Preface

This book was written for use in a course at Linköping University and to aid the electrical engineer to understand and design analog filters. Most of the advanced mathematics required for the synthesis of analog filters has been avoided by providing a set of MATLAB functions that allows sophisticated filters to be designed. Most of these functions can easily be converted to run under Octave as well.

The first chapter gives an overview of filter technologies, terminology, and basic concepts. Approximation of common frequency selective filters and some more advanced approximations are discussed in Chapter 2. The reader is recommended to compare the standard approximation with respect to the group delay, e.g., Example 2.5, and learn to use the corresponding MATLAB functions. Geometrically symmetric frequency transformations are discussed as well as more general synthesis using MATLAB functions.

Chapter 3 deals with passive LC filters with lumped elements. The reader may believe that this is an outdated technology. However, it is still being used and more importantly the theory behind all advanced filter structures is based on passive LC filters. This is also the case for digital and switched-capacitor filters. The reader is strongly recommended to carefully study the principle of maximum power transfer, sensitivity to element errors, and the implications of Equation (3.26). MATLAB functions are used for the synthesis of ladder and lattice structures. Chapter 4deals with passive filters with distributed elements. These are useful for very high-frequency applications, but also in the design of corresponding wave digital filters.

In Chapter 5, basic circuit elements and their description as one-, two-, and three-ports are discussed.

Chapter 6 discusses first- and second-order sections using single and multiple amplifiers. The reader is recommended to study the implication of the gain-sensitivity product and the two-integrator loop. Chapter 7 discusses coupled forms and signal scaling, and Chapter 8 discusses various methods for immitance simulation. Wave active filters are discussed in Chapter 9 and leapfrog filters in Chapter 10. Finally, tuning techniques are discussed in Chapter 11.

Text with a smaller font is either solved examples or material that the reader may skip over without losing the main points.