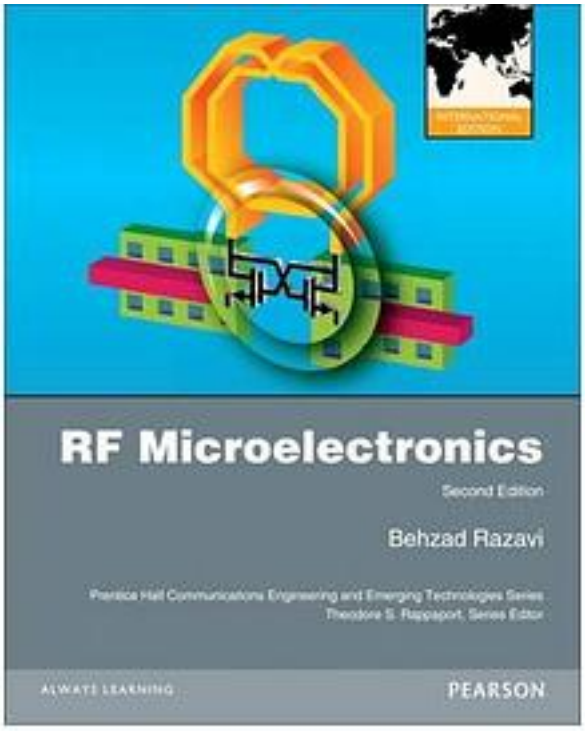
RF Microelectronics



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出版者:Prentice Hall

出版时间:2011-10-2

装帧:

isbn:9780137134731

The Acclaimed RF Microelectronics Best-Seller, Expanded and Updated for the Newest Architectures, Circuits, and Devices Wireless communication has become almost as ubiquitous as electricity, but RF design continues to challenge engineers and researchers. In the 15 years since the first edition of this classic text, the demand for higher performance has led to an explosive growth of RF design techniques. In "RF Microelectronics, Second Edition, " Behzad Razavi systematically teaches the fundamentals as well as the state-of-the-art developments in the analysis and design

of RF circuits and transceivers. Razavi has written the second edition to reflect today's RF microelectronics, covering key topics in far greater detail. At nearly three times the length of the first edition, the second edition is an indispensable tome for both students and practicing engineers. With his lucid prose, Razavi now

Offers a stronger tutorial focus along with hundreds of examples and problems

Teaches design as well as analysis with the aid of step-by-step design procedures and a chapter dedicated to the design of a dual-band WiFi transceiver

Describes new design paradigms and analysis techniques for circuits such as low-noise amplifiers, mixers, oscillators, and frequency dividers

This edition's extensive coverage includes brand new chapters on mixers, passive devices, integer-N synthesizers, and fractional-N synthesizers. Razavi's teachings culminate in a new chapter that begins with WiFi's radio specifications and, step by step, designs the transceiver at the transistor level. Coverage includes

Core RF principles, including noise and nonlinearity, with ties to analog design, microwave theory, and communication systems

An intuitive treatment of modulation theory and wireless standards from the standpoint of the RF IC designer

Transceiver architectures such as heterodyne, sliding-IF, directconversion, image-reject, and low-IF topologies.

Low-noise amplifiers, including cascode common-gate and commonsource topologies, noise-cancelling schemes, and reactance-cancelling configurations

Passive and active mixers, including their gain and noise analysis and new mixer topologies

Voltage-controlled oscillators, phase noise mechanisms, and various VCO topologies dealing with noisepower-tuning trade-offs

All-new coverage of passive devices, such as integrated inductors, MOS varactors, and transformers

A chapter on the analysis and design of phase-locked loops with emphasis on low phase noise and low spur levels

Two chapters on integer-N and fractional-N synthesizers, including the design of frequency dividers

Power amplifier principles and circuit topologies along with transmitter architectures, such as polar modulation and outphasing

Editorial Reviews

From the Inside Flap

Preface

The annual worldwide sales of cellular phones has exceeded $2.5B. With 4.5 million customers, home satellite networks comprise a $2.5B industry. The global positioning system is expected to become a $5B market by the year 2000. In Europe, the sales of equipment and services for mobile communications will reach $30B by 1998. The statistics are overwhelming.

The radio frequency (RF) and wireless market has suddenly expanded to unimaginable dimensions. Devices such as pagers, cellular and cordless phones, cable modems, and RF identification tags are rapidly penetrating all aspects of our lives, evolving from luxury items to indispensable tools. Semiconductor and system companies, small and large, analog and digital, have seen the statistics and are striving to capture their own market share by introducing various RF products. RF design is unique in that it draws upon many disciplines unrelated to integrated circuits (ICs). The RF knowledge base has grown for almost a century, creating a seemingly endless body of literature for the novice.

