Advanced Microwave Circuits and Systems

This book is based on recent research work conducted by the authors dealing with the design and development of active and passive microwave components, integrated circuits and systems. It is divided into seven parts. In the first part comprising the first two chapters, alternative concepts and equations for multiport network analysis and characterization are provided. A thru-only de-embedding technique for accurate on-wafer characterization is introduced. The second part of the book corresponds to the analysis and design of ultra-wideband low-noise amplifiers (LNA). The LNA is the most critical component in a receiving system. Its performance determines the overall system sensitivity because it is the first block to amplify the received signal from the antenna. Hence, for the achievement of high receiver performance, the LNA is required to have a low noise figure with good input matching as well as sufficient gain in a wide frequency range of operation, which is very difficult to achieve. Most circuits demonstrated are not stable across the frequency band, which makes these amplifiers prone to self-oscillations and therefore limit their applicability. The trade-off between noise figure, gain, linearity, bandwidth, and power consumption, which generally accompanies the LNA design process, is discussed in this part. The requirement from an amplifier design differs for different applications. A power amplifier is a type of amplifier which drives the antenna of a transmitter. Unlike LNA, a power amplifier is usually optimized to have high output power, high efficiency, optimum heat dissipation and high gain. The third part of this book presents power amplifier designs through a series of design examples. Designs undertaken include a switching mode power amplifier, Doherty power amplifier, and flexible power amplifier architectures. In addition, distortion analysis and power combining techniques are considered. Another key element in most microwave systems is a signal generator. It forms the heart of all kinds of communication and radar systems. The fourth part of this book is dedicated to signal generators such as voltage-controlled oscillators and electron devices for millimeter wave and submillimeter wave applications. This part also covers studies of integrated buffer circuits. Passive components are indispensable elements of any electronic system. The increasing demands to miniaturization and cost effectiveness push currently available technologies to the limits. Some considerations to meet the growing requirements are provided in the fifth part of this book. The following part deals with circuits based on LTCC and MEMS technologies. The book concludes with chapters considering application of microwaves in measurement and sensing systems. This includes topics related to six-port reflectometers, remote network analysis, inverse scattering for microwave imaging systems, spectroscopy for medical applications and interaction with transponders in medical sensors.

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