | 1.7658735<br>2.7698611<br>17.0590037    | 0.1275561<br>0.9204984              | 0.4375391              | 1.1855394              | 1.3487429 | 2.0899360 |           |
|        | 1.35 | 60.381  | 1.9089166<br>3.0468391<br>19.1687817    | 0.1197248<br>0.9212103              | 0.4225047              | 1.1574453              | 1.3326845 | 2.0723022 |           |
|        | 1.40 | 63.193  | 2.0571405<br>3.3317143<br>21.3298812    | 0.1135692<br>0.9218179              | 0.4102555              | 1.1345748              | 1.3194750 | 2.0578406 |           |
|        | 1.45 | 65.798  | 2.2105880<br>3.6250000<br>23.5480505    | 0.1086050<br>0.9223429              | 0.4000820              | 1.1155750              | 1.3084110 | 2.0457554 |           |
|        | 1.50 | 68.231  | 2.3692888<br>3.9270510<br>25.8272420    | 0.1045196<br>0.9228010              | 0.3915010              | 1.0995354              | 1.2990086 | 2.0355039 |           |
|        | 1.70 | 76.678  | 3.0569811<br>5.2271136<br>35.6008780    | 0.0935601<br>0.9241655              | 0.3674785              | 1.0544955              | 1.2723113 | 2.0064831 |           |
|        | 2.00 | 86.814  | 4.2481552<br>7.4641016<br>52.3568408    | 0.0850044<br>0.9253962              | 0.3476058              | 1.0169868              | 1.2497545 | 1.9820616 |           |
|        | 7    | 1.05    | 40.926                                  | 1.1175213<br>1.3083409<br>2.7143721 | 0.1576625<br>2.6510125 | 0.6017573<br>0.9125805 | 1.1064552 | 2.2500967 | 1.8620959 |
|        |      | 1.10    | 49.816                                  | 1.2341277<br>1.5239435<br>3.5147693 | 0.1112174<br>2.5363599 | 0.4903824<br>0.9141089 | 0.9529513 | 2.0209395 | 1.7563342 |
| 1.15   |      | 56.218  | 1.3546897<br>1.7321918<br>4.2484927     | 0.0898885<br>2.4698417              | 0.4304293<br>0.9152853 | 0.8705229              | 1.8917367 | 1.6958418 |           |
| 1.20   |      | 61.422  | 1.4798722<br>1.9413408<br>4.9666973     | 0.0773183<br>2.4244421              | 0.3916809<br>0.9162023 | 0.8165456              | 1.8052552 | 1.6546732 |           |
| 1.25   |      | 65.891  | 1.6099341<br>2.1544332<br>5.6874343     | 0.0689614<br>2.3908983              | 0.3642358<br>0.9169412 | 0.7777427              | 1.7422699 | 1.6242692 |           |
| 1.30   |      | 69.851  | 1.7450051<br>2.3729509<br>6.4192876     | 0.0629861<br>2.3648886              | 0.3436663<br>0.9175515 | 0.7482520              | 1.6939719 | 1.6006880 |           |
| 1.35   |      | 73.429  | 1.8851599<br>2.5977295<br>7.1670237     | 0.0584980<br>2.3440458              | 0.3276387<br>0.9180652 | 0.7249830              | 1.6556109 | 1.5817821 |           |
| 1.40   |      | 76.710  | 2.0304452<br>2.8292857<br>7.9335602     | 0.0550044<br>2.3269357              | 0.3147878<br>0.9185039 | 0.7061172              | 1.6243480 | 1.5662535 |           |
| 1.45   |      | 79.750  | 2.1808921<br>3.0679607<br>8.7208069     | 0.0522097<br>2.3126263              | 0.3042542<br>0.9188829 | 0.6905005              | 1.5983606 | 1.5532597 |           |
| 1.50   |      | 82.588  | 2.3365223<br>3.3139902<br>9.5300781     | 0.0499256<br>2.3004806              | 0.2954669<br>0.9192135 | 0.6773588              | 1.5764156 | 1.5422249 |           |
| 1.70   |      | 92.443  | 3.0111362<br>4.3744590<br>13.0029293    | 0.0438731<br>2.2660623              | 0.2713360<br>0.9201967 | 0.6406775              | 1.5147893 | 1.5109222 |           |
| 2.00   |      | 104.268 | 4.1800429<br>6.2017764<br>18.9610948    | 0.0392290<br>2.2370580              | 0.2518902<br>0.9210811 | 0.6104007              | 1.4634976 | 1.4845003 |           |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB})=1.0$              |                        |                        |                        |           |           |
|--------|------|---------|----------------------------------------------------|------------------------|------------------------|------------------------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                                                 | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8  | A4<br>A9  |
| 8      | 1.05 | 49.331  | 1.1138641<br>1.2431181<br>1.9061395<br>11.0466061  | 0.1117368<br>2.1493230 | 0.3777362<br>2.9705605 | 1.1632875<br>0.9116280 | 1.6150706 | 3.0212152 |
|        | 1.10 | 59.491  | 1.2282855<br>1.4271032<br>2.3804113<br>15.1062239  | 0.0749879<br>2.0304235 | 0.2938214<br>2.8381612 | 0.9515661<br>0.9129534 | 1.4108347 | 2.7125274 |
|        | 1.15 | 66.807  | 1.3469136<br>1.6072975<br>2.8200771<br>18.7925269  | 0.0587913<br>1.9614215 | 0.2505912<br>2.7616023 | 0.8414452<br>0.9138720 | 1.2977554 | 2.5407814 |
|        | 1.20 | 72.755  | 1.4702527<br>1.7895085<br>3.2528314<br>22.3835994  | 0.0494932<br>1.9142874 | 0.2234140<br>2.7093634 | 0.7710675<br>0.9145755 | 1.2228936 | 2.4263226 |
|        | 1.25 | 77.863  | 1.5984994<br>1.9759013<br>3.6885364<br>25.9769795  | 0.0434282<br>1.8794312 | 0.2045447<br>2.6707571 | 0.7214309<br>0.9151391 | 1.1687948 | 2.3431315 |
|        | 1.30 | 82.388  | 1.7317524<br>2.1675370<br>4.1319051<br>29.6189023  | 0.0391551<br>1.8523815 | 0.1906173<br>2.6408123 | 0.6842823<br>0.9156033 | 1.1275582 | 2.2794146 |
|        | 1.35 | 86.478  | 1.8700686<br>2.3650162<br>4.5855625<br>33.3349904  | 0.0359831<br>1.8306892 | 0.1798971<br>2.6168084 | 0.6553404<br>0.9159934 | 1.0949620 | 2.2288462 |
|        | 1.40 | 90.227  | 2.0134836<br>2.5687116<br>5.0511190<br>37.1409040  | 0.0335377<br>1.8128698 | 0.1713874<br>2.5970974 | 0.6321233<br>0.9163261 | 1.0685016 | 2.1876576 |
|        | 1.45 | 93.701  | 2.1620209<br>2.7788694<br>5.5296305<br>41.0468858  | 0.0315975<br>1.7979584 | 0.1644704<br>2.5806086 | 0.6130777<br>0.9166133 | 1.0465790 | 2.1534341 |
|        | 1.50 | 96.945  | 2.3156973<br>2.9956604<br>6.0218242<br>45.0599777  | 0.0300227<br>1.7852950 | 0.1587413<br>2.5666098 | 0.5971747<br>0.9168636 | 1.0281189 | 2.1245440 |
|        | 1.70 | 108.208 | 2.9819909<br>3.9311886<br>8.1360237<br>62.2665524  | 0.0259004<br>1.7493731 | 0.1432062<br>2.5269227 | 0.5534048<br>0.9176069 | 0.9765419 | 2.0434616 |
|        | 2.00 | 121.722 | 4.1367342<br>5.5450630<br>11.7666735<br>91.7615329 | 0.0227916<br>1.7190558 | 0.1309067<br>2.4934570 | 0.5179885<br>0.9182744 | 0.9339212 | 1.9760297 |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB}) = 1.0$           |                        |                        |                        |                        |           |
|--------|------|---------|---------------------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------|
| n      | Ws   | As(dB)  | C1                                                | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9  |
| 9      | 1.05 | 57.736  | 1.1114059<br>1.2054102<br>1.5942707<br>3.9936736  | 0.0629026<br>3.8865837 | 0.3248769<br>2.4398958 | 0.7644661<br>3.2892844 | 1.9224738<br>0.9111509 | 2.2301505 |
|        | 1.10 | 69.167  | 1.2243475<br>1.3703136<br>1.9377187<br>5.2992478  | 0.0401615<br>3.4938833 | 0.2379754<br>2.3051746 | 0.6027271<br>3.1400958 | 1.5925974<br>0.9121705 | 1.9553030 |
|        | 1.15 | 77.397  | 1.3416657<br>1.5336053<br>2.2599957<br>6.4899114  | 0.0305437<br>3.2748971 | 0.1958555<br>2.2272244 | 0.5206531<br>3.0537040 | 1.4184474<br>0.9128926 | 1.8041339 |
|        | 1.20 | 84.089  | 1.4637563<br>1.6996171<br>2.5791043<br>7.6523927  | 0.0251657<br>3.1289227 | 0.1703284<br>2.1740050 | 0.4690942<br>2.9947217 | 1.3064655<br>0.9134463 | 1.7041822 |
|        | 1.25 | 89.835  | 1.5907740<br>1.8699785<br>2.9015215<br>8.8171818  | 0.0217239<br>3.0228391 | 0.1530541<br>2.1346535 | 0.4332033<br>2.9511158 | 1.2272085<br>0.9138895 | 1.6319661 |
|        | 1.30 | 94.925  | 1.7227963<br>2.0454918<br>3.2303598<br>9.9987492  | 0.0193344<br>2.9416047 | 0.1405489<br>2.1041164 | 0.4066207<br>2.9172837 | 1.1677511<br>0.9142543 | 1.5769138 |
|        | 1.35 | 99.526  | 1.8598680<br>2.2266128<br>3.5673591<br>11.2051201 | 0.0175815<br>2.8771469 | 0.1310696<br>2.0796277 | 0.3860867<br>2.8901577 | 1.1213468<br>0.9145606 | 1.5333885 |
|        | 1.40 | 103.745 | 2.0020170<br>2.4136247<br>3.9135894<br>12.4412023 | 0.0162431<br>2.8246551 | 0.1236379<br>2.0595111 | 0.3697317<br>2.8678788 | 1.0840696<br>0.9148217 | 1.4980489 |
|        | 1.45 | 107.652 | 2.1492622<br>2.6067151<br>4.2697534<br>13.7102067 | 0.0151899<br>2.7810472 | 0.1176595<br>2.0426776 | 0.3563965<br>2.8492389 | 1.0534551<br>0.9150469 | 1.4687642 |
|        | 1.50 | 111.302 | 2.3016164<br>2.8060141<br>4.6363361<br>15.0143415 | 0.0143409<br>2.7442409 | 0.1127507<br>2.0283819 | 0.3453197<br>2.8334117 | 1.0278674<br>0.9152431 | 1.4441002 |
|        | 1.70 | 123.972 | 2.9622803<br>3.6668482<br>6.2125942<br>20.6082544 | 0.0121455<br>2.6409706 | 0.0996430<br>1.9878303 | 0.3151188<br>2.7885298 | 0.9573217<br>0.9158253 | 1.3751655 |
|        | 2.00 | 139.176 | 4.1074418<br>5.1532091<br>8.9221914<br>30.2010593 | 0.0105182<br>2.5551227 | 0.0894842<br>1.9536068 | 0.2910072<br>2.7506699 | 0.9001002<br>0.9163475 | 1.3181714 |