This book deals with the analysis and design of RF integrated circuits and systems. Providing a systematic treatment of RF electronics in a tutorial language, the book begins with the necessary background knowledge from microwave and communication theory and leads the reader to the design of RF transceivers and circuits. The text emphasizes both architecture and circuit level issues with respect to monolithic implementation in VLSI technologies.

The primary focus is on bipolar and CMOS design, but most of the concepts can be applied to other technologies as well. The reader is assumed to have a basic understanding of analog IC design and the theory of signals and systems. The book consists of nine chapters.

Chapter 1 gives a general introduction, posing questions and providing motivation for subsequent chapters.

Chapter 2 describes basic concepts in RF and microwave design, emphasizing the effects of nonlinearity and noise.

Chapters 3 and 4 take the reader to the communication system level, giving an overview of modulation, detection, multiple access techniques, and wireless standards. While initially appearing to be unnecessary, this material is in fact essential to the concurrent design of RF circuits and systems.

Chapter 5 deals with transceiver architectures, presenting various receiver and transmitter topologies along with their merits and drawbacks. This chapter also includes a number of case studies that exemplify the approaches taken in actual RF products.

Chapters 6 through 9 address the design of RF building blocks: low-noise amplifiers and mixers, oscillators, frequency synthesizers, and power amplifiers , with particular attention to minimizing the number of off-chip components. An important goal of these chapters is to demonstrate how the system requirements define the parameters of the circuits and how the performance of each circuit impacts that of the overall transceiver.

I have taught approximately 80% of the material in this book in a 4-unit graduate course at UCLA. Chapters 3, 4, 8, and 9 had to be shortened in a ten-week quarter, but in a semester system they can be covered more thoroughly. Much of my RF design

knowledge comes from interactions with colleagues.Helen Kim, Ting-Ping Liu, and Dan Avidor of Bell Laboratories, and David Su and Andrew Gzegorek of Hewlett-Packard Laboratories have contributed to the material in this book in many ways. The text was also reviewed by a number of experts: Stefan Heinen (Siemens), Bart Jansen (Hewlett-Packard), Ting-Ping Liu (Bell Labs), John Long (University of Toronto), Tadao Nak-agawa (NTT), Gitty Nasserbakht (Texas Instruments), Ted Rappaport (Virginia Tech), Tirdad Sowlati (Gennum), Trudy Stetzler (Bell Labs), David Su (Hewlett-Packard), and Rick Wesel (UCLA). In addition, a number of UCLA students, including Farbod Behbahani, Hooman Darabi, John Leete, and Jacob Rael, test drove various chapters and provided useful feedback. I am indebted to all of the above for their kind assistance. I would also like to thank the staff at Prentice Hall, particularly Russ Hall, Maureen Diana, and Kerry Reardon for their support.Behzad RazaviJuly 1997 --This text refers to an alternate Hardcover edition.

作者介绍:

About the Author

Behzad Razavi, Professor of Electrical Engineering at UCLA, leads the Communication Circuits Laboratory (CCL). Emphasizing the use of mainstream CMOS technologies, CCL's research seeks and exploits new devices, circuits, and architectures to push the performance envelope. Razavi holds a BSEE from Sharif University of Technology and MSEE and PhDEE degrees from Stanford. He was with ATT Bell Laboratories and HP Labs until 1996. An IEEE Distinguished Lecturer and IEEE Fellow, his books include Design of Analog CMOS Integrated Circuits, Design of Integrated Circuits for Optical Communications, and Fundamentals of Microelectronics.

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有水平，有耐心

膜拜神书!

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书评

这本书很薄。但是很有用。现在出了第二版，第二版很厚，很全。但是第一版仍有它的价值，可以让你在短时间内学到很多关键而基础的知识。很适合初学者。读过第一版后，具体做什么就读第二版的相关部分，可以有一个合理的由浅入深的过程。

非常好的一本书。
虽然看似简略，但是论述范围很广，内容取舍得当，简而不浅，显露大师风范，触及到很多主题，是一本相当好的入门书。

新版的可读性增加很多，比旧版多了很多例子，非常好。适合初学，但是analog领域的内容可挖掘的东西很深刻，就像剥洋葱一样，一层接一层，很难敢说完全懂这样的话。razavi 的内容适合剥前几层。如果你真的想学analog IC，可以买张飞机票来挺abidi的讲课，从理论的层面，他比raz...

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