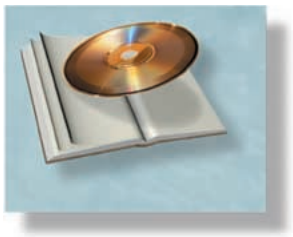


Book/Software Reviews

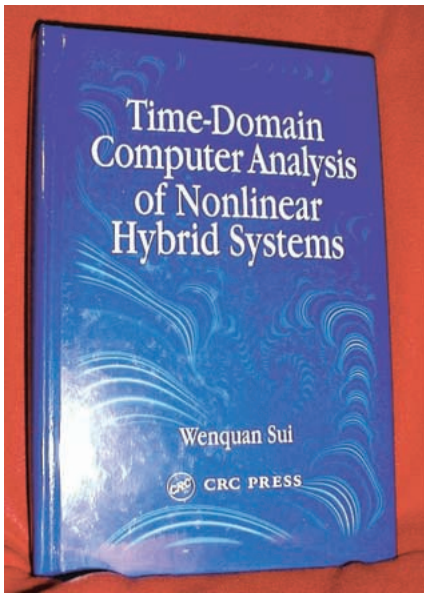
In this issue of *IEEE Microwave Magazine*, we are pleased to present two book reviews. The first, by regular book reviewer Alfy Riddle, is Dr. Wenquan Sui's *Time-Domain Computer Analysis of Nonlinear Hybrid Systems*. For the second review, we welcome Matthew N.O. Sadiku and his review of Jia-Sheng Hong and M.J. Lancaster's *Microstrip Flters for RF/Microwave Applications*.

Time-Domain Computer Analysis of Nonlinear Hybrid Systems

by Wenquan Sui

My first thought upon picking up *Time-Domain Computer Analysis of Nonlinear Hybrid Systems* by Wenquan Sui was wondering just what kind of hybrid he was going to discuss. Dr. Sui's hybrid world consists of bringing together finite difference time domain (FDTD) electromagnetic simulators with circuit level nonlinear device simulators. In spite of the fact that analyzing even a fraction of a printed circuit board can bring an electromagnetic simulator to its knees, there is a continuing drive to create simulators that will reduce more and more of our problems to a number. The bottom line is that we live in an age where we can join the circuit laws of Kirchoff to the electromagnetic formulations of Maxwell and the nonlinear physics of semiconductors and solve the lot on a desktop computer.

Dr. Sui's book takes on the formidable task of joining FDTD electromagnetic analysis with nonlinear circuit analysis. His treatment is application oriented rather than theoretical or historical. Working at Bell Labs, IBM Microelectronics, and Conexant has obviously motivated Dr. Sui toward the practical side of computer-aided design (CAD). This book appears targeted at the professional who uses CAD or develops CAD programs. Each topic is handled in depth, and the book covers a wide range of subjects quickly. This book is not oriented toward classroom use, though it could be used in a graduate course with supplementary materials. Many of the chapters in this book could serve as semester-long topics in themselves.



Time-Domain Computer Analysis of Nonlinear Hybrid Systems by Wenquan Sui, ISBN 0-8493-1396-1, © 2002, CRC Press, www.crcpress.com, 397 pages, US$99.95.

While there are 22 pages of references to support the book, these serve more as background than being integrated with the text.

Time-Domain Computer Analysis of Nonlinear Hybrid Systems starts with an overview of electromagnetic-field theory and a review of circuit analysis that includes distributed networks and scattering parameters. The next chapters discuss the FDTD method and how it is implemented on a computer. The following chapter on circuit simulation was coauthored with Tong Li. Chapters 7 and 8 form the core of the book by discussing the joining of FDTD and circuit simulators. Chapters 9 and 10 round out the book by presenting examples of analyzing packaging and optical device problems. Dr. Sui's book includes appendices on vector analysis and Laplace transformation.

There appears to be a lot of work and thought behind this book. The material is easy to read, concise, and complete. Surely Dr. Sui has spent a great deal of time working through simulations and has written a book that will serve as much as a reference for himself as a tutorial for others.

Reviewed by Alfy Riddle

Microstrip Filters for RF/Microwave Applications

by Jia-Sheng Wong and M.J. Lancaster

Filters have been used in practical applications for more than eight decades. Filter technology feeds related applications, such as equalizers, impedance-matching networks, transformers, shaping networks, power

dividers, attenuators, and directional couplers and is continuously providing practicing engineers with opportunities to innovate and experiment. Filters are important in many microstrip designs. They are essential components in a variety of electronic systems, such cellular radio, satellite communications, and radar.

This book is based on the extensive research experience of the authors. Dr. Jia-Sheng Hong is a professor at Heriot-Watt University in Edinburgh, Scotland, and Dr. M.J. Lancaster is a professor at the University of Birmingham, England. The book competes with two popular books on filters—*Microwave Filters, Impedance-Matching Networks, and Coupling Structures* by G. Matthaei, E.M.T. Jones, and L. Young and *Theory and Design of Microwave Filters* by Ian Hunter. Although the book by Matthaei, et al. has become a classic, it was published in 1980 and needs updating. The book by Hunter provides excellent coverage of modern microwave filters, but it is not comprehensive. The present book by Hong is successful in carving out a niche that is distinctly different from the two competing books.