| CASE A |      |         | Passband Ripple: Ap(dB)=1.0 |                 |                 |           |           |           |
|--------|------|---------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 10     | 1.05 | 66.141  | 1.1096718                   | 0.0445798       | 0.1984461       | 0.7365633 | 1.3133951 | 2.9395319 |
|        |      |         | 1.1814619                   | 2.9338894       | 4.8557784       | 2.7297718 | 3.6083282 | 0.9107669 |
|        |      |         | 1.4386640                   |                 |                 |           |           |           |
|        |      |         | 2.5336482                   |                 |                 |           |           |           |
|        |      |         | 16.8596102                  |                 |                 |           |           |           |
|        | 1.10 | 78.842  | 1.2215638                   | 0.0270788       | 0.1387188       | 0.5504932 | 1.0527659 | 2.4485571 |
|        |      |         | 1.3338339                   | 2.5821804       | 4.3670822       | 2.5798651 | 3.4422520 | 0.9115982 |
|        |      |         | 1.7140833                   |                 |                 |           |           |           |
|        |      |         | 3.2619424                   |                 |                 |           |           |           |
|        |      |         | 23.1838025                  |                 |                 |           |           |           |
|        | 1.15 | 87.987  | 1.3379528                   | 0.0199770       | 0.1109209       | 0.4600760 | 0.9184151 | 2.1894412 |
|        |      |         | 1.4860346                   | 2.3881835       | 4.0948427       | 2.4930517 | 3.3460589 | 0.9121829 |
|        |      |         | 1.9755745                   |                 |                 |           |           |           |
|        |      |         | 3.9305495                   |                 |                 |           |           |           |
|        |      |         | 28.9230322                  |                 |                 |           |           |           |
|        | 1.20 | 95.422  | 1.4591581                   | 0.0161091       | 0.0945052       | 0.4048952 | 0.8333603 | 2.0226690 |
|        |      |         | 1.6414311                   | 2.2597866       | 3.9134468       | 2.4337686 | 3.2803691 | 0.9126304 |
|        |      |         | 2.2359899                   |                 |                 |           |           |           |
|        |      |         | 4.5854918                   |                 |                 |           |           |           |
|        |      |         | 34.5122486                  |                 |                 |           |           |           |
|        | 1.25 | 101.806 | 1.5853042                   | 0.0136806       | 0.0836039       | 0.3672952 | 0.7738498 | 1.9045187 |
|        |      |         | 1.8012990                   | 2.1669667       | 3.7816581       | 2.3899294 | 3.2317947 | 0.9129883 |
|        |      |         | 2.5000000                   |                 |                 |           |           |           |
|        |      |         | 5.2430274                   |                 |                 |           |           |           |
|        |      |         | 40.1039839                  |                 |                 |           |           |           |
|        | 1.30 | 107.462 | 1.7164539                   | 0.0120192       | 0.0758261       | 0.3399065 | 0.7296059 | 1.8158077 |
|        |      |         | 1.9662686                   | 2.0961809       | 3.6807617       | 2.3559083 | 3.1941017 | 0.9132827 |
|        |      |         | 2.7698611                   |                 |                 |           |           |           |
|        |      |         | 5.9108926                   |                 |                 |           |           |           |
|        |      |         | 45.7705353                  |                 |                 |           |           |           |
|        | 1.35 | 112.575 | 1.8526432                   | 0.0108146       | 0.0699985       | 0.3190319 | 0.6953262 | 1.7465204 |
|        |      |         | 2.1366988                   | 2.0402000       | 3.6007163       | 2.3286246 | 3.1638760 | 0.9135296 |
|        |      |         | 3.0468391                   |                 |                 |           |           |           |
|        |      |         | 6.5933849                   |                 |                 |           |           |           |
|        |      |         | 51.5519660                  |                 |                 |           |           |           |
|        | 1.40 | 117.262 | 1.9938949                   | 0.0089039       | 0.0654734       | 0.3025888 | 0.6679552 | 1.6908251 |
|        |      |         | 2.3128131                   | 1.9947371       | 3.5355401       | 2.3062117 | 3.1390486 | 0.9137400 |
|        |      |         | 3.3317143                   |                 |                 |           |           |           |
|        |      |         | 7.2931353                   |                 |                 |           |           |           |
|        |      |         | 57.4727614                  |                 |                 |           |           |           |
|        | 1.45 | 121.604 | 2.1402240                   | 0.0091929       | 0.0618622       | 0.2893059 | 0.6455912 | 1.6450587 |
|        |      |         | 2.4947597                   | 1.9570564       | 3.4814016       | 2.2874563 | 3.1182745 | 0.9139215 |
|        |      |         | 3.6250000                   |                 |                 |           |           |           |
|        |      |         | 8.0118665                   |                 |                 |           |           |           |
|        |      |         | 63.5489356                  |                 |                 |           |           |           |
|        | 1.50 | 125.658 | 2.2916411                   | 0.0086238       | 0.0589175       | 0.2783599 | 0.6269813 | 1.6067885 |
|        |      |         | 2.6826414                   | 1.9253160       | 3.4357120       | 2.2715284 | 3.1006337 | 0.9140795 |
|        |      |         | 3.9270510                   |                 |                 |           |           |           |
|        |      |         | 8.7507642                   |                 |                 |           |           |           |
|        |      |         | 69.7914985                  |                 |                 |           |           |           |
|        | 1.70 | 139.737 | 2.9483149                   | 0.0071701       | 0.0511487       | 0.2489342 | 0.5760765 | 1.5011815 |
|        |      |         | 3.4947482                   | 1.8365783       | 3.3075429       | 2.2263464 | 3.0506011 | 0.9145481 |
|        |      |         | 5.2271136                   |                 |                 |           |           |           |
|        |      |         | 11.9220243                  |                 |                 |           |           |           |
|        |      |         | 96.5555666                  |                 |                 |           |           |           |
|        | 2.00 | 156.630 | 4.0866858                   | 0.0061109       | 0.0452297       | 0.2259031 | 0.5352454 | 1.4154084 |
|        |      |         | 4.8979715                   | 1.7631824       | 3.2010276       | 2.1882147 | 3.0083872 | 0.9149680 |
|        |      |         | 7.4641016                   |                 |                 |           |           |           |
|        |      |         | 17.3634536                  |                 |                 |           |           |           |
|        |      |         | 142.4309671                 |                 |                 |           |           |           |

| CASE A |         |            | Passband Ripple: $A_p(\text{dB})=1.0$ |                 |                 |           |           |           |
|--------|---------|------------|---------------------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB)     | C1                                    | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 11     | 1.05    | 74.546     | 1.1084015                             | 0.0250962       | 0.1634612       | 0.4701784 | 1.4024273 | 2.0670679 |
|        |         |            | 1.1652129                             | 4.2380768       | 3.7313045       | 5.9265000 | 3.0198280 | 3.9274214 |
|        |         |            | 1.3488607                             | 0.9104837       |                 |           |           |           |
|        |         |            | 1.9760810                             |                 |                 |           |           |           |
|        |         |            | 5.6021835                             |                 |                 |           |           |           |
|        | 1.10    | 88.517     | 1.2195217                             | 0.0145026       | 0.1079371       | 0.3375975 | 1.0659039 | 1.6720948 |
|        |         |            | 1.3088558                             | 3.5453465       | 3.2923844       | 5.3317998 | 2.8546170 | 3.7445363 |
|        |         |            | 1.5834523                             | 0.9111705       |                 |           |           |           |
|        |         |            | 2.4791006                             |                 |                 |           |           |           |
|        |         |            | 7.5378437                             |                 |                 |           |           |           |
| 1.15   | 98.576  | 1.3352275  | 0.0103786                             | 0.0834152       | 0.2751332       | 0.9001731 | 1.4677603 |           |
|        |         | 1.4533340  | 3.1789762                             | 3.0501952       | 5.0005746       | 2.7589357 | 3.6385779 |           |
|        |         | 1.8085794  | 0.9116533                             |                 |                 |           |           |           |
|        |         | 2.9446236  |                                       |                 |                 |           |           |           |
|        |         | 9.2991673  |                                       |                 |                 |           |           |           |
| 1.20   | 106.755 | 1.4557817  | 0.0081909                             | 0.0693938       | 0.2377899       | 0.7982482 | 1.3379823 |           |
|        |         | 1.6013465  | 2.9429054                             | 2.8898359       | 4.7799250       | 2.6935916 | 3.5662066 |           |
|        |         | 2.0339626  | 0.9120224                             |                 |                 |           |           |           |
|        |         | 3.4024453  |                                       |                 |                 |           |           |           |
|        |         | 11.0168385 |                                       |                 |                 |           |           |           |
| 1.25   | 113.778 | 1.5812870  | 0.0068434                             | 0.0602936       | 0.2127311       | 0.7284148 | 1.2469441 |           |
|        |         | 1.7539211  | 2.7755264                             | 2.7738724       | 4.6196472       | 2.6452678 | 3.5126846 |           |
|        |         | 2.2631658  | 0.9123175                             |                 |                 |           |           |           |
|        |         | 3.8631607  |                                       |                 |                 |           |           |           |
|        |         | 12.7367378 |                                       |                 |                 |           |           |           |
| 1.30   | 119.999 | 1.7117951  | 0.0059350                             | 0.0539132       | 0.1946957       | 0.6773298 | 1.1791170 |           |
|        |         | 1.9115674  | 2.6497744                             | 2.6854140       | 4.4969582       | 2.6077650 | 3.4711479 |           |
|        |         | 2.4979196  | 0.9125600                             |                 |                 |           |           |           |
|        |         | 4.3318290  |                                       |                 |                 |           |           |           |
|        |         | 14.4806247 |                                       |                 |                 |           |           |           |
| 1.35   | 125.623 | 1.8473359  | 0.0052841                             | 0.0491986       | 0.1810831       | 0.6382599 | 1.1264730 |           |
|        |         | 2.0745762  | 2.5515069                             | 2.6154427       | 4.3996365       | 2.5776884 | 3.4378372 |           |
|        |         | 2.7391978  | 0.9127634                             |                 |                 |           |           |           |
|        |         | 4.8112671  |                                       |                 |                 |           |           |           |
|        |         | 16.2605612 |                                       |                 |                 |           |           |           |
| 1.40   | 130.779 | 1.9879279  | 0.0047967                             | 0.0455789       | 0.1704465       | 0.6073954 | 1.0843765 |           |
|        |         | 2.2431285  | 2.4724827                             | 2.5586081       | 4.3204017       | 2.5529807 | 3.4104737 |           |
|        |         | 2.9876021  | 0.9129367                             |                 |                 |           |           |           |
|        |         | 5.3032020  |                                       |                 |                 |           |           |           |
|        |         | 18.0839213 |                                       |                 |                 |           |           |           |
| 1.45   | 135.555 | 2.1335836  | 0.0044193                             | 0.0427175       | 0.1619126       | 0.5824016 | 1.0499371 |           |
|        |         | 2.4173448  | 2.4075229                             | 2.5114956       | 4.2545916       | 2.5323047 | 3.3875762 |           |
|        |         | 3.2435289  | 0.9130861                             |                 |                 |           |           |           |
|        |         | 5.8087659  |                                       |                 |                 |           |           |           |
|        |         | 19.9555287 |                                       |                 |                 |           |           |           |
| 1.50   | 140.015 | 2.2843118  | 0.0041193                             | 0.0404027       | 0.1549211       | 0.5617614 | 1.0212473 |           |
|        |         | 2.5973085  | 2.3531860                             | 2.4718055       | 4.1990563       | 2.5147455 | 3.3681312 |           |
|        |         | 3.5072526  | 0.9132161                             |                 |                 |           |           |           |
|        |         | 6.3287388  |                                       |                 |                 |           |           |           |
|        |         | 21.8787000 |                                       |                 |                 |           |           |           |
| 1.70   | 155.502 | 2.9380530  | 0.0033623                             | 0.0343813       | 0.1363206       | 0.5060627 | 0.9426138 |           |
|        |         | 3.3756369  | 2.2031570                             | 2.3608183       | 4.0432908       | 2.4649351 | 3.3129760 |           |
|        |         | 4.6433716  | 0.9136016                             |                 |                 |           |           |           |
|        |         | 8.5619394  |                                       |                 |                 |           |           |           |
|        |         | 30.1261720 |                                       |                 |                 |           |           |           |
| 2.00   | 174.084 | 4.0714332  | 0.0028202                             | 0.0298832       | 0.1219758       | 0.4622272 | 0.8793598 |           |
|        |         | 4.7212543  | 2.0812045                             | 2.2689919       | 3.9138690       | 2.4228966 | 3.2664337 |           |
|        |         | 6.5999975  | 0.9139468                             |                 |                 |           |           |           |
|        |         | 12.3963998 |                                       |                 |                 |           |           |           |
|        |         | 44.2665611 |                                       |                 |                 |           |           |           |

