

Preface

This book covers devices, systems, and circuits that have been proposed for biomedical applications using the two recently established bands: ultra-wideband (3.1–10.6 GHz) and 60 GHz ISM band (57–66 GHz). There has been some recent interest in using ultra-wide band (UWB) and the 60 GHz wireless technology for health care applications because of some important benefits they offer such as low-power design, low radio frequency (RF) and electromagnetic interference (EMI) effects in medical environment, small size antenna, and high-speed communication. The physical size of devices at these frequencies can be extremely small because of the circuit design at gigahertz (GHz) range. These bands are not crowded when compared to the other available bands, and thus have been very attractive for implementation in biomedical environment. Thus far, ultra-wideband has been successfully used for wireless body area network (WBAN) applications, medical imaging, biomedical sensing, and vital signs monitoring.

The unlicensed 60 GHz ISM provides one of the largest bandwidths, making this technology attractive for medical applications. This book investigates some potential applications of this band in the e-health areas. A wireless system based on the 60 GHz ISM band can be deployed in medical centers or homes to initiate fast connectivity at low cost. It can provide video data transmission from one point to another without using wires. The 60-GHz radios can support multi-gigabit per second data communication for body-centric wireless systems with high level of security. It will possibly enable high level of miniaturization for the antennas and transceiver circuits and will have low interference effect on other wireless systems in the same environment.

UWB communication has been used for monitoring continuous medical signals such as EEG (*electroencephalogram*) and ECG (*electrocardiogram*) and high-speed medical monitoring such as electronic pills (i.e., wireless capsules) and multichannel neural recording for brain–computer interfaces. UWB is also attractive for medical gait analysis and tracking due to the highly accurate performance that can be obtained. UWB radar is being used in medicine to detect tumors externally for certain body organs especially for breast cancer detection.

This book contains the current state of art by focusing latest research related to design, development, and circuits for ultra-wide band and the 60 GHz wireless system

technology. The recent technologies and developments proposed or used in medical monitoring systems based on the two bands will be covered. The book will introduce possible solutions and design techniques to implement these systems efficiently in the medical environment.

This book covers topics that will be suitable for a broad range of researchers. The book will be a key resource for the Medical ICT (Information and Communication Technology) professionals, bio-medical engineers, graduate, and senior undergraduate students in computer, electrical, electronic, and biomedical engineering disciplines.

All individual chapters are written by leading experts in their fields. Contributions by authors are on various applications of ultra-wideband and the 60 GHz ISM band including circuit implementation, UWB and 60 GHz signal transmission around and in-body, antenna design solution, hardware implementation of body sensors, UWB transceiver design, 60 GHz transceiver design, UWB Radar for contactless respiratory monitoring, and ultra-wideband based medical imaging.

I hope that this book will be a key resource for researchers and students who are working in these emerging areas of wireless technologies. The rapid progress in these wireless systems will play important roles in the future health care and associated areas. Finally, I would like to thank all the authors for their excellent contributions in helping us develop a key book as we enter the era of wireless e-health. I also thank the publisher for delivering a key book in a timely manner.

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