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ADVANCED DESIGN TECHNIQUES FOR RF POWER AMPLIFIERS

by

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Contents

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Preface

Power amplifier is the main power consumption block in any advanced wireless communications system. When the DC power is limited, it is crucial to design power amplifiers with high power-added efficiency. The output power and efficiency depends on the active device, bias conditions according to the operating class, matching networks, and so on. One of the methods to improve the output power and efficiency is to terminate the harmonics at the output. Among the harmonics, the first five are especially in want of tuning, because their magnitudes are relatively larger than the others'.

In the last seven years the authors have made a lot of efforts in the field of development of high-efficiency polyharmonic power amplifiers, and the original results are highly enhanced both by the modelling and the related design methodologies. Thus, the main idea of this book will be to provide the reader with a deep analysis of modeling and design strategies of BJT high-efficiency polyharmonic power amplifiers, as well as to organize in a coherent manner all the authors' results in the field of polyharmonic power amplifiers. Hence, the book allows the reader not only to understand the operating principle and the features of bipolar transistor power amplifiers, but also to design high-efficiency amplifiers at the frequencies close to transition.

The book can be used as a guide by researchers and practicing engineers dealing with this subject and as a text book to graduate and postgraduate students who want to extend their knowledge and study all aspects of the analysis and design of high-efficiency polyharmonic power amplifiers. Although the material is presented in a formal and theoretical manner, much emphasis is made on a design perspective. To further link the book's

theoretical aspects with practical issues, simulation and experimental examples are included.

The book is organized into five chapters. Chapter 1 is introductory and it contains analytical review of current state of high-efficiency power amplifiers design problem. The strength and weakness of existing approaches are highlighted, unsolved issues pointed out.

Chapter 2 of the book is devoted to theoretical analysis of BJT class-F power amplifier near transition frequency and is divided into three sections. In section 1, we propose the simplified transistor model accounting the charge storage issues that will be needed in the sequel. Section 2 describes the analytical derivation of collector current harmonic content depending on the operating frequency and the biasing conditions, while section 3 presents the Class F realization conditions according to the analysis.

Chapter 3 deals with verification and demonstration of the results achieved in Chapter 2. Section 1 covers the simulation of BJT class-F power amplifier near the transition frequency using the accurate transistor model. Furthermore, section 2 contains experimental results of the fabricated prototype.

Chapter 4 is devoted to the use of photonic band-gap structures (PBG) as the output networks of high-efficiency polyharmonic power amplifiers. The novel type of PBG is proposed providing improved characteristics in the both stop and pass bands.

Finally, Chapter 5 presents the BJT fifth-harmonic peaking class F power amplifier design using proposed in Chapter 4 structure.

In addition, we provide our own comprehensive nonlinear power amplifiers' simulation tutorial in Appendix.

Anna Rudiakova,

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