| CASE A |      |         | Passband Ripple: Ap(dB)=1.0 |                 |                 |           |           |           |
|--------|------|---------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 12     | 1.10 | 98.192  | 1.2179786                   | 0.0097784       | 0.0618767       | 0.2913974 | 0.6797953 | 1.8514584 |
|        |      |         | 1.2909254                   | 2.4851417       | 4.9110928       | 4.0857633 | 6.3881227 | 3.1294105 |
|        |      |         | 1.4996665                   | 4.0469124       | 0.9108428       |           |           |           |
|        |      |         | 2.0872157                   |                 |                 |           |           |           |
|        |      |         | 4.3499304                   |                 |                 |           |           |           |
|        |      |         | 33.0577896                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.15 | 109.166 | 1.3331670                   | 0.0067881       | 0.0464523       | 0.2297725 | 0.5611879 | 1.5742776 |
|        |      |         | 1.4297858                   | 2.1913100       | 4.4123055       | 3.7901512 | 5.9921351 | 3.0248697 |
|        |      |         | 1.7009576                   | 3.9312104       | 0.9112478       |           |           |           |
|        |      |         | 2.4494590                   |                 |                 |           |           |           |
|        |      |         | 5.2979222                   |                 |                 |           |           |           |
|        |      |         | 41.3060302                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.20 | 118.088 | 1.4532283                   | 0.0052432       | 0.0378557       | 0.1940001 | 0.4895691 | 1.4030915 |
|        |      |         | 1.5724303                   | 2.0042043       | 4.0906915       | 3.5943432 | 5.7283951 | 2.9534704 |
|        |      |         | 1.9034206                   | 3.8521751       | 0.9115576       |           |           |           |
|        |      |         | 2.8072245                   |                 |                 |           |           |           |
|        |      |         | 6.2244021                   |                 |                 |           |           |           |
|        |      |         | 49.3373729                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.25 | 125.749 | 1.5782485                   | 0.0043096       | 0.0323791       | 0.1705049 | 0.4411600 | 1.2854238 |
|        |      |         | 1.7197065                   | 1.8727006       | 3.8625437       | 3.4527100 | 5.5368488 | 2.9006701 |
|        |      |         | 2.1098820                   | 3.7937207       | 0.9118066       |           |           |           |
|        |      |         | 3.1681544                   |                 |                 |           |           |           |
|        |      |         | 7.1532769                   |                 |                 |           |           |           |
|        |      |         | 57.3715316                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.30 | 132.536 | 1.7082709                   | 0.0036894       | 0.0285941       | 0.1538728 | 0.4061197 | 1.1991213 |
|        |      |         | 1.8720353                   | 1.7745739       | 3.6910607       | 3.3446399 | 5.3902368 | 2.8596841 |
|        |      |         | 2.3217202                   | 3.7483506       | 0.9120084       |           |           |           |
|        |      |         | 3.5359122                   |                 |                 |           |           |           |
|        |      |         | 8.0959007                   |                 |                 |           |           |           |
|        |      |         | 65.5126430                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.35 | 138.671 | 1.8433207                   | 0.0032503       | 0.0258293       | 0.1414850 | 0.3795498 | 1.1329760 |
|        |      |         | 2.0296574                   | 1.6983202       | 3.5570132       | 3.2591447 | 5.2739525 | 2.8268166 |
|        |      |         | 2.5397132                   | 3.7119646       | 0.9121789       |           |           |           |
|        |      |         | 3.9125428                   |                 |                 |           |           |           |
|        |      |         | 9.0585736                   |                 |                 |           |           |           |
|        |      |         | 73.8184125                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.40 | 144.296 | 1.9834134                   | 0.0029247       | 0.0237267       | 0.1319107 | 0.3587087 | 1.0806284 |
|        |      |         | 2.1927230                   | 1.6372822       | 3.4491860       | 3.1896933 | 5.1792890 | 2.7998179 |
|        |      |         | 2.7643424                   | 3.6820741       | 0.9123248       |           |           |           |
|        |      |         | 4.2993023                   |                 |                 |           |           |           |
|        |      |         | 10.0451492                  |                 |                 |           |           |           |
|        |      |         | 82.3241078                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.45 | 149.506 | 2.1285596                   | 0.0026746       | 0.0220777       | 0.1242993 | 0.3419326 | 1.0381723 |
|        |      |         | 2.3613317                   | 1.5873014       | 3.3605259       | 3.1321122 | 5.1006674 | 2.7772209 |
|        |      |         | 2.9959256                   | 3.6570598       | 0.9124492       |           |           |           |
|        |      |         | 4.6970152                   |                 |                 |           |           |           |
|        |      |         | 11.0581496                  |                 |                 |           |           |           |
|        |      |         | 91.0527944                  |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.50 | 154.372 | 2.2787664                   | 0.0024772       | 0.0207527       | 0.1181119 | 0.3281497 | 1.0030650 |
|        |      |         | 2.5355530                   | 1.5456339       | 3.2863494       | 3.0835992 | 5.0343259 | 2.7580314 |
|        |      |         | 3.2346828                   | 3.6358168       | 0.9125581       |           |           |           |
|        |      |         | 5.1062498                   |                 |                 |           |           |           |
|        |      |         | 12.0993095                  |                 |                 |           |           |           |
|        |      |         | 100.0203299                 |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 1.70 | 171.266 | 2.9302881                   | 0.0019849       | 0.0173471       | 0.1018761 | 0.2912953 | 0.9080980 |
|        |      |         | 3.2893923                   | 1.4312750       | 3.0814641       | 2.9479194 | 4.8482749 | 2.7035980 |
|        |      |         | 4.2640673                   | 3.5755587       | 0.9128816       |           |           |           |
|        |      |         | 6.8651328                   |                 |                 |           |           |           |
|        |      |         | 16.5660270                  |                 |                 |           |           |           |
|        |      |         | 138.4661013                 |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        | 2.00 | 191.538 | 4.0598914                   | 0.0016385       | 0.0148457       | 0.0895957 | 0.2626654 | 0.8330979 |
|        |      |         | 4.5932605                   | 1.3391008       | 2.9148270       | 2.8356323 | 4.6937120 | 2.6576529 |
|        |      |         | 6.0382667                   | 3.5247042       | 0.9131697       |           |           |           |
|        |      |         | 9.8873550                   |                 |                 |           |           |           |
|        |      |         | 24.2272012                  |                 |                 |           |           |           |
|        |      |         | 204.3626509                 |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |
|        |      |         |                             |                 |                 |           |           |           |

| CASE A |      | Passband Ripple: $A_p(\text{dB})=2.0$ |           |                 |                 |           |          |          |  |
|--------|------|---------------------------------------|-----------|-----------------|-----------------|-----------|----------|----------|--|
| n      | Ws   | As(dB)                                | C1        | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8 | A4<br>A9 |  |
| 2      | 1.05 | 4.859                                 | 1.4386640 | 1.0351449       | 0.3136639       |           |          |          |  |
|        | 1.10 | 6.482                                 | 1.7140833 | 1.0231136       | 0.4255997       |           |          |          |  |
|        | 1.15 | 7.849                                 | 1.9755745 | 1.0074934       | 0.4974621       |           |          |          |  |
|        | 1.20 | 9.058                                 | 2.2359899 | 0.9920957       | 0.5483446       |           |          |          |  |
|        | 1.25 | 10.153                                | 2.5000000 | 0.9779034       | 0.5863258       |           |          |          |  |
|        | 1.30 | 11.157                                | 2.7698611 | 0.9651268       | 0.6157013       |           |          |          |  |
|        | 1.35 | 12.089                                | 3.0468391 | 0.9537230       | 0.6390291       |           |          |          |  |
|        | 1.40 | 12.958                                | 3.3317143 | 0.9435677       | 0.6579441       |           |          |          |  |
|        | 1.45 | 13.774                                | 3.6250000 | 0.9345178       | 0.6735442       |           |          |          |  |
|        | 1.50 | 14.545                                | 3.9270510 | 0.9264359       | 0.6865949       |           |          |          |  |
|        | 1.70 | 17.266                                | 5.2271136 | 0.9015363       | 0.7223837       |           |          |          |  |
|        | 2.00 | 20.587                                | 7.4641016 | 0.8782917       | 0.7508225       |           |          |          |  |
| 3      | 1.05 | 11.284                                | 1.2054102 | 0.6550857       | 1.0691532       | 0.7774294 |          |          |  |
|        | 1.10 | 14.843                                | 1.3703136 | 0.5660600       | 1.0742665       | 0.7437443 |          |          |  |
|        | 1.15 | 17.499                                | 1.5336053 | 0.5172979       | 1.0731855       | 0.7317471 |          |          |  |
|        | 1.20 | 19.690                                | 1.6996171 | 0.4852154       | 1.0704626       | 0.7265863 |          |          |  |
|        | 1.25 | 21.583                                | 1.8699785 | 0.4621340       | 1.0673350       | 0.7242945 |          |          |  |
|        | 1.30 | 23.268                                | 2.0454918 | 0.4446012       | 1.0642264       | 0.7233825 |          |          |  |
|        | 1.35 | 24.793                                | 2.2266128 | 0.4307813       | 1.0612907       | 0.7231848 |          |          |  |
|        | 1.40 | 26.194                                | 2.4136247 | 0.4195892       | 1.0585784       | 0.7233703 |          |          |  |
|        | 1.45 | 27.494                                | 2.6067151 | 0.4103351       | 1.0560971       | 0.7237625 |          |          |  |
|        | 1.50 | 28.708                                | 2.8060141 | 0.4025561       | 1.0538367       | 0.7242627 |          |          |  |
|        | 1.70 | 32.926                                | 3.6668482 | 0.3808900       | 1.0466480       | 0.7264986 |          |          |  |
|        | 2.00 | 37.992                                | 5.1532091 | 0.3630663       | 1.0396729       | 0.7293004 |          |          |  |



| CASE A |      |        | Passband Ripple: Ap(dB)=2.0 |                 |                 |           |           |           |
|--------|------|--------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB) | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 4      | 1.05 | 19.316 | 1.1536336<br>3.3125181      | 0.5205180       | 0.6378233       | 1.5527730 | 0.6738993 |           |
|        | 1.10 | 24.351 | 1.2909254<br>4.3499304      | 0.4284007       | 0.6288189       | 1.4700574 | 0.6904039 |           |
|        | 1.15 | 27.997 | 1.4297858<br>5.2979222      | 0.3797798       | 0.6164100       | 1.4260480 | 0.6966358 |           |
|        | 1.20 | 30.967 | 1.5724303<br>6.2244021      | 0.3486131       | 0.6054040       | 1.3974861 | 0.7000511 |           |
|        | 1.25 | 33.518 | 1.7197065<br>7.1532769      | 0.3266223       | 0.5960853       | 1.3770723 | 0.7022964 |           |
|        | 1.30 | 35.780 | 1.8720353<br>8.0959007      | 0.3101691       | 0.5882161       | 1.3616106 | 0.7039344 |           |
|        | 1.35 | 37.824 | 2.0296574<br>9.0585736      | 0.2973572       | 0.5815266       | 1.3494335 | 0.7052085 |           |
|        | 1.40 | 39.699 | 2.1927230<br>10.0451492     | 0.2870849       | 0.5757911       | 1.3395688 | 0.7062421 |           |
|        | 1.45 | 41.435 | 2.3613317<br>11.0581496     | 0.2786626       | 0.5708314       | 1.3314042 | 0.7071051 |           |
|        | 1.50 | 43.057 | 2.5355530<br>12.0993095     | 0.2716331       | 0.5665086       | 1.3245315 | 0.7078407 |           |
| 5      | 1.05 | 27.664 | 1.1334220<br>1.7737385      | 0.2628966       | 0.8150631       | 0.9483996 | 1.8281690 | 0.6963229 |
|        | 1.10 | 34.007 | 1.2593204<br>2.1930925      | 0.2049142       | 0.7325326       | 0.8797625 | 1.7521024 | 0.6961133 |
|        | 1.15 | 38.578 | 1.3881033<br>2.5834170      | 0.1760076       | 0.6827349       | 0.8433400 | 1.7063852 | 0.6970393 |
|        | 1.20 | 42.295 | 1.5211268<br>2.9683674      | 0.1580535       | 0.6482645       | 0.8194062 | 1.6747567 | 0.6979793 |
|        | 1.25 | 45.487 | 1.6589139<br>3.3563960      | 0.1456538       | 0.6226462       | 0.8020669 | 1.6512344 | 0.6988077 |
|        | 1.30 | 48.315 | 1.8017262<br>3.7515494      | 0.1365234       | 0.6027358       | 0.7887718 | 1.6329309 | 0.6995212 |
|        | 1.35 | 50.872 | 1.9497131<br>4.1560845      | 0.1295019       | 0.5867707       | 0.7781892 | 1.6182337 | 0.7001355 |
|        | 1.40 | 53.215 | 2.1029685<br>4.5713865      | 0.1239291       | 0.5736680       | 0.7695376 | 1.6061541 | 0.7006673 |
|        | 1.45 | 55.386 | 2.2615546<br>4.9983644      | 0.1193982       | 0.5627179       | 0.7623210 | 1.5960444 | 0.7011310 |
|        | 1.50 | 57.414 | 2.4255147<br>5.4376446      | 0.1156434       | 0.5534324       | 0.7562052 | 1.5874597 | 0.7015381 |
| 6      | 1.70 | 64.453 | 3.1356145<br>7.3252003      | 0.1054464       | 0.5271847       | 0.7388991 | 1.5631229 | 0.7027596 |
|        | 2.00 | 72.899 | 4.3649509<br>10.5677323     | 0.0973473       | 0.5051715       | 0.7243109 | 1.5426149 | 0.7038691 |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB})=2.0$ |                        |                        |           |           |           |
|--------|------|---------|---------------------------------------|------------------------|------------------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                                    | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 6      | 1.05 | 36.061  | 1.1233258<br>1.4386640<br>6.5287683   | 0.2090486<br>0.6915754 | 0.4554768              | 1.3616333 | 1.1438637 | 2.1575798 |
|        | 1.10 | 43.680  | 1.2433620<br>1.7140833<br>8.8264550   | 0.1550218<br>0.6934884 | 0.3935626              | 1.2035439 | 1.0797923 | 2.0570627 |
|        | 1.15 | 49.167  | 1.3669587<br>1.9755745<br>10.9158033  | 0.1291640<br>0.6945763 | 0.3576760              | 1.1174836 | 1.0413629 | 1.9994259 |
|        | 1.20 | 53.628  | 1.4950350<br>2.2359899<br>12.9526713  | 0.1135188<br>0.6953723 | 0.3334790              | 1.0606661 | 1.0148144 | 1.9602084 |
|        | 1.25 | 57.459  | 1.6279471<br>2.5000000<br>14.9917591  | 0.1029173<br>0.6960015 | 0.3158360              | 1.0195758 | 0.9950770 | 1.9312621 |
|        | 1.30 | 60.852  | 1.7658735<br>2.7698611<br>17.0590037  | 0.0952249<br>0.6965178 | 0.3023242              | 0.9881977 | 0.9797148 | 1.9088252 |
|        | 1.35 | 63.920  | 1.9089166<br>3.0468391<br>19.1687817  | 0.0893785<br>0.6969512 | 0.2916167              | 0.9633421 | 0.9673725 | 1.8908470 |
|        | 1.40 | 66.732  | 2.0571405<br>3.3317143<br>21.3298812  | 0.0847832<br>0.6973210 | 0.2829135              | 0.9431228 | 0.9572210 | 1.8760881 |
|        | 1.45 | 69.337  | 2.2105880<br>3.6250000<br>23.5480505  | 0.0810772<br>0.6976404 | 0.2756988              | 0.9263379 | 0.9487185 | 1.8637442 |
|        | 1.50 | 71.770  | 2.3692888<br>3.9270510<br>25.8272420  | 0.0780273<br>0.6979191 | 0.2696228              | 0.9121780 | 0.9414929 | 1.8532660 |
|        | 1.70 | 80.218  | 3.0569811<br>5.2271136<br>35.6008780  | 0.0698457<br>0.6987484 | 0.2526572              | 0.8724735 | 0.9209742 | 1.8235663 |
|        | 2.00 | 90.353  | 4.2481552<br>7.4641016<br>52.3568408  | 0.0634586<br>0.6994956 | 0.2386696              | 0.8394833 | 0.9036337 | 1.7985295 |
| 7      | 1.05 | 44.465  | 1.1175213<br>1.3083409<br>2.7143721   | 0.1049005<br>2.4742302 | 0.4837279<br>0.6916350 | 0.7845361 | 1.9561099 | 1.3703446 |
|        | 1.10 | 53.355  | 1.2341277<br>1.5239435<br>3.5147693   | 0.0739983<br>2.3584822 | 0.3903597<br>0.6925909 | 0.6738953 | 1.7452544 | 1.2800324 |
|        | 1.15 | 59.757  | 1.3546897<br>1.7321918<br>4.2484927   | 0.0598072<br>2.2913326 | 0.3409128<br>0.6933135 | 0.6143494 | 1.6272552 | 1.2438942 |
|        | 1.20 | 64.961  | 1.4798722<br>1.9413408<br>4.9666973   | 0.0514436<br>2.2454680 | 0.3092242<br>0.6938747 | 0.5753579 | 1.5485599 | 1.2124470 |
|        | 1.25 | 69.430  | 1.6099341<br>2.1544332<br>5.6874343   | 0.0458834<br>2.2115556 | 0.2869009<br>0.6943262 | 0.5473438 | 1.4913794 | 1.1892050 |
|        | 1.30 | 73.390  | 1.7450051<br>2.3729509<br>6.4192876   | 0.0419077<br>2.1852430 | 0.2702342<br>0.6946989 | 0.5260674 | 1.4476072 | 1.1711703 |
|        | 1.35 | 76.968  | 1.8851599<br>2.5977295<br>7.1670237   | 0.0389216<br>2.1641458 | 0.2572851<br>0.6950123 | 0.5092912 | 1.4128870 | 1.1567066 |
|        | 1.40 | 80.249  | 2.0304452<br>2.8292857<br>7.9335602   | 0.0365971<br>2.1468184 | 0.2469257<br>0.6952799 | 0.4956982 | 1.3846216 | 1.1448238 |
|        | 1.45 | 83.289  | 2.1808921<br>3.0679607<br>8.7208069   | 0.0347376<br>2.1323213 | 0.2384498<br>0.6955109 | 0.4844527 | 1.3611469 | 1.1348790 |
|        | 1.50 | 86.127  | 2.3365223<br>3.3139902<br>9.5300781   | 0.0332179<br>2.1200119 | 0.2313896<br>0.6957124 | 0.4749945 | 1.3413388 | 1.1264323 |
|        | 1.70 | 95.982  | 3.0111362<br>4.3744590<br>13.0029293  | 0.0291909<br>2.0851060 | 0.2120506<br>0.6963112 | 0.4486211 | 1.2857891 | 1.1024653 |
|        | 2.00 | 107.807 | 4.1800429<br>6.2017764<br>18.9610948  | 0.0261010<br>2.0556623 | 0.1965183<br>0.6968494 | 0.4268852 | 1.2396435 | 1.0822290 |

