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图书基本信息

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前言

导读　RF Microelectronics一书的作者Behzad Razavi是美国加州大学洛杉矶分校终身教授，曾经在美国贝尔实验室和惠普实验室从事多年的射频电路设计工作，在射频电路领域有数十年的科研和教学经验。

本书的第一版于1998年问世，经过不断的再版和翻译，成为射频电路设计领域的经典书籍。

14年来，射频电路设计领域发生了巨大的变化，高集成度的无线设备和宽带的无线应用，促使科研人员在收发信机结构、电路形式及器件特性上，不断推陈出新。

而且，新的电路分析方法及建模技术的成熟，使科研人员对射频电路的理解步入一个新的台阶。

为反映这些变化，本书的第二版得以问世。

与旧版相比，新版在篇章结构与具体内容上都有显著变化，两者的内容重合度在10%左右。

在新版著作中，作者通过大量的设计实例和问题讨论，帮助读者在学习射频电路整体分析方法的同时，了解射频电路设计中可能遇到的细节问题。

同时，在新版著作中，作者也更加强调如何帮助读者掌握射频电路设计的基本方法，为此作者还特别增加了一章，用于指导读者如何一步一步地设计晶体管级的双频段WiFi收发信机。

本书的具体内容可以概括如下。

第2章介绍射频电路设计中的基本概念，其中增加了双端口网络S参数的定义和计算实例，为本书后续章节的分析打下基础。

随后，第3章对无线通信的基本概念进行阐述，重点介绍数字调制方式及其相应的电路实现实例。

第4章不仅介绍传统经典结构的各类收发信机，同时基于作者对射频电路最新发展趋势的跟踪，广受关注的新型收发信机结构也出现在新版著作中。

值得一提的是，作者还通过问题讨论等方式，结合802.11a/g等具体无线通信标准，讲解了设计中需要注意的实际问题。

本书的第5章至第12章，详尽介绍了无线收发信机中的各个子模块。

与旧版相比，各子模块的分类方式有显著改进，作者也浓墨重彩地分析了各类新型模块技术，使读者能够及时地掌握射频电路设计的新趋势。

新版还加入了无源器件的介绍与分析，使内容更趋完整。

本书的第13章是收发信机设计实例，如前所述，本章内容是全书知识点的灵活运用，也是作者专注于设计方法传授的点睛之笔。

本书的内容体系基本涵盖了国内高校“通信基本电路”（亦称“高频电子线路”）专业基础课程的教学内容。

但是，通过本人在上海交通大学电子工程系本科三年级的亲身教学实践（1学期64学时），发现本书与“通信基本电路”课程的教学大纲存在一定的不匹配之处。

本书的内容相对于本科阶段的知识体系显得内容过于庞大，系统级的电路分析定性讲解有余，而单元电路的定量分析不足。

因此，本书更适合作为理工类大专院校电子类专业研究生的课程教材。

如果作为理工类大专院校通信、电子类本科生双语教学和全英文教学的教材，建议结合Thomas H. Lee的Design of CMOS Radio-Frequency Integrated Circuits（由电子工业出版社翻译出版），以便于学生掌握单元电路基础知识，为今后的科研打下扎实的基础。

本书内容涵盖无线收发信机各个模块的介绍、分析和设计，并融入了Razavi教授数十年的电路设计经验，对从事射频电路设计的专业技术人员而言，更是一本不可多得的必备书籍。

甘小莺　副教授　上海交通大学电子工程系

内容概要

本书侧重系统级描述，综合了无线通信电路系统描述、器件特性及单元电路分析，讨论最新架构、电路和器件。
第1和第2章首先介绍射频电子学基本概念和术语；第3章和第4章讨论通信系统层的建模、检测、多路存取等技术及无线标准；第5章讨论无线前端收发器的结构和集成电路的实现，第6章到第9章详细讨论了低噪声放大器和混频器、振荡器、频率综合器和功放器电路原理和分析方法。

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2.Bandwidth efficiency, i.e., the bandwidth occupied by the modulated carrier for a given information rate in the baseband signal.This aspect plays a critical role in today's systems because the available spectrum is limited.For example, the GSM phone system provides a total bandwidth of 25 MHz for millions of users in crowded cities.The sharing of this bandwidth among so many users is explained in Section 3.6. 3.Power efficiency, i.e., the type of power amplifier（PA）that can be used in the transmitter.As explained later in this chapter, some modulated waveforms can be processed by means of nonlinear power amplifiers, whereas some others require linear amplifiers.Since nonlinear PAs are generally more efficient（Chapter 12）, it is desirable to employ a modulation scheme that lends itself to nonlinear amplification. The above three attributes typically trade with one another.For example, we may suspect that the modulation format in Fig.3.3（b）is more bandwidth-efficient than that in Fig.3.3（a）because it carries twice as much information for the same bandwidth.This advantage comes at the cost of detectability-because the amplitude values are more closely spaced-and power efficiency-because PA nonlinearity compresses the larger amplitudes. 3.2 ANALOG MODULATION If an analog signal, e.g., that produced by a microphone, is impressed on a carrier, then we say we have performed analog modulation.While uncommon in today's high-performance communications, analog modulation provides fundamental concepts that prove essential in studying digital modulation as well. 3.2.1 Amplitude Modulation For a baseband signal xBB（t）, an amplitude-modulated（AM）waveform can be constructed as xAM（t）= Ac（1+mxBB（t））cosωct,（3.2） where m is called the"modulation index."Illustrated in Fig.3.4（a）is a multiplication method for generating an AM signal.We say the baseband signal is"upconverted."The waveform Ac cosωct is generated by a"local oscillator"（LO）.Multiplication by cosωct in the time domain simply translates the spectrum of xBB（t）to a center frequency of ωc（Fig.3.4（b））.Thus, the bandwidth of xAM（t）iS twice that of xBB（t）.Note that since XBB（t）has a symmetric spectrum around zero（because it is a real signal）, the spectrum of xAM（t）is also symmetric around ωc.This symmetry does not hold for all modulation schemes and plays a significant role in the design of transceiver architectures（Chapter 4）. ……

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