The main objective of the book is to provide a comprehensive treatment of RF/microwave filters based on the microwave structure. The book consists of 12 chapters and one appendix that present some useful constants and data. The first six chapters deal with the basic concepts of RF/microwave filter design, while the remaining six chapters focus on more advanced topics.

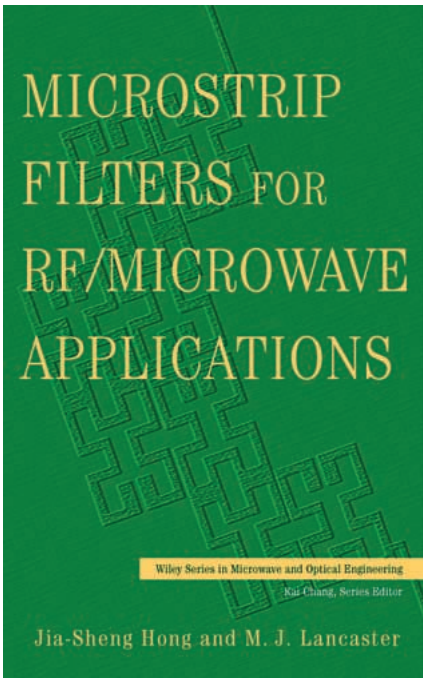
Chapter 1: Introduction. This defines basic concepts, such as RF and microwaves as part of the electromagnetic spectrum. The rest of the chapter basically serves as an introduction to the rest of the book.

Chapter 2: Network Analysis. This addresses various network concepts useful for the analysis of filter networks. Such concepts include admittance, impedance, scattering, and ABCD parameters and their relationships.

Chapter 3: Basic Concepts and Theories of Filters. This introduces the reader to the general concepts and theories for designing RF/microwave filters. Topics covered include filter transfer functions (e.g., Butterworth, Chebyshev, elliptic, Gaussian), lowpass prototypes, frequency and element transformations, immittance inverters, Richards' transformation, and Kurada identities.

Chapter 4: Transmission Lines and Components. This summaries the basic concepts and design equations for microstrip lines, coupled microstrip lines, and discontinuities. It also covers lumped and distributed components used in designing filters.

Chapter 5: Lowpass and Bandpass Filters. This covers conventional microstrip lowpass and bandpass filters, including stepped-impedance filters, open-stub filters, semilumped filters, interdigital filters, and combline filters.



Microstrip Filters for RF/Microwave Applications by Jia-Sheng Hong and M.J. Lancaster, ISBN 0-4713-8877-7, © 2001, Wiley-Interscience, www.wiley.com, 488 pages, US$125.

Chapter 6: Highpass and Bandpass Filters. This describes typical microstrip highpass and bandpass filters including quasilumped element and optimum distributed highpass filters. The authors present some design equations, tables, and examples for easy reference.

Chapter 7: Advanced Materials and Technologies. This contains some advanced materials and technologies for RF/microwave filter applications, including high-temperature superconductors, MEMS, MMIC, ferroelectrics, active filters, photonic bandgap materials, and LTCC.

Chapter 8: Coupled Resonator Circuits. This deals with the general treatment of coupled resonant circuits. It presents the general formulation for extracting coupling coefficients and external quality factor. Numerical examples are later presented to show how to apply these formulations.

Chapter 9: CAD for Low-Cost and High-Volume Production. This summarizes some basic techniques for designing filters using CAD. These techniques include electromagnetic (EM) 2-D or 3-D simulators, such as method of moments (MoM), finite difference time-domain (FDTD), finite element method (FEM), and artificial neural network (ANN). It lists some commercially available EM solvers such as ADS, HFSS, IE3D, and Unisym.

Chapter 10: Advanced RF/Microwave Filters. This is devoted to some advanced filters such as cascaded quadruplet filters, trisection and cascaded trisection filters, cross-coupled filters, and extracted-pole filters, which must meet stringent requirements of RF/microwave systems.

Chapter 11: Compact Filters and Filter Miniaturization. This discusses novel designs for compact filters and filter miniaturization. The types of filters described here include ladder-line filters, pseudointerdigital-line filters, slow-wave resonator filters, multilayer filters, and filters using high-dielectric constant substrates.

Chapter 12: Case Study for Mobile Communications Applications. This last chapter presents a case study on high-temperature superconducting microstrip filters with specific application to cellular base stations. The work presented here is a summary of the involvement of the authors in a European research project.

The book has two major strengths. First, the book is well written in a concise and clear manner. It is easy to read and practical. It covers a lot of territory and offers a unique and comprehensive

treatment of the subject, which is not found in other books. Second, the book presents a lot of design examples, with some even using commercially available CAD tools.

However, the book has two weaknesses. First, as it is right now, the book is a monograph. It is close to being a textbook suitable for classroom use if the authors had included end-of-chapter problems for students to solve. Second, although the book presents and applies some CAD tools in Chapter 9, it does not integrate computer usage throughout the chapters.

In summary, the authors cover a remarkable span of RF/microwave filter design. The topics are accessible for the advanced undergraduate yet challenging enough for graduate students, researchers, and working engineers.

For those who are interested in learning about microstrip filter design for RF/microwave applications, this book is the best I have seen so far. Beginners in microstrip filter design can use this book as a key to enter the exciting field. With its unique organization and presentation, the book will become an invaluable reference on microstrip filter design. The book is worth having on your bookshelf.

Reviewed by Matthew N.O. Sadiku