| CASE A |      |         | Passband Ripple: Ap(dB)=2.0                        |                        |                        |                        |           |           |
|--------|------|---------|----------------------------------------------------|------------------------|------------------------|------------------------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                                                 | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8  | A4<br>A9  |
| 8      | 1.05 | 52.870  | 1.1138641<br>1.2431181<br>1.9061395<br>11.0466061  | 0.0834155<br>1.5889417 | 0.2613385<br>2.7937336 | 0.9588255<br>0.6910699 | 1.1594738 | 2.6684724 |
|        | 1.10 | 63.030  | 1.2282855<br>1.4271032<br>2.3804113<br>15.1062239  | 0.0559810<br>1.4982320 | 0.2021929<br>2.6607563 | 0.7797277<br>0.6918789 | 1.0093685 | 2.3830310 |
|        | 1.15 | 70.346  | 1.3469136<br>1.6072975<br>2.8200771<br>18.7925269  | 0.0438897<br>1.4455970 | 0.1719719<br>2.5837559 | 0.6868785<br>0.6924410 | 0.9265583 | 2.2245617 |
|        | 1.20 | 76.294  | 1.4702527<br>1.7895085<br>3.2528314<br>22.3835994  | 0.0369483<br>1.4096336 | 0.1530537<br>2.5311737 | 0.6277158<br>0.6928712 | 0.8718359 | 2.1191447 |
|        | 1.25 | 81.402  | 1.5984994<br>1.9759013<br>3.6885364<br>25.9769795  | 0.0324206<br>1.3830316 | 0.1399542<br>2.4922910 | 0.5860916<br>0.6932157 | 0.8323395 | 2.0426374 |
|        | 1.30 | 85.927  | 1.7317524<br>2.1675370<br>4.1319051<br>29.6189023  | 0.0292305<br>1.3623833 | 0.1303042<br>2.4621180 | 0.5550024<br>0.6934993 | 0.8022614 | 1.9841087 |
|        | 1.35 | 90.017  | 1.8700686<br>2.3650162<br>4.5855625<br>33.3349904  | 0.0268626<br>1.3458217 | 0.1228870<br>2.4379222 | 0.5308220<br>0.6937375 | 0.7785031 | 1.9377031 |
|        | 1.40 | 93.766  | 2.0134836<br>2.5687116<br>5.0511190<br>37.1409040  | 0.0250370<br>1.3322151 | 0.1170059<br>2.4180473 | 0.5114518<br>0.6939406 | 0.7592287 | 1.8999359 |
|        | 1.45 | 97.240  | 2.1620209<br>2.7788694<br>5.5296305<br>41.0468858  | 0.0235886<br>1.3208276 | 0.1122299<br>2.4014171 | 0.4955811<br>0.6941158 | 0.7432680 | 1.8685770 |
|        | 1.50 | 100.484 | 2.3156973<br>2.9956604<br>6.0218242<br>45.0599777  | 0.0224129<br>1.3111561 | 0.1082770<br>2.3872948 | 0.4823428<br>0.6942686 | 0.7298341 | 1.8421210 |
|        | 1.70 | 111.747 | 2.9819909<br>3.9311886<br>8.1360237<br>62.2665524  | 0.0193355<br>1.2837161 | 0.0975719<br>2.3472408 | 0.4459748<br>0.6947218 | 0.6923299 | 1.7679500 |
|        | 2.00 | 125.261 | 4.1367342<br>5.5450630<br>11.7666735<br>91.7615329 | 0.0170147<br>1.2605519 | 0.0891107<br>2.3134451 | 0.4166249<br>0.6951287 | 0.6613733 | 1.7063605 |

| CASE A |      |         | Passband Ripple: Ap(dB)=2.0                       |                        |                        |                        |                        |           |
|--------|------|---------|---------------------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------|
| n      | Ws   | As(dB)  | C1                                                | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9  |
| 9      | 1.05 | 61.275  | 1.1114059<br>1.2054102<br>1.5942707<br>3.9936736  | 0.0418521<br>3.4784988 | 0.2563204<br>1.8092883 | 0.5355924<br>3.1127824 | 1.6222774<br>0.6907690 | 1.6123324 |
|        | 1.10 | 72.706  | 1.2243475<br>1.3703136<br>1.9377187<br>5.2992478  | 0.0267214<br>3.1114075 | 0.1864467<br>1.7067481 | 0.4209269<br>2.9630830 | 1.3353659<br>0.6913946 | 1.4098312 |
|        | 1.15 | 80.936  | 1.3416657<br>1.5336053<br>2.2599957<br>6.4899114  | 0.0203222<br>2.9072994 | 0.1528905<br>1.6473758 | 0.3628558<br>2.8763368 | 1.1847914<br>0.6918368 | 1.2985848 |
|        | 1.20 | 87.628  | 1.4637563<br>1.6996171<br>2.5791043<br>7.6523927  | 0.0167439<br>2.7714935 | 0.1326532<br>1.6068258 | 0.3264384<br>2.8170832 | 1.0883148<br>0.6921755 | 1.2251034 |
|        | 1.25 | 93.374  | 1.5907740<br>1.8699785<br>2.9015215<br>8.8171818  | 0.0144540<br>2.6729334 | 0.1190024<br>1.5768352 | 0.3011230<br>2.7732599 | 1.0202065<br>0.6924466 | 1.1720547 |
|        | 1.30 | 98.464  | 1.7227963<br>2.0454918<br>3.2303598<br>9.9987492  | 0.0128641<br>2.5975400 | 0.1091429<br>1.5535582 | 0.2823943<br>2.7392488 | 0.9692130<br>0.6926696 | 1.1316405 |
|        | 1.35 | 103.065 | 1.8598680<br>2.2266128<br>3.5673591<br>11.2051201 | 0.0116978<br>2.5377683 | 0.1016820<br>1.5348889 | 0.2679406<br>2.7119723 | 0.9294774<br>0.6928567 | 1.0997055 |
|        | 1.40 | 107.284 | 2.0020170<br>2.4136247<br>3.9135894<br>12.4412023 | 0.0108073<br>2.4891273 | 0.0958408<br>1.5195512 | 0.2564374<br>2.6895651 | 0.8975987<br>0.6930162 | 1.0737882 |
|        | 1.45 | 111.191 | 2.1492622<br>2.6067151<br>4.2697534<br>13.7102067 | 0.0101065<br>2.4487429 | 0.0911470<br>1.5067155 | 0.2470642<br>2.6708146 | 0.8714464<br>0.6931538 | 1.0523197 |
|        | 1.50 | 114.841 | 2.3016164<br>2.8060141<br>4.6363361<br>15.0143415 | 0.0095417<br>2.4146749 | 0.0872965<br>1.4958140 | 0.2392829<br>2.6548909 | 0.8496087<br>0.6932736 | 1.0342447 |
|        | 1.70 | 127.511 | 2.9622803<br>3.6668482<br>6.2125942<br>20.6082544 | 0.0080810<br>2.3191767 | 0.0770305<br>1.4648864 | 0.2180885<br>2.6097223 | 0.7895017<br>0.6936290 | 0.9837566 |
|        | 2.00 | 142.715 | 4.1074418<br>5.1532091<br>8.9221914<br>30.2010593 | 0.0069983<br>2.2398940 | 0.0690907<br>1.4387802 | 0.2011914<br>2.5716052 | 0.7408613<br>0.6939476 | 0.9420501 |

