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Contents

Preface

The most recent research efforts in medical therapies and monitoring aim to develop wearable and wireless devices that can help assess patients' health conditions during everyday life. The advantages of these devices are twofold: avoiding patients' hospitalization to reduce the costs for the healthcare systems and improve patients' comfort and providing long-term continuous monitoring of patients' physiological parameters for achieving personalized therapies and preventing potentially life-threatening events. During the last decade, the challenge has been to merge disciplines such as chemistry, biology, engineering, and medicine to produce a new class of smart devices that are capable of managing and monitoring a wide range of cognitive and physical disabilities. Within this research frame, the medical market has started to offer sophisticated medical devices combined with wireless communication capabilities. These systems provide caregivers with new opportunities to access patients' medical data in real time and enhance the possibilities of prompt interventions in case of emergency.

This book tries to cover the most important steps that lead to the development and fabrication of wireless medical devices and some of the most advanced algorithms and data processing in the field. The book chapters will provide readers with an overview and practical examples of some of the latest challenges and solutions for medical needs, electronic design, advanced materials chemistry, wireless body sensors networks, and technologies suitable for wireless medical devices. The book includes practical examples and case studies for readers with different skills, ranging from engineers to medical doctors, chemists, and biologists, who can find new exciting ideas and opportunities for their work.

In the first section, we describe the technological and manufacturing challenges for the development of wireless medical devices. The first two chapters discuss the development and fabrication of electronics and packaging of biochips with emphasis on the readout circuit and microassembly. The other two chapters report on research studies and devices for wireless biomedical sensing.

In the second section, readers are introduced to the techniques and strategies that can optimize the performances of algorithms for medical applications and provide robust results in terms of data reliability. Two chapters are dedicated to practical examples in the field of brain–computer interfaces and artificial pancreas.

We thank all the authors for their contributions to this volume. Finally, we thank the staff of CRC Press, Boca Raton, FL, for their kind help in publishing this book.

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Editors

Pietro Salvo, PhD, earned his MSc degree in electronics engineering and his PhD degree in automation, robotics and bioengineering from the University of Pisa, Italy, in 2004 and 2009, respectively. He was a research associate at the Institute for the Conservation and Promotion of Cultural Heritage, National Council of Research, Florence, Italy, from 2008 to 2009. From 2009 to 2013, he was at the Centre for Microsystems Technology (CMST), Ghent University, Belgium, where he was responsible for the development of sensors, and electronic and microfluidic systems for bioengineering applications. Presently, he is with the Department of Chemistry and Industrial Chemistry, University of Pisa, Italy. His current research activity aims at the development of noninvasive tools and sensors for diagnostics and monitoring in healthcare applications.

Miguel Hernandez-Silveira was born in Caracas, Venezuela, in 1970. He earned his computer science and electronics engineering degree from the Universidad Fermin Toro, Venezuela, in 1996. He joined one of the most prestigious Venezuelan universities situated in the Andes region (UNET) in 1998, where he held lecturer and researcher positions until 2003. He was a member, a cofounder, and the director of the Biomedical Engineering Research Group of this institution. During his time in UNET, Miguel participated in the design and development of different medical devices and technologies for healthcare monitoring involving biomedical circuits, systems, and algorithms. He earned a PhD degree in biomedical engineering from the University of Surrey (Guildford, UK), where he worked in the development of electrode technologies for functional electrical stimulation to assist the gait of patients with upper motor neuron impairments.

Miguel joined Sensium Healthcare Ltd (formerly Toumaz) in 2008, where his main role has been in the development and optimization of DSP and machine learning vital-signs algorithms for ultralow-power Sensium® microchips. He is currently the head of Biomedical Technologies of the Toumaz Group, and together with his team, he actively participates in and coordinates the ongoing development of new intelligent algorithms for wireless healthcare monitoring. Dr. Hernandez-Silveira is also a visiting researcher at Imperial College of London, where he occasionally imparts lectures, supervises postgraduate projects, and participates/contributes in large-scale research projects at the Centre for Bio-inspired Technologies.

His main interests include wireless low-power healthcare systems and smart algorithms for analysis and interpretation of physiological data. Miguel has been either the author or a coauthor of publications in this field.

Krzysztof (Kris) Iniewski is managing R&D at Redlen Technologies Inc., a start-up company in Vancouver, Canada. Redlen's revolutionary production process for advanced semiconductor materials enables a new generation of more accurate, all-digital, radiation-based imaging solutions. Kris is also a founder of ET CMOS Inc. (www.etcmos.com), an organization of high-tech events covering communications,

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