

Preface

Impulse-based ultra-wideband (UWB) systems, notably unlicensed UWB systems operating across or within 3.1–10.6 GHz, are unique systems possessing many desired characteristics, owing to the transmission and reception of only a single signal having pulse waveform at all times, rather than multiple consecutive CW signals having sinusoidal waveform at different times as in CW-based systems. This unique operation is equivalent to transmitting and receiving many CW signals across an extremely broad bandwidth concurrently. A UWB impulse system can hence be considered to some extent as electrically equivalent to multiple CW systems, each operating at a single frequency in an ultra-wide bandwidth, working simultaneously. It is this unique operation that makes the UWB impulse systems distinctly different from the UWB CW systems, not only in the design and performance, but also in applications. The three most important subsystems in a UWB impulse system, as in any other RF systems, are the UWB transmitter, receiver, and antenna.

Silicon-based Complementary-Metal-Oxide-Semiconductor (CMOS) RFICs plays a dominant role in realizing miniature low-cost and low-power consumption single-chip RF systems, which are particularly essential for portable or hand-held implementations. CMOS single-chip RFIC transmitters and receivers are especially needed for advanced miniature UWB impulse systems.

This book is devoted to the design of CMOS RFIC UWB impulse transmitters and receivers and their components for UWB impulse systems. Specifically, it addresses three main topics of UWB impulse transmitters and receivers: CMOS UWB transmitter design, CMOS UWB receiver design, and UWB uniplanar antenna design. The book also describes the actual design, simulation, fabrication and measurement of these subsystems, which can readily be integrated together to realize UWB impulse systems for potential applications in communications and sensing.

Although the book is succinct, the material is very much self-contained and contains practical, valuable and sufficient information presented in such a way that allows readers with undergraduate background in electrical engineering or physics, with some experiences or graduate courses in RF circuits, to understand and design

easily UWB impulse transmitters, receivers, and antennas for various UWB applications.

The book is useful for engineers, physicists, and graduate students who work in radar, sensor, and communication systems as well as those involved in the design of RF circuits and systems. It is our sincere hope that the book can serve not only as a reference for the development of UWB systems and components, but also for possible generation of innovative ideas that can benefit many existing sensing and communication applications or be implemented for other new applications.

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