| CASE A |      |         | Passband Ripple: Ap(dB)=2.0                                      |                        |                        |                        |                        |                        |
|--------|------|---------|------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| n      | Ws   | As(dB)  | C1                                                               | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9               |
| 10     | 1.05 | 69.680  | 1.1096718<br>1.1814619<br>1.4386640<br>2.5336482<br>16.8596102   | 0.0332803<br>2.1333063 | 0.1360381<br>4.3915326 | 0.5964541<br>2.0292592 | 0.9305981<br>3.4319947 | 2.5227971<br>0.6905323 |
|        | 1.10 | 82.381  | 1.2215638<br>1.3338339<br>1.7140833<br>3.2619424<br>23.1838025   | 0.0202152<br>1.8729971 | 0.0947228<br>3.9315243 | 0.4432034<br>1.9152152 | 0.7434578<br>3.2655155 | 2.0892347<br>0.6910417 |
|        | 1.15 | 91.526  | 1.3379528<br>1.4860346<br>1.9755745<br>3.9305495<br>28.9230322   | 0.0149135<br>1.7296159 | 0.0755887<br>3.6758786 | 0.3691048<br>1.8491446 | 0.6472781<br>3.1690369 | 1.8614316<br>0.6913997 |
|        | 1.20 | 98.961  | 1.4591581<br>1.6414311<br>2.2359899<br>4.5854918<br>34.5122486   | 0.0120260<br>1.6348056 | 0.0643190<br>3.5058133 | 0.3240381<br>1.8040148 | 0.5865006<br>3.1031281 | 1.7152499<br>0.6916735 |
|        | 1.25 | 105.345 | 1.5853042<br>1.8012990<br>2.5000000<br>5.2430274<br>40.1039839   | 0.0102130<br>1.5663130 | 0.0568477<br>3.3824047 | 0.2934075<br>1.7706359 | 0.5440329<br>3.0543785 | 1.6119157<br>0.6918924 |
|        | 1.30 | 111.001 | 1.7164539<br>1.9662686<br>2.7698611<br>5.9108926<br>45.7705353   | 0.0089727<br>1.5141077 | 0.0515237<br>3.2880126 | 0.2711394<br>1.7447289 | 0.5124921<br>3.0165412 | 1.5344629<br>0.6920724 |
|        | 1.35 | 116.114 | 1.8526432<br>2.1366988<br>3.0468391<br>6.5933849<br>51.5519660   | 0.0080735<br>1.4728402 | 0.0475382<br>3.2131849 | 0.2541943<br>1.7239510 | 0.4880750<br>2.9861947 | 1.4740534<br>0.6922237 |
|        | 1.40 | 120.801 | 1.9938949<br>2.3128131<br>3.3317143<br>7.2931353<br>57.4727614   | 0.0073936<br>1.4393378 | 0.0444458<br>3.1522951 | 0.2408636<br>1.7068797 | 0.4685921<br>2.9612639 | 1.4255501<br>0.6923520 |
|        | 1.45 | 125.143 | 2.1402240<br>2.4947597<br>3.6250000<br>8.0118665<br>63.5489356   | 0.0068628<br>1.4115794 | 0.0419794<br>3.1017443 | 0.2301066<br>1.6925937 | 0.4526824<br>2.9404008 | 1.3857325<br>0.6924629 |
|        | 1.50 | 129.197 | 2.2916411<br>2.6826414<br>3.9270510<br>8.7507642<br>69.7914985   | 0.0064380<br>1.3882035 | 0.0399691<br>3.0591021 | 0.2212502<br>1.6804607 | 0.4394499<br>2.9226823 | 1.3524644<br>0.6925594 |
|        | 1.70 | 143.276 | 2.9483149<br>3.4947482<br>5.2271136<br>11.9220243<br>96.5555666  | 0.0053527<br>1.3228829 | 0.0346700<br>2.9395802 | 0.1974802<br>1.6460399 | 0.4032860<br>2.8724195 | 1.2607971<br>0.6928457 |
|        | 2.00 | 160.169 | 4.0866858<br>4.8979715<br>7.4641016<br>17.3634536<br>142.4309671 | 0.0045620<br>1.2688937 | 0.0306370<br>2.8403666 | 0.1789172<br>1.6169860 | 0.3743146<br>2.8299992 | 1.1865013<br>0.6931021 |

| CASE A |      |         | Passband Ripple: Ap(dB)=2.0 |                 |                 |           |           |           |
|--------|------|---------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 11     | 1.05 | 78.085  | 1.1084015                   | 0.0166977       | 0.1275361       | 0.3266441 | 1.1602466 | 1.4761008 |
|        |      |         | 1.1652129                   | 3.6878146       | 2.7251192       | 5.4063019 | 2.2493171 | 3.7512280 |
|        |      |         | 1.3488607                   | 0.69C3571       |                 |           |           |           |
|        |      |         | 1.9760810                   |                 |                 |           |           |           |
|        |      |         | 5.6021835                   |                 |                 |           |           |           |
|        | 1.10 | 92.056  | 1.2195217                   | 0.0096493       | 0.0837576       | 0.2337974 | 0.8764961 | 1.1905485 |
|        |      |         | 1.3088558                   | 3.0680272       | 2.3993541       | 4.8432022 | 2.1237034 | 3.5680077 |
|        |      |         | 1.5834523                   | 0.6907781       |                 |           |           |           |
|        |      |         | 2.4791006                   |                 |                 |           |           |           |
|        |      |         | 7.5378437                   |                 |                 |           |           |           |
|        | 1.15 | 102.115 | 1.3352275                   | 0.0069054       | 0.0645456       | 0.1901727 | 0.7375310 | 1.0431477 |
|        |      |         | 1.4533340                   | 2.7416131       | 2.2197995       | 4.5302734 | 2.0509292 | 3.4618135 |
|        |      |         | 1.8085794                   | 0.6910737       |                 |           |           |           |
|        |      |         | 2.9446236                   |                 |                 |           |           |           |
|        |      |         | 9.2991673                   |                 |                 |           |           |           |
|        | 1.20 | 110.294 | 1.4557817                   | 0.0054498       | 0.0535979       | 0.1641409 | 0.6523642 | 0.9496703 |
|        |      |         | 1.6013465                   | 2.5318641       | 2.1010026       | 4.3221180 | 2.0012187 | 3.3892618 |
|        |      |         | 2.0339626                   | 0.6912997       |                 |           |           |           |
|        |      |         | 3.4024453                   |                 |                 |           |           |           |
|        |      |         | 11.0168385                  |                 |                 |           |           |           |
|        | 1.25 | 117.317 | 1.5812870                   | 0.0045532       | 0.0465086       | 0.1466967 | 0.5941587 | 0.8841701 |
|        |      |         | 1.7539211                   | 2.3834472       | 2.0151444       | 4.1710802 | 1.9644511 | 3.3355954 |
|        |      |         | 2.2631658                   | 0.6914802       |                 |           |           |           |
|        |      |         | 3.8631607                   |                 |                 |           |           |           |
|        |      |         | 12.7367378                  |                 |                 |           |           |           |
|        | 1.30 | 123.538 | 1.7117951                   | 0.0039488       | 0.0415462       | 0.1341551 | 0.5516616 | 0.8354127 |
|        |      |         | 1.9115674                   | 2.2721164       | 1.9496808       | 4.0555626 | 1.9359135 | 3.2939401 |
|        |      |         | 2.4979196                   | 0.6916286       |                 |           |           |           |
|        |      |         | 4.3318290                   |                 |                 |           |           |           |
|        |      |         | 14.4806247                  |                 |                 |           |           |           |
|        | 1.35 | 129.162 | 1.8473359                   | 0.0035158       | 0.0378838       | 0.1246969 | 0.5192097 | 0.7975966 |
|        |      |         | 2.0745762                   | 2.1852283       | 1.8979180       | 3.9639927 | 1.9130250 | 3.2605298 |
|        |      |         | 2.7391978                   | 0.6917530       |                 |           |           |           |
|        |      |         | 4.8112671                   |                 |                 |           |           |           |
|        |      |         | 16.2605612                  |                 |                 |           |           |           |
|        | 1.40 | 134.318 | 1.9879279                   | 0.0031915       | 0.0350748       | 0.1173118 | 0.4936056 | 0.7673750 |
|        |      |         | 2.2431285                   | 2.1154284       | 1.8558866       | 3.8894834 | 1.8942209 | 3.2330814 |
|        |      |         | 2.9876021                   | 0.6918589       |                 |           |           |           |
|        |      |         | 5.3032020                   |                 |                 |           |           |           |
|        |      |         | 18.0839213                  |                 |                 |           |           |           |
|        | 1.45 | 139.094 | 2.1335836                   | 0.0029404       | 0.0328559       | 0.1113900 | 0.4728936 | 0.7426628 |
|        |      |         | 2.4173448                   | 2.0581018       | 1.8210544       | 3.8276280 | 1.8784843 | 3.2101107 |
|        |      |         | 3.2435289                   | 0.6919502       |                 |           |           |           |
|        |      |         | 5.8087659                   |                 |                 |           |           |           |
|        |      |         | 19.9555287                  |                 |                 |           |           |           |
|        | 1.50 | 143.554 | 2.2843118                   | 0.0027408       | 0.0310621       | 0.1065408 | 0.4558046 | 0.7220852 |
|        |      |         | 2.5973085                   | 2.0101860       | 1.7917166       | 3.7754516 | 1.8651192 | 3.1906019 |
|        |      |         | 3.5072526                   | 0.6920297       |                 |           |           |           |
|        |      |         | 6.3287388                   |                 |                 |           |           |           |
|        |      |         | 21.8787000                  |                 |                 |           |           |           |
|        | 1.70 | 159.041 | 2.9380530                   | 0.0022371       | 0.0264011       | 0.0936510 | 0.4097620 | 0.6657287 |
|        |      |         | 3.3756369                   | 1.8780649       | 1.7097122       | 3.6292161 | 1.8272032 | 3.1352578 |
|        |      |         | 4.6433716                   | 0.6922653       |                 |           |           |           |
|        |      |         | 8.5619394                   |                 |                 |           |           |           |
|        |      |         | 30.1261720                  |                 |                 |           |           |           |
|        | 2.00 | 177.623 | 4.0714332                   | 0.0018764       | 0.0229244       | 0.0837223 | 0.3736063 | 0.6204437 |
|        |      |         | 4.7212543                   | 1.7708729       | 1.6419053       | 3.5078396 | 1.7951994 | 3.0885460 |
|        |      |         | 6.5999975                   | 0.6924762       |                 |           |           |           |
|        |      |         | 12.3963998                  |                 |                 |           |           |           |
|        |      |         | 44.2665611                  |                 |                 |           |           |           |

| CASE A |         |         | Passband Ripple: Ap(dB)=2.0 |                 |                 |           |           |           |
|--------|---------|---------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws      | As(dB)  | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 12     | 1.10    | 101.731 | 1.2179786                   | 0.0072999       | 0.0420473       | 0.2317791 | 0.4757607 | 1.5481949 |
|        |         |         | 1.2909254                   | 1.7809029       | 4.2997061       | 2.9888464 | 5.8465024 | 2.3322332 |
|        |         |         | 1.4996665                   | 3.8705490       | 0.6905851       |           |           |           |
|        |         |         | 2.0872157                   |                 |                 |           |           |           |
|        |         |         | 4.3499304                   |                 |                 |           |           |           |
|        |         |         | 33.0577896                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.15   | 112.705 | 112.705 | 1.3331670                   | 0.0050675       | 0.0315157       | 0.1821792 | 0.3919981 | 1.3117232 |
|        |         |         | 1.4297858                   | 1.5676770       | 3.8505451       | 2.7691257 | 5.4705074 | 2.2527346 |
|        |         |         | 1.7009576                   | 3.7546439       | 0.6908254       |           |           |           |
|        |         |         | 2.4494590                   |                 |                 |           |           |           |
|        |         |         | 5.2979222                   |                 |                 |           |           |           |
|        |         |         | 41.3060302                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.20   | 121.627 | 121.627 | 1.4532283                   | 0.0039142       | 0.0256571       | 0.1534797 | 0.3415126 | 1.1661524 |
|        |         |         | 1.5724303                   | 1.4320891       | 3.5616644       | 2.6237046 | 5.2204311 | 2.1984499 |
|        |         |         | 1.9034206                   | 3.6754586       | 0.6910169       |           |           |           |
|        |         |         | 2.8072245                   |                 |                 |           |           |           |
|        |         |         | 6.2244021                   |                 |                 |           |           |           |
|        |         |         | 49.3373729                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.25   | 129.288 | 129.288 | 1.5782485                   | 0.0032173       | 0.0219294       | 0.1346732 | 0.3074318 | 1.0663250 |
|        |         |         | 1.7197065                   | 1.3368820       | 3.3571082       | 2.5185560 | 5.0389797 | 2.1582862 |
|        |         |         | 2.1098820                   | 3.6168800       | 0.6911655       |           |           |           |
|        |         |         | 3.1681544                   |                 |                 |           |           |           |
|        |         |         | 7.1532769                   |                 |                 |           |           |           |
|        |         |         | 57.3715316                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.30   | 136.075 | 136.075 | 1.7082709                   | 0.0027543       | 0.0193553       | 0.1213834 | 0.2827886 | 0.9932426 |
|        |         |         | 1.8720353                   | 1.2659008       | 3.2035870       | 2.4383730 | 4.9002143 | 2.1271236 |
|        |         |         | 2.3217202                   | 3.5714131       | 0.6912918       |           |           |           |
|        |         |         | 3.5359122                   |                 |                 |           |           |           |
|        |         |         | 8.0959007                   |                 |                 |           |           |           |
|        |         |         | 65.5126430                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.35   | 142.210 | 142.210 | 1.8433207                   | 0.0024265       | 0.0174764       | 0.1114986 | 0.2641170 | 0.9373100 |
|        |         |         | 2.0296574                   | 1.2107723       | 3.0837142       | 2.3749494 | 4.7902156 | 2.1021204 |
|        |         |         | 2.5397132                   | 3.5349425       | 0.6913943       |           |           |           |
|        |         |         | 3.9125428                   |                 |                 |           |           |           |
|        |         |         | 9.0585736                   |                 |                 |           |           |           |
|        |         |         | 73.8184125                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.40   | 147.835 | 147.835 | 1.9834134                   | 0.0021834       | 0.0160481       | 0.1038675 | 0.2494810 | 0.8930980 |
|        |         |         | 2.1927230                   | 1.1666678       | 2.9873823       | 2.3234437 | 4.7007165 | 2.0815827 |
|        |         |         | 2.7643424                   | 3.5049802       | 0.6914830       |           |           |           |
|        |         |         | 4.2993023                   |                 |                 |           |           |           |
|        |         |         | 10.0451492                  |                 |                 |           |           |           |
|        |         |         | 82.3241078                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.45   | 153.045 | 153.045 | 2.1285596                   | 0.0019967       | 0.0149286       | 0.0978064 | 0.2377068 | 0.8572778 |
|        |         |         | 2.3613317                   | 1.1305736       | 2.9082445       | 2.2807641 | 4.6264259 | 2.0644070 |
|        |         |         | 2.9959256                   | 3.4799084       | 0.6915640       |           |           |           |
|        |         |         | 4.6970152                   |                 |                 |           |           |           |
|        |         |         | 11.0581496                  |                 |                 |           |           |           |
|        |         |         | 91.0527944                  |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.50   | 157.911 | 157.911 | 2.2787664                   | 0.0018493       | 0.0140293       | 0.0928832 | 0.2280371 | 0.8276812 |
|        |         |         | 2.5355530                   | 1.1004879       | 2.8420727       | 2.2447953 | 4.5637513 | 2.0498009 |
|        |         |         | 3.2346828                   | 3.4586097       | 0.6916272       |           |           |           |
|        |         |         | 5.1062498                   |                 |                 |           |           |           |
|        |         |         | 12.0993095                  |                 |                 |           |           |           |
|        |         |         | 100.0203299                 |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 1.70   | 174.805 | 174.805 | 2.9302881                   | 0.0014818       | 0.0117192       | 0.0799820 | 0.2022035 | 0.7477443 |
|        |         |         | 3.2893923                   | 1.0179782       | 2.6595312       | 2.1442531 | 4.3881141 | 2.0083867 |
|        |         |         | 4.2640673                   | 3.3981922       | 0.6918235       |           |           |           |
|        |         |         | 6.8651328                   |                 |                 |           |           |           |
|        |         |         | 16.5660270                  |                 |                 |           |           |           |
|        |         |         | 138.4661013                 |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
| 2.00   | 195.077 | 195.077 | 4.0598914                   | 0.0012232       | 0.0100238       | 0.0702423 | 0.1821586 | 0.6847494 |
|        |         |         | 4.5932605                   | 0.9515405       | 2.5113287       | 2.0610948 | 4.2423474 | 1.9734349 |
|        |         |         | 6.0382667                   | 3.3471974       | 0.6920010       |           |           |           |
|        |         |         | 9.8873550                   |                 |                 |           |           |           |
|        |         |         | 24.2272012                  |                 |                 |           |           |           |
|        |         |         | 204.3626509                 |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |
|        |         |         |                             |                 |                 |           |           |           |

