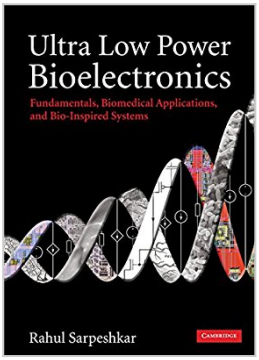

Ultra Low Power Bioelectronics: Fundamentals, Biomedical Applications, and Bio-Inspired Systems

By Rahul Sarpeshkar

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This book provides, for the first time, a broad and deep treatment of the fields of both ultra low power electronics and bioelectronics. It discusses fundamental principles and circuits for ultra low power electronic design and their applications in biomedical systems. It also discusses how ultra-energy-efficient cellular and neural systems in biology can inspire revolutionary low power architectures in mixed-signal and RF electronics. A wealth of insights and examples from cochlear implants, brain implants, systems and synthetic biology, cardiac devices, bio-molecular sensing, and bio-inspired systems, make the book useful and engaging for students and practicing engineers. The book presents a unique, unifying view of ultra low power analog and digital electronics and emphasizes the use of the ultra-energy-efficient subthreshold regime of transistor operation in both. Chapters on batteries, energy harvesting, and the future of energy provide an understanding of fundamental relationships between energy use and energy generation at small scales and at large scales, in biology and in engineering.

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Editorial Review

Review
"This truly interdisciplinary book is about much more than circuits. It contains the most comprehensive and deep treatment I have seen of the interplay and parallels between biology and circuits, and of how one discipline can inform the other. The comparisons between analog, digital, and biological implementations are fundamental and highly valuable. The breadth of the book is unique, ranging from feedback and antennas to battery chemistry." --Yannis Tsividis, Columbia University

"Sarpeshkar's focus on modeling cells as analog rather than digital circuits offers a new approach that will expand the frontiers of synthetic biology. Rahul has nicely laid a foundation that many of us in synthetic biology will be able to build on." --James Collins, Boston University

"Professor Sarpeshkar's textbook from MIT provides an excellent overview of ten key fundamental principles related to ultra low power circuit and system design. Examples of many practical, experimental micro-power systems in cardiac, neural, and other medical-electronics applications make the text highly useful. Practitioners in this field will gain insight from his system-level analysis, which is presented at a level deeper than that found in most texts. In fact, the focus on systems thinking and connections made to a diverse set of problems - natural and man-made, from medical implants, to cells, to low-power cars - truly sets this book apart." --Dr. Tim Denison, Medtronic Fellow

About the Author
Rahul Sarpeshkar leads a research group on Analog Circuits and Biological systems at the Massachusetts Institute of Technology (MIT). This book is based on material from a highly-rated course that Professor Sarpeshkar has taught at MIT on biomedical, bio-inspired, ultra low power, and analog electronic and system design. He has won several awards for his interdisciplinary bioengineering research including the Packard Fellow Award given to outstanding faculty and two teaching awards at MIT. His work was featured by Google Tech Talks as a highlight of the 2011 'Frontiers of Engineering' conference organized by the National Academy of Engineering. His book provides an intuitive and pioneering approach for analyzing and designing both biological and engineering systems via the universal language of analog circuits.

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