Theory and Synthesis of Linear Passive Time-Invariant Networks

Exploring the overlap of mathematics and engineering network synthesis, this book presents a rigorous treatment of the key principles underpinning linear lumped passive time-invariant networks.

Based around a series of lectures given by the author, this thoughtfully written book draws on his wide experience in the field, carefully revealing the essential mathematical structure of network synthesis problems. Topics covered include passive n-ports, broadband matching, the design of passive multiplexers, and two-state passive devices. It also includes material not usually found in existing texts, such as the theoretical behavior of transverse electromagnetic (TEM) coupled transmission lines.

Introducing fundamental principles in a formal theorem-proof style, illustrated by worked examples, this book is an invaluable resource for graduate students studying linear networks and circuit design, academic researchers, and professional circuit engineers.

Dante C. Youla is a Presidential Fellow of the New York University Polytechnic School of Engineering, and a Professor Emeritus of the Department of Electrical and Computer Engineering. He has been awarded the IEEE Circuits and Systems Society Vitold Belevitch Award for his fundamental contributions to the field, and the Youla–Kučera parameterization is named after him. He is a Fellow of the National Academy of Engineering, and a Fellow of the IEEE.

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Preface

Here, in this set of eighteen extended lectures, an attempt has been made to present in readable and digested rigorous form some of the cardinal ideas underlying the synthesis of both lumped-passive and a significant subset of linear lumped-distributed passive networks.

As is inevitably almost always the case, the work has evolved from the author's own research, as well as the now classical contributions of many others, which we undoubtedly inadequately acknowledge in the references.

Although it is assumed that the reader's grasp of circuit theory is strictly undergraduate, I do suppose that their mathematical maturity suffices to encourage further growth. To help promote this growth is the object of Chapter 1 and the several appendices incorporated throughout the body of the book.

Also, an earnest attempt has been made to avoid unnecessary overlap with the presently available standard texts. For example, almost nothing is said about the foundations of approximation theory, especially as it pertains to the choice of suitable gain functions. On the other hand, a great deal of hard-to-obtain useful information regarding the theoretical description of multiconductor TEM transmission lines is developed in great detail.

To ensure proper understanding, a large number of illustrative examples and problems, some quite challenging, are worked out with all necessary intermediate steps included. Experience indicates that the first twelve chapters can be covered comfortably in a two-semester graduate course that meets 3 hours per week.

Finally, I wish to express sincere gratitude to Eve Henderson, to my colleague, Professor Unnikrishna Pillai, and to his charming and talented daughter Priya Pillai who is totally responsible for the elegant and attractive cover design. Without Eve's help many crucial software issues could never have been resolved. The appearance of an index is owed completely to Professor Pillai's insistence, efforts, and persuasive arguments. Needless to say, the encouragement by my colleagues and the resources provided by the Electrical Engineering Department have proved to be decisive in this endeavor.

Long Island, New York — Dante C. Youla