| CASE A |      | Passband Ripple: $A_p(\text{dB}) = 3.0$ |           |                 |                 |           |          |          |
|--------|------|-----------------------------------------|-----------|-----------------|-----------------|-----------|----------|----------|
| n      | Ws   | As(dB)                                  | C1        | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8 | A4<br>A9 |
| 2      | 1.05 | 6.540                                   | 1.4386640 | 0.9571580       | 0.2886861       |           |          |          |
|        | 1.10 | 8.368                                   | 1.7140833 | 0.9238786       | 0.3772832       |           |          |          |
|        | 1.15 | 9.853                                   | 1.9755745 | 0.8974798       | 0.4311711       |           |          |          |
|        | 1.20 | 11.139                                  | 2.2359899 | 0.8760711       | 0.4681407       |           |          |          |
|        | 1.25 | 12.285                                  | 2.5000000 | 0.8583926       | 0.4951858       |           |          |          |
|        | 1.30 | 13.327                                  | 2.7698611 | 0.8435742       | 0.5158226       |           |          |          |
|        | 1.35 | 14.285                                  | 3.0468391 | 0.8309957       | 0.5320589       |           |          |          |
|        | 1.40 | 15.175                                  | 3.3317143 | 0.8202034       | 0.5451380       |           |          |          |
|        | 1.45 | 16.007                                  | 3.6250000 | 0.8108573       | 0.5558746       |           |          |          |
|        | 1.50 | 16.790                                  | 3.9270510 | 0.8026975       | 0.5648266       |           |          |          |
|        | 1.70 | 19.540                                  | 5.2271136 | 0.7784662       | 0.5892711       |           |          |          |
|        | 2.00 | 22.880                                  | 7.4641016 | 0.7568188       | 0.6086410       |           |          |          |
| 3      | 1.05 | 13.458                                  | 1.2054102 | 0.5021895       | 1.0208264       | 0.6212619 |          |          |
|        | 1.10 | 17.093                                  | 1.3703136 | 0.4339423       | 1.0123455       | 0.5991278 |          |          |
|        | 1.15 | 19.776                                  | 1.5336053 | 0.3965612       | 1.0038075       | 0.5914263 |          |          |
|        | 1.20 | 21.979                                  | 1.6996171 | 0.3719667       | 0.9962989       | 0.5882136 |          |          |
|        | 1.25 | 23.880                                  | 1.8699785 | 0.3542725       | 0.9898298       | 0.5868644 |          |          |
|        | 1.30 | 25.568                                  | 2.0454918 | 0.3408318       | 0.9842577       | 0.5864003 |          |          |
|        | 1.35 | 27.096                                  | 2.2266128 | 0.3302374       | 0.9794343       | 0.5863871 |          |          |
|        | 1.40 | 28.499                                  | 2.4136247 | 0.3216576       | 0.9752326       | 0.5866106 |          |          |
|        | 1.45 | 29.799                                  | 2.6067151 | 0.3145634       | 0.9715490       | 0.5869573 |          |          |
|        | 1.50 | 31.014                                  | 2.8060141 | 0.3086000       | 0.9683000       | 0.5873643 |          |          |
|        | 1.70 | 35.234                                  | 3.6668482 | 0.2919907       | 0.9584742       | 0.5890702 |          |          |
|        | 2.00 | 40.301                                  | 5.1532091 | 0.2783271       | 0.9494731       | 0.5911283 |          |          |



| CASE A |      |        | Passband Ripple: Ap(dB)=3.0 |                 |                 |           |           |           |
|--------|------|--------|-----------------------------|-----------------|-----------------|-----------|-----------|-----------|
| n      | Ws   | As(dB) | C1                          | A0<br>A5<br>A10 | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 4      | 1.05 | 21.603 | 1.1536336<br>3.3125181      | 0.4488032       | 0.5130162       | 1.4629686 | 0.5522635 |           |
|        | 1.10 | 26.653 | 1.2909254<br>4.3499304      | 0.3687641       | 0.5011811       | 1.3837530 | 0.5634015 |           |
|        | 1.15 | 30.303 | 1.4297858<br>5.2979222      | 0.3267709       | 0.4892429       | 1.3408921 | 0.5676669 |           |
|        | 1.20 | 33.274 | 1.5724303<br>6.2244021      | 0.2999059       | 0.4793005       | 1.3127276 | 0.5700369 |           |
|        | 1.25 | 35.826 | 1.7197065<br>7.1532769      | 0.2809669       | 0.4711134       | 1.2924119 | 0.5716119 |           |
|        | 1.30 | 38.088 | 1.8720353<br>8.0959007      | 0.2668036       | 0.4643087       | 1.2769166 | 0.5727699 |           |
|        | 1.35 | 40.132 | 2.0296574<br>9.0585736      | 0.2557777       | 0.4585835       | 1.2646462 | 0.5736756 |           |
|        | 1.40 | 42.007 | 2.1927230<br>10.0451492     | 0.2469389       | 0.4537103       | 1.2546624 | 0.5744132 |           |
|        | 1.45 | 43.744 | 2.3613317<br>11.0581496     | 0.2396926       | 0.4495191       | 1.2463698 | 0.5750306 |           |
|        | 1.50 | 45.366 | 2.5355530<br>12.0993095     | 0.2336451       | 0.4458813       | 1.2393691 | 0.5755579 |           |
|        | 1.70 | 50.997 | 3.2893923<br>16.5660270     | 0.2170157       | 0.4351876       | 1.2196987 | 0.5770860 |           |
|        | 2.00 | 57.754 | 4.5932605<br>24.2272012     | 0.2035760       | 0.4257555       | 1.2032862 | 0.5784372 |           |
| 5      | 1.05 | 29.970 | 1.1334220<br>1.7737385      | 0.2015369       | 0.7433622       | 0.7554526 | 1.7499784 | 0.5669510 |
|        | 1.10 | 36.315 | 1.2593204<br>2.1930925      | 0.1570875       | 0.6629470       | 0.7007596 | 1.6716667 | 0.5669502 |
|        | 1.15 | 40.887 | 1.3881033<br>2.5834170      | 0.1349276       | 0.6154087       | 0.6713858 | 1.6250678 | 0.5676581 |
|        | 1.20 | 44.604 | 1.5211268<br>2.9683674      | 0.1211640       | 0.5828379       | 0.6519691 | 1.5929341 | 0.5683526 |
|        | 1.25 | 47.796 | 1.6589139<br>3.3563960      | 0.1116584       | 0.5587862       | 0.6378538 | 1.5690663 | 0.5689587 |
|        | 1.30 | 50.624 | 1.8017262<br>3.7515494      | 0.1046590       | 0.5401765       | 0.6270073 | 1.5505029 | 0.5694785 |
|        | 1.35 | 53.180 | 1.9497131<br>4.1560845      | 0.0992763       | 0.5253038       | 0.6183613 | 1.5355988 | 0.5699249 |
|        | 1.40 | 55.524 | 2.1029685<br>4.5713865      | 0.0950042       | 0.5131289       | 0.6112858 | 1.5233482 | 0.5703109 |
|        | 1.45 | 57.695 | 2.2615546<br>4.9983644      | 0.0915308       | 0.5029751       | 0.6053796 | 1.5130941 | 0.5706471 |
|        | 1.50 | 59.722 | 2.4255147<br>5.4376446      | 0.0886524       | 0.4943792       | 0.6003718 | 1.5043851 | 0.5709421 |
|        | 1.70 | 66.761 | 3.1356145<br>7.3252003      | 0.0808353       | 0.4701499       | 0.5861904 | 1.4796844 | 0.5718263 |
|        | 2.00 | 75.208 | 4.3649509<br>10.5677323     | 0.0746266       | 0.4499044       | 0.5742280 | 1.4588518 | 0.5726286 |

