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Hoi-Jun Yoo · Chris van Hoof  
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# Bio-Medical CMOS ICs

 Springer

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# Preface

A major societal challenge for the decades to come will be the delivery of effective medical services while at the same time curbing the growing cost of healthcare. It is expected that new concepts—particularly electronically assisted healthcare will provide an answer. This will include new devices, new medical services as well as networking. On the device side, impressive innovation has been made possible by micro- and nanoelectronics or CMOS Integrated Circuits. Even higher accuracy and smaller form factor combined with reduced cost and increased convenience of use are enabled by incorporation of CMOS IC design in the realization of bio-medical systems. The compact hearing aid devices and current pacemakers are good examples of how CMOS ICs bring about these new functionalities and services in the medical field. Apart from these existing applications, many researchers are trying to develop new bio-medical solutions such as Artificial Retina, Deep Brain Stimulation, and Wearable Healthcare Systems. These are possible by combining the recent advances of bio-medical technology with low power CMOS IC technology.

CMOS IC design alone is a challenging discipline and needs a long-term education to master it. Bio-medical services also require long experience and deep knowledge about the physiology, pathology, as well as the psychology of the patients. Bio-medical CMOS IC is different from other CMOS ICs in that it will be used in very intimate contact with the body with the bio-medical services in mind. Biological effects and interactions related to the specific application should therefore be considered before the chip design and after the chip fabrication. Recently, electronic detection has contributed even to psychological monitoring by sensing stress and emotions through vital-sign monitoring, and this has been enabled by bio-medical IC design. The obvious interdisciplinary nature of bio-medical IC design is very challenging. One of the editors has taught “Bio-Medical IC Design” course to graduate students in KAIST, and feels the necessity of a text book or a good reference book for students explaining the basic principles and current trends of such a wide range of topics in relatively simple and clear terms.

The purpose of this book is therefore to provide the readers with a complete overview of how to design and apply CMOS ICs for bio-medical applications. Even though the importance of CMOS ICs is well-known, there is hardly any literature

devoted to this subject. Many journal papers and lectures at conferences have dealt with the bio-medical ICs, but they were not comprehensive and generally only one circuit or a specific application was covered. This bio-medical IC design book in contrast covers the basic circuits and systems of the current leading-edge researches and products. The editors and the authors have been involved in bio-medical IC design for many years, and have tried to write a book showing how to design bio-medical ICs specifically targeting those readers that have limited experience in CMOS IC design. The book is also suitable for experienced engineers who would like to be introduced to recent trends in bio-medical ICs. For this purpose, we start every chapter with a brief introduction of a basic principle behind the circuits and systems. Also, we tried to write the contents with simple and plain expressions. In addition, where appropriate, most chapters provide a summary of current trends and an overview of the future directions.

This book would not have been possible without intensive help from many people. First of all, we would like to thank all authors for their invaluable contributions. We would like to also thank Prof. Anantha Chandrakasan, the series editor, for his encouragement to write this book, and all members of the Springer team, especially Alex Greene and Ciara Vincent, for their support. Last but not least, we give our sincere thanks to graduate students of Semiconductor Systems Lab of KAIST, IMEC, and the Holst Centre for their help and support during the preparation of the book.

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