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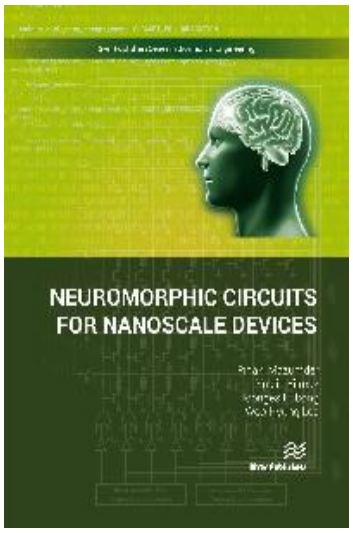
River Publishers Book Catalogue

Series in Biomedical Engineering



River Publishers Series in Biomedical Engineering

Neuromorphic Circuits for Nanoscale Devices

Authors:
Pinaki Mazumder, University of Michigan, Ann Arbor, USA
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Woo Hyung Lee, University of Michigan, Ann Arbor, USA
ISBN: 9788770220606
e-ISBN: 9788770220590
Available From: October 2019
Price: € 95.00

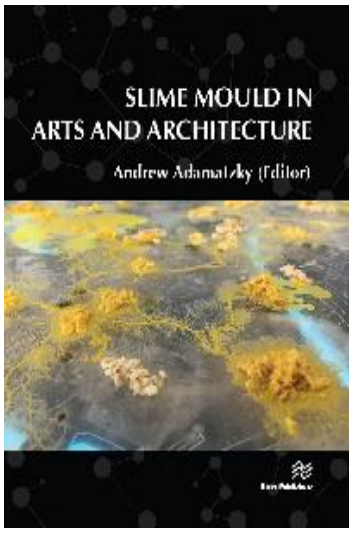
Description:
Nanoscale devices attracted significant research effort from the industry and academia due to their operation principals being based on different physical properties which provide advantages in the design of certain classes of circuits over conventional CMOS transistors.

Neuromorphic Circuits for Nanoscale Devices contains recent research papers presented in various international conferences and journals to provide insight into how the operational principles of the nanoscale devices can be utilized for the design of neuromorphic circuits for various applications of non-volatile memory, neural network training/learning, and image processing.

The topics discussed in the book include:

- Nanoscale Crossbar Memory Design
- Q-Learning and Value Iteration using Nanoscale Devices
- Image Processing and Computer Vision Applications for Nanoscale Devices
- Nanoscale Devices based Cellular Nonlinear/Neural Networks

Keywords: Memristor, Crossbar Memory, Non-volatile Memory, Multi-State Memory Cell, Neuromorphics, Image Processing, Q-Learning, Resonant Tunnelling Diode (RTD), Cellular Neural/Nonlinear Network (CNN), Computer Vision



River Publishers Series in Biomedical Engineering

Slime Mould in Arts and Architecture

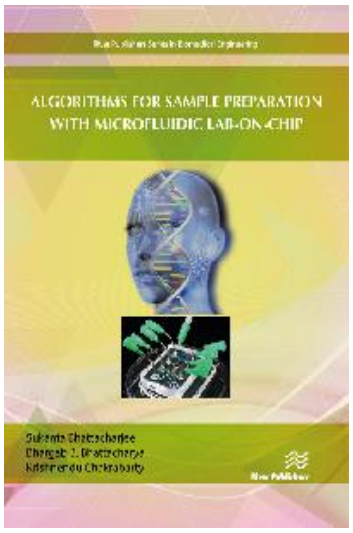
Editor: Andrew Adamatzky, University of the West of England, Bristol, UK
ISBN: 9788770220729
e-ISBN: 9788770220712
Available From: May 2019
Price: € 95.00

Description:
The slime mould Physarum polycephalum was a source of explosive growth of bioengineered hybrid sensing and computing devices in the past decade. Being in its vegetative state, the plasmodium, the slime mould configures its protoplasmic network to optimize its geometry with relation to patterns of attractants and repellents.

The slime mould's adaptability, polymorphism and aestheticism inspired artists and architects. The slime mould has been seen as a self-conscious liquid form continuously changing its shape in response to external stimulation and due to interactions of thousands of micro-oscillators in its body. Elusiveness is a magic feature of the slime mould. One moment the slime mould gives you