| CASE A |            |                  | Passband Ripple: $A_p(\text{dB})=3.0$ |                                     |                 |           |           |           |
|--------|------------|------------------|---------------------------------------|-------------------------------------|-----------------|-----------|-----------|-----------|
| n      | $\omega_s$ | $A_s(\text{dB})$ | C1                                    | A0<br>A5<br>A10                     | A1<br>A6<br>A11 | A2<br>A7  | A3<br>A8  | A4<br>A9  |
| 6      | 1.05       | 38.369           | 1.1233258<br>1.4386640<br>6.5287683   | 0.1798204<br>0.5637384              | 0.3585196       | 1.2536814 | 0.9179649 | 2.0766084 |
|        | 1.10       | 45.989           | 1.2433620<br>1.7140833<br>8.8264550   | 0.1333417<br>0.5650957              | 0.3086005       | 1.1051644 | 0.8650512 | 1.9760901 |
|        | 1.15       | 51.476           | 1.3669587<br>1.9755745<br>10.9158033  | 0.1110995<br>0.5658806              | 0.2799210       | 1.0241371 | 0.8334825 | 1.9182557 |
|        | 1.20       | 55.937           | 1.4950350<br>2.2359899<br>12.9526713  | 0.0976422<br>0.5664572              | 0.2606660       | 0.9706279 | 0.8117079 | 1.8788472 |
|        | 1.25       | 59.767           | 1.6279471<br>2.5000000<br>14.9917591  | 0.0885234<br>0.5669134              | 0.2466634       | 0.9319405 | 0.7955298 | 1.8497355 |
|        | 1.30       | 63.161           | 1.7658735<br>2.7698611<br>17.0590037  | 0.0819068<br>0.5672878              | 0.2359592       | 0.9024102 | 0.7829415 | 1.8271576 |
|        | 1.35       | 66.229           | 1.9089166<br>3.0468391<br>19.1687817  | 0.0768781<br>0.5676021              | 0.2274880       | 0.8790293 | 0.7728292 | 1.8090588 |
|        | 1.40       | 69.041           | 2.0571405<br>3.3317143<br>21.3298812  | 0.0729255<br>0.5678702              | 0.2206098       | 0.8600185 | 0.7645125 | 1.7941959 |
|        | 1.45       | 71.646           | 2.2105880<br>3.6250000<br>23.5480505  | 0.0697378<br>0.5681018              | 0.2149127       | 0.8442437 | 0.7575470 | 1.7817617 |
|        | 1.50       | 74.079           | 2.3692888<br>3.9270510<br>25.8272420  | 0.0671145<br>0.5683038              | 0.2101180       | 0.8309413 | 0.7516276 | 1.7712042 |
| 7      | 1.70       | 82.526           | 3.0569811<br>5.2271136<br>35.6008780  | 0.0600772<br>0.5689047              | 0.1967456       | 0.7936711 | 0.7348182 | 1.7412678 |
|        | 2.00       | 92.662           | 4.2481552<br>7.4641016<br>52.3568408  | 0.0545833<br>0.5694459              | 0.1857369       | 0.7627414 | 0.7206119 | 1.7160167 |
|        | 1.05       | 46.773           | 1.1175213<br>1.3083409<br>2.7143721   | 0.0804168<br>2.3940889<br>0.5637272 | 0.4330143       | 0.6199318 | 1.8260212 | 1.1018312 |
|        | 1.10       | 55.664           | 1.2341277<br>1.5239435<br>3.5147693   | 0.0567272<br>2.2779565<br>0.5644280 | 0.3476918       | 0.5318117 | 1.6237139 | 1.0363124 |
|        | 1.15       | 62.065           | 1.3546897<br>1.7321918<br>4.2484927   | 0.0458483<br>2.2105848<br>0.5649541 | 0.3028603       | 0.4843509 | 1.5108848 | 0.9986111 |
|        | 1.20       | 67.270           | 1.4798722<br>1.9413408<br>4.9666973   | 0.0394367<br>2.1645568<br>0.5653620 | 0.2742489       | 0.4532774 | 1.4357698 | 0.9729004 |
|        | 1.25       | 71.739           | 1.6099341<br>2.1544332<br>5.6874343   | 0.0351742<br>2.1305148<br>0.5656900 | 0.2541476       | 0.4309593 | 1.3812543 | 0.9538929 |
|        | 1.30       | 75.698           | 1.7450051<br>2.3729509<br>6.4192876   | 0.0321265<br>2.1040960<br>0.5659606 | 0.2391686       | 0.4140151 | 1.3395582 | 0.9391418 |
|        | 1.35       | 79.277           | 1.8851599<br>2.5977295<br>7.1670237   | 0.0298373<br>2.0829095<br>0.5661881 | 0.2275475       | 0.4006593 | 1.3065072 | 0.9273102 |
|        | 1.40       | 82.558           | 2.0304452<br>2.8292857<br>7.9335602   | 0.0280553<br>2.0655059<br>0.5663823 | 0.2182612       | 0.3898411 | 1.2796155 | 0.9175892 |
| 8      | 1.45       | 85.597           | 2.1808921<br>3.0679607<br>8.7208069   | 0.0265299<br>2.0509431<br>0.5665499 | 0.2106701       | 0.3808937 | 1.2572921 | 0.9094531 |
|        | 1.50       | 88.436           | 2.3365223<br>3.3139902<br>9.5300781   | 0.0254649<br>2.0385763<br>0.5666961 | 0.2043518       | 0.3733702 | 1.2384629 | 0.9025423 |
|        | 1.70       | 98.291           | 3.0111362<br>4.3744590<br>13.0029293  | 0.0223778<br>2.0034998<br>0.5671304 | 0.1870671       | 0.3524016 | 1.1856958 | 0.8829320 |
|        | 2.00       | 110.116          | 4.1800429<br>6.2017764<br>18.9610848  | 0.0200090<br>1.9739026<br>0.5678206 | 0.1732085       | 0.3351324 | 1.1419053 | 0.8663726 |

| CASE A |      |         | Passband Ripple: Ap(dB)=3.0                        |                        |                        |                        |           |           |
|--------|------|---------|----------------------------------------------------|------------------------|------------------------|------------------------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                                                 | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8  | A4<br>A9  |
| 8      | 1.05 | 55.178  | 1.1138641<br>1.2431181<br>1.9061395<br>11.0466061  | 0.0717492<br>1.2802921 | 0.2040797<br>2.7135833 | 0.8705534<br>0.5633217 | 0.9215131 | 2.5119748 |
|        | 1.10 | 65.339  | 1.2282855<br>1.4271032<br>2.3804113<br>15.1062239  | 0.0481515<br>1.2061604 | 0.1575032<br>2.5804011 | 0.7057104<br>0.5639088 | 0.8009372 | 2.2371198 |
|        | 1.15 | 72.655  | 1.3469136<br>1.6072975<br>2.8200771<br>18.7925269  | 0.0377513<br>1.1631477 | 0.1337920<br>2.5032449 | 0.6204190<br>0.5643173 | 0.7345239 | 2.0847195 |
|        | 1.20 | 78.603  | 1.4702527<br>1.7895085<br>3.2528314<br>22.3835994  | 0.0317807<br>1.1337561 | 0.1189774<br>2.4505416 | 0.5661620<br>0.5646300 | 0.6906737 | 1.9834402 |
|        | 1.25 | 83.711  | 1.5984994<br>1.9759013<br>3.6885364<br>25.9769795  | 0.0278863<br>1.1120134 | 0.1087321<br>2.4115617 | 0.5280398<br>0.5648802 | 0.6590424 | 1.9099925 |
|        | 1.30 | 88.235  | 1.7317524<br>2.1675370<br>4.1319051<br>29.6189023  | 0.0251424<br>1.0951357 | 0.1011913<br>2.3813086 | 0.4995969<br>0.5650862 | 0.6349643 | 1.8538393 |
|        | 1.35 | 92.325  | 1.8700686<br>2.3650162<br>4.5855625<br>33.3349904  | 0.0231056<br>1.0815977 | 0.0953991<br>2.3570453 | 0.4774943<br>0.5652592 | 0.6159519 | 1.8093397 |
|        | 1.40 | 96.075  | 2.0134836<br>2.5687116<br>5.0511190<br>37.1409040  | 0.0215354<br>1.0704746 | 0.0908088<br>2.3371129 | 0.4598019<br>0.5654066 | 0.6005321 | 1.7731391 |
|        | 1.45 | 99.549  | 2.1620209<br>2.7788694<br>5.5296305<br>41.0468858  | 0.0202895<br>1.0611654 | 0.0870827<br>2.3204329 | 0.4453148<br>0.5655338 | 0.5877665 | 1.7430919 |
|        | 1.50 | 102.793 | 2.3156973<br>2.9956604<br>6.0218242<br>45.0599777  | 0.0192783<br>1.0532585 | 0.0839997<br>2.3062674 | 0.4332373<br>0.5656447 | 0.5770239 | 1.7177503 |
|        | 1.70 | 114.055 | 2.9819909<br>3.9311886<br>8.1360237<br>62.2665524  | 0.0166313<br>1.0308243 | 0.0756554<br>2.2660847 | 0.4000905<br>0.5659737 | 0.5470447 | 1.6467436 |
|        | 2.00 | 127.570 | 4.1367342<br>5.5450630<br>11.7666735<br>91.7615329 | 0.0146350<br>1.0118845 | 0.0690653<br>2.2321733 | 0.3733769<br>0.5662688 | 0.5223125 | 1.5878285 |

| CASE A |      |         | Passband Ripple: $A_p(\text{dB})=3.0$             |                        |                        |                        |                        |           |
|--------|------|---------|---------------------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------|
| n      | Ws   | As(dB)  | C1                                                | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9  |
| 9      | 1.05 | 63.583  | 1.1114059<br>1.2054102<br>1.5942707<br>3.9936736  | 0.0320839<br>3.2967966 | 0.2272399<br>1.4599367 | 0.4208268<br>3.0327472 | 1.4914434<br>0.5630998 | 1.2857316 |
|        | 1.10 | 75.014  | 1.2243475<br>1.3703136<br>1.9377187<br>5.2992478  | 0.0204847<br>2.9414198 | 0.1646868<br>1.3762112 | 0.3302289<br>2.8828674 | 1.2235943<br>0.5635550 | 1.1228366 |
|        | 1.15 | 83.245  | 1.3416657<br>1.5336053<br>2.2599957<br>6.4899114  | 0.0155790<br>2.7441157 | 0.1347873<br>1.3277199 | 0.2843923<br>2.7959982 | 1.0834456<br>0.5638766 | 1.0334018 |
|        | 1.20 | 89.936  | 1.4637563<br>1.6996171<br>2.5791043<br>7.6523927  | 0.0128359<br>2.6129608 | 0.1168012<br>1.2945970 | 0.2556713<br>2.7366470 | 0.9938142<br>0.5641228 | 0.9743561 |
|        | 1.25 | 95.682  | 1.5907740<br>1.8699785<br>2.9015215<br>8.8171818  | 0.0110804<br>2.5178421 | 0.1046891<br>1.2700973 | 0.2357192<br>2.6927472 | 0.9306221<br>0.5643197 | 0.9317454 |
|        | 1.30 | 100.772 | 1.7227963<br>2.0454918<br>3.2303598<br>9.9987492  | 0.0098616<br>2.4451208 | 0.0959514<br>1.2510809 | 0.2209662<br>2.6586730 | 0.8833578<br>0.5644817 | 0.8992932 |
|        | 1.35 | 105.374 | 1.8598680<br>2.2266128<br>3.5673591<br>11.2051201 | 0.0089675<br>2.3874929 | 0.0893454<br>1.2358282 | 0.2095856<br>2.6313437 | 0.8465582<br>0.5646177 | 0.8736562 |
|        | 1.40 | 109.592 | 2.0020170<br>2.4136247<br>3.9135894<br>12.4412023 | 0.0082849<br>2.3406136 | 0.0841772<br>1.2232968 | 0.2005316<br>2.6088914 | 0.8170549<br>0.5647335 | 0.8528547 |
|        | 1.45 | 113.500 | 2.1492622<br>2.6067151<br>4.2697534<br>13.7102067 | 0.0077477<br>2.3017040 | 0.0800265<br>1.2128092 | 0.1931563<br>2.5901019 | 0.7928651<br>0.5648334 | 0.8356269 |
|        | 1.50 | 117.149 | 2.3016164<br>2.8060141<br>4.6363361<br>15.0143415 | 0.0073147<br>2.2688887 | 0.0766233<br>1.2039019 | 0.1870352<br>2.5741443 | 0.7726758<br>0.5649204 | 0.8211246 |
|        | 1.70 | 129.820 | 2.9622803<br>3.6668482<br>6.2125942<br>20.6082544 | 0.0061949<br>2.1769463 | 0.0675571<br>1.1786305 | 0.1703707<br>2.5288751 | 0.7171543<br>0.5651784 | 0.7806276 |
|        | 2.00 | 145.024 | 4.1074418<br>5.1532091<br>8.9221914<br>30.2010593 | 0.0053649<br>2.1006671 | 0.0605529<br>1.1572975 | 0.1570938<br>2.4906676 | 0.6722791<br>0.5654097 | 0.7471881 |

| CASE A |      |         | Passband Ripple: Ap(dB)=3.0                                      |                        |                        |                        |                        |                        |
|--------|------|---------|------------------------------------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| n      | ws   | As(dB)  | C1                                                               | A0<br>A5<br>A10        | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9               |
| 10     | 1.05 | 71.988  | 1.1096718<br>1.1814619<br>1.4386640<br>2.5336482<br>16.8596102   | 0.0286257<br>1.7057628 | 0.1057805<br>4.1843425 | 0.5364782<br>1.6393255 | 0.7350963<br>3.3520205 | 2.3402312<br>0.5629282 |
|        | 1.10 | 84.689  | 1.2215638<br>1.3338339<br>1.7140833<br>3.2619424<br>23.1838025   | 0.0173879<br>1.4959241 | 0.0735204<br>3.7374280 | 0.3973979<br>1.5462237 | 0.5863584<br>3.1853987 | 1.9321868<br>0.5632985 |
|        | 1.15 | 93.834  | 1.3379528<br>1.4860346<br>1.9755745<br>3.9305495<br>28.9230322   | 0.0128277<br>1.3804185 | 0.0586139<br>3.4893614 | 0.3303331<br>1.4922775 | 0.5100217<br>3.0888191 | 1.7182858<br>0.5635585 |
|        | 1.20 | 101.269 | 1.4591581<br>1.6414311<br>2.2359899<br>4.5854918<br>34.5122486   | 0.0103440<br>1.3040736 | 0.0498448<br>3.3244726 | 0.2896191<br>1.4554250 | 0.4618246<br>3.0228329 | 1.5812369<br>0.5637569 |
|        | 1.25 | 107.654 | 1.5853042<br>1.8012990<br>2.5000000<br>5.2430274<br>40.1039839   | 0.0087846<br>1.2489393 | 0.0440359<br>3.2048935 | 0.2619845<br>1.4281676 | 0.4281685<br>2.9740216 | 1.4844695<br>0.5639162 |
|        | 1.30 | 113.310 | 1.7164539<br>1.9662686<br>2.7698611<br>5.9108926<br>45.7705353   | 0.0077178<br>1.2069262 | 0.0398988<br>3.1134739 | 0.2419154<br>1.4070102 | 0.4031840<br>2.9361335 | 1.4120033<br>0.5640468 |
|        | 1.35 | 118.422 | 1.8526432<br>2.1366988<br>3.0468391<br>6.5933849<br>51.5519660   | 0.0069443<br>1.1737223 | 0.0368033<br>3.0410305 | 0.2266563<br>1.3900405 | 0.3838499<br>2.9057442 | 1.3555237<br>0.5641565 |
|        | 1.40 | 123.109 | 1.9938949<br>2.3128131<br>3.3317143<br>7.2931353<br>57.4727614   | 0.0063595<br>1.1467721 | 0.0344021<br>2.9821007 | 0.2146604<br>1.3760996 | 0.3684280<br>2.8807775 | 1.3102033<br>0.5642504 |
|        | 1.45 | 127.451 | 2.1402240<br>2.4947597<br>3.6250000<br>8.0118665<br>63.5489356   | 0.0059030<br>1.1244447 | 0.0324876<br>2.9331895 | 0.2049859<br>1.3644311 | 0.3558378<br>2.8598828 | 1.2730169<br>0.5643306 |
|        | 1.50 | 131.506 | 2.2916411<br>2.6826414<br>3.9270510<br>8.7507642<br>69.7914985   | 0.0055376<br>1.1056451 | 0.0309275<br>2.8919402 | 0.1970247<br>1.3545213 | 0.3453685<br>2.8421371 | 1.2419606<br>0.5644006 |
|        | 1.70 | 145.585 | 2.9483149<br>3.4947482<br>5.2271136<br>11.9220243<br>96.5555666  | 0.0046041<br>1.0531247 | 0.0268165<br>2.7763712 | 0.1756753<br>1.3264071 | 0.3167685<br>2.7917933 | 1.1564536<br>0.5646085 |
|        | 2.00 | 162.478 | 4.0866858<br>4.8979715<br>7.4641016<br>17.3634536<br>142.4309671 | 0.0039240<br>1.0097298 | 0.0236894<br>2.6804955 | 0.1590225<br>1.3026754 | 0.2938698<br>2.7493005 | 1.0872257<br>0.5647948 |

