

Preface

In the last decade wireless communications engineering has seen outstanding progress, making merged, enhanced and novel applications in the area of mobile phones, wireless networks, sensors and television feasible. Technologies have developed from hybrid systems to highly integrated solutions in silicon, SiGe, GaAs and InP. By aggressive scaling of device dimensions below $0.1\text{ }\mu\text{m}$ and employing advanced technologies such as SOI, strained silicon and low-k, circuits with operation frequencies and bandwidths up to approximately 100 GHz can now be fabricated. However, especially in silicon, the restrictions inherent in scaling make circuit engineering a demanding task. Examples of these drawbacks are the limited high frequency signal power, leakage effects and significant parasitics in passive devices. Enhanced circuit topologies and design techniques have to be applied to achieve maximum performance. In this context, designers must have profound skills in the following areas: circuit theory, IC technologies, communications standards, system design, measurement techniques, etc. The aim of this book is to address all these multidisciplinary issues in a compact and comprehensive form and in a single volume. Suitable for students, engineers and scientists, the manuscript provides the necessary theoretical background together with cookbook-like optimisation strategies and state-of-the-art design examples. Each chapter is accompanied by tutorial questions repeating the key issues of the treated subjects.

The manuscript is organised as follows: Chapter 1 preludes with an introduction concerned with the exciting history of integrated circuits, technologies and wireless communications. Moreover, an overview of the IC circuit design flow, tools, applications and markets is given. Chapter 2 reviews the key architectures of wireless systems. In Chap. 3 we study S-parameters and the Smith chart being instrumental for small signal circuit analyses and optimisations. Important RF basics including gain, stability, linearity and noise are treated in Chap. 4. Transistors and passive devices are discussed in Chaps. 5 and 6. Key circuit design techniques and components such as LNAs, PAs, VCOs, synthesisers, mixers, amplitude control elements and phase shifter are elaborated in Chaps. 7–14. Measurement methods and setups are outlined in Chap. 15.

Most of the subjects treated in this book are taught in lectures at the Dresden University of Technology (TUD) in Germany. Lecturers who might be interested in using the material of this manuscript for teaching purposes are encouraged to contact the author. An exchange of experiences is welcome.

This is the second edition of this book. However, the manuscript may still exhibit some unclear phrasings or errors awaiting to be discovered by careful readers like you! I would be very pleased to receive appropriate comments.

This book would not have been possible without the constructive impact of several great colleagues.

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Most of this book has been written during my holidays in Brazil (Porto Galinhas and Fortaleza) and Spain (Canary Islands and Mallorca). These gorgeous locations gave me a fruitful balance and relaxation during the writing of the manuscript.

Since my student days I have found high-speed analogue and RF circuit design very interesting and enthralling. If this book succeeds in inspiring the same enthusiasm in others, then the efforts of its compilation have borne the desired fruit.

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