| CASE A |      |         | Passband Ripple: Ap(dB)=3.0                                     |                                     |                        |                        |                        |                        |
|--------|------|---------|-----------------------------------------------------------------|-------------------------------------|------------------------|------------------------|------------------------|------------------------|
| n      | Ws   | As(dB)  | C1                                                              | A0<br>A5<br>A10                     | A1<br>A6<br>A11        | A2<br>A7               | A3<br>A8               | A4<br>A9               |
| 11     | 1.05 | 80.393  | 1.1084015<br>1.1652129<br>1.3488607<br>1.9760810<br>5.6021835   | 0.0128005<br>3.4457112<br>0.5627992 | 0.1124014<br>2.1834825 | 0.2556316<br>5.1736952 | 1.0556999<br>1.8187651 | 1.1703315<br>3.6713032 |
|        | 1.10 | 94.364  | 1.2195217<br>1.3088558<br>1.5834523<br>2.4791006<br>7.5378437   | 0.0073972<br>2.8584612<br>0.5631054 | 0.0736038<br>1.9205288 | 0.1826962<br>4.6250118 | 0.7949572<br>1.7162425 | 0.9426315<br>3.4879644 |
|        | 1.15 | 104.424 | 1.3352275<br>1.4533340<br>1.8085794<br>2.9446236<br>9.2991673   | 0.0052937<br>2.5498477<br>0.5633204 | 0.0566344<br>1.7756702 | 0.1484716<br>4.3204337 | 0.6676315<br>1.6568380 | 0.8252164<br>3.3816870 |
|        | 1.20 | 112.602 | 1.4557817<br>1.6013465<br>2.0339626<br>3.4024453<br>11.0168385  | 0.0041778<br>2.3518152<br>0.5634846 | 0.0469822<br>1.6798636 | 0.1280672<br>4.1179822 | 0.5897408<br>1.6162568 | 0.7508077<br>3.3090717 |
|        | 1.25 | 119.625 | 1.5812870<br>1.7539211<br>2.2631658<br>3.8631607<br>12.7367378  | 0.0034905<br>2.2118333<br>0.5636159 | 0.0407393<br>1.6106400 | 0.1144028<br>3.9711633 | 0.5365781<br>1.5862399 | 0.6986964<br>3.2553544 |
|        | 1.30 | 125.847 | 1.7117951<br>1.9115674<br>2.4979196<br>4.3318290<br>14.4806247  | 0.0030272<br>2.1069142<br>0.5637237 | 0.0363732<br>1.5578712 | 0.1045835<br>3.8589206 | 0.4978023<br>1.5629410 | 0.6599215<br>3.2136572 |
|        | 1.35 | 131.471 | 1.8473359<br>2.0745762<br>2.7391978<br>4.8112671<br>16.2605612  | 0.0026952<br>2.0250833<br>0.5638141 | 0.0331530<br>1.5161536 | 0.0971815<br>3.7699773 | 0.4682160<br>1.5442535 | 0.6298579<br>3.1802118 |
|        | 1.40 | 136.626 | 1.9879279<br>2.2431285<br>2.9876021<br>5.3032020<br>18.0839213  | 0.0024466<br>1.9593814<br>0.5638911 | 0.0306843<br>1.4822840 | 0.0914036<br>3.6976263 | 0.4448883<br>1.5289004 | 0.6058385<br>3.1527336 |
|        | 1.45 | 141.403 | 2.1335836<br>2.4173448<br>3.2435289<br>5.8087659<br>19.9555287  | 0.0022541<br>1.9054448<br>0.5639574 | 0.0287352<br>1.4542191 | 0.0867719<br>3.6375771 | 0.4260283<br>1.5160516 | 0.5862025<br>3.1297371 |
|        | 1.50 | 145.863 | 2.2843118<br>2.5973085<br>3.5072526<br>6.3287388<br>21.8787000  | 0.0021011<br>1.8603800<br>0.5640152 | 0.0271600<br>1.4305838 | 0.0829800<br>3.5869348 | 0.4104747<br>1.5051389 | 0.5698550<br>3.1102059 |
|        | 1.70 | 161.349 | 2.9380530<br>3.3756369<br>4.6433716<br>8.5619394<br>30.1261720  | 0.0017149<br>1.7362062<br>0.5641863 | 0.0230694<br>1.3645318 | 0.0729047<br>3.4450522 | 0.3686038<br>1.4741793 | 0.5250997<br>3.0547952 |
|        | 2.00 | 179.932 | 4.0714332<br>4.7212543<br>6.5999975<br>12.3963998<br>44.2665611 | 0.0014384<br>1.6355601<br>0.5643395 | 0.0200207<br>1.3099307 | 0.0651482<br>3.3273508 | 0.3357624<br>1.4480461 | 0.4891549<br>3.0080239 |

| CASE A |      |         | Passband Ripple: Ap(dB)=3.0 |           |           |           |           |           |
|--------|------|---------|-----------------------------|-----------|-----------|-----------|-----------|-----------|
| n      | Ws   | As(dB)  | C1                          | A0        | A1        | A2        | A3        | A4        |
|        |      |         |                             | A5        | A6        | A7        | A8        | A9        |
|        |      |         |                             | A10       | A11       |           |           |           |
| 12     | 1.10 | 104.039 | 1.2179786                   | 0.0062789 | 0.0325613 | 0.2064804 | 0.3736477 | 1.4168479 |
|        |      |         | 1.2909254                   | 1.4143895 | 4.0303507 | 2.3967082 | 5.6042573 | 1.8863795 |
|        |      |         | 1.4996665                   | 3.7905775 | 0.5629963 |           |           |           |
|        |      |         | 2.0872157                   |           |           |           |           |           |
|        |      |         | 4.3499304                   |           |           |           |           |           |
|        |      |         | 33.0577896                  |           |           |           |           |           |
|        | 1.15 | 115.013 | 1.3331670                   | 0.0043588 | 0.0243872 | 0.1620142 | 0.3075806 | 1.1981754 |
|        |      |         | 1.4297858                   | 1.2440337 | 3.6033311 | 2.2191651 | 5.2373564 | 1.8214248 |
|        |      |         | 1.7009576                   | 3.6745900 | 0.5631447 |           |           |           |
|        |      |         | 2.4494590                   |           |           |           |           |           |
|        |      |         | 5.2979222                   |           |           |           |           |           |
|        |      |         | 41.3060302                  |           |           |           |           |           |
|        | 1.20 | 123.936 | 1.4532283                   | 0.0033668 | 0.0198442 | 0.1363302 | 0.2677988 | 1.0637957 |
|        |      |         | 1.5724303                   | 1.1358023 | 3.3290634 | 2.1017645 | 4.9935208 | 1.7771383 |
|        |      |         | 1.9034206                   | 3.5953552 | 0.5632918 |           |           |           |
|        |      |         | 2.8072245                   |           |           |           |           |           |
|        |      |         | 6.2244021                   |           |           |           |           |           |
|        |      |         | 49.3373729                  |           |           |           |           |           |
|        | 1.25 | 131.597 | 1.5782485                   | 0.0027673 | 0.0169552 | 0.1195200 | 0.2409577 | 0.9717517 |
|        |      |         | 1.7197065                   | 1.0598220 | 3.1350215 | 2.0168513 | 4.8166645 | 1.7443219 |
|        |      |         | 2.1098820                   | 3.5367275 | 0.5633869 |           |           |           |
|        |      |         | 3.1681544                   |           |           |           |           |           |
|        |      |         | 7.1532769                   |           |           |           |           |           |
|        |      |         | 57.3715316                  |           |           |           |           |           |
|        | 1.30 | 138.384 | 1.7082709                   | 0.0023691 | 0.0149612 | 0.1076525 | 0.2215609 | 0.9044358 |
|        |      |         | 1.8720353                   | 1.0032131 | 2.9895134 | 1.9521570 | 4.6814870 | 1.7189088 |
|        |      |         | 2.3217202                   | 3.4912303 | 0.5634880 |           |           |           |
|        |      |         | 3.5359122                   |           |           |           |           |           |
|        |      |         | 8.0959007                   |           |           |           |           |           |
|        |      |         | 65.5126430                  |           |           |           |           |           |
|        | 1.35 | 144.519 | 1.8433207                   | 0.0020871 | 0.0135060 | 0.0988318 | 0.2068682 | 0.8529525 |
|        |      |         | 2.0296574                   | 0.9592463 | 2.8759522 | 1.9009558 | 4.5743485 | 1.6984773 |
|        |      |         | 2.5397132                   | 3.4547259 | 0.5635538 |           |           |           |
|        |      |         | 3.9125428                   |           |           |           |           |           |
|        |      |         | 9.0585736                   |           |           |           |           |           |
|        |      |         | 73.8184125                  |           |           |           |           |           |
|        | 1.40 | 150.143 | 1.9834134                   | 0.0018780 | 0.0124002 | 0.0920263 | 0.1953554 | 0.8122842 |
|        |      |         | 2.1927230                   | 0.9240854 | 2.7847420 | 1.8593956 | 4.4872063 | 1.6817106 |
|        |      |         | 2.7643424                   | 3.4247382 | 0.5636175 |           |           |           |
|        |      |         | 4.2993023                   |           |           |           |           |           |
|        |      |         | 10.0451492                  |           |           |           |           |           |
|        |      |         | 82.3241078                  |           |           |           |           |           |
|        | 1.45 | 155.354 | 2.1285596                   | 0.0017174 | 0.0115336 | 0.0866237 | 0.1860958 | 0.7793517 |
|        |      |         | 2.3613317                   | 0.8953139 | 2.7098387 | 1.8249538 | 4.4148822 | 1.6676804 |
|        |      |         | 2.9959256                   | 3.3996417 | 0.5636731 |           |           |           |
|        |      |         | 4.6970152                   |           |           |           |           |           |
|        |      |         | 11.0581496                  |           |           |           |           |           |
|        |      |         | 91.0527944                  |           |           |           |           |           |
|        | 1.50 | 160.220 | 2.2787664                   | 0.0015906 | 0.0108376 | 0.0822372 | 0.1784935 | 0.7521548 |
|        |      |         | 2.5355530                   | 0.8713410 | 2.6472366 | 1.7959440 | 4.3538885 | 1.6557644 |
|        |      |         | 3.2346828                   | 3.3783266 | 0.5637215 |           |           |           |
|        |      |         | 5.1062498                   |           |           |           |           |           |
|        |      |         | 12.0993095                  |           |           |           |           |           |
|        |      |         | 100.0203299                 |           |           |           |           |           |
|        | 1.70 | 177.114 | 2.9302881                   | 0.0012746 | 0.0090502 | 0.0707510 | 0.1581905 | 0.6787560 |
|        |      |         | 3.2893923                   | 0.8056107 | 2.4746436 | 1.7148516 | 4.1830076 | 1.6219586 |
|        |      |         | 4.2640673                   | 3.3178541 | 0.5638649 |           |           |           |
|        |      |         | 6.8651328                   |           |           |           |           |           |
|        |      |         | 16.5660270                  |           |           |           |           |           |
|        |      |         | 138.4661013                 |           |           |           |           |           |
|        | 2.00 | 197.385 | 4.0598914                   | 0.0010521 | 0.0077389 | 0.0620881 | 0.1424454 | 0.6209776 |
|        |      |         | 4.5932605                   | 0.7527064 | 2.3346409 | 1.6477930 | 4.0412532 | 1.5934228 |
|        |      |         | 6.0382667                   | 3.2668089 | 0.5639931 |           |           |           |
|        |      |         | 9.8873550                   |           |           |           |           |           |
|        |      |         | 24.2272012                  |           |           |           |           |           |
|        |      |         | 204.3626509                 |           |           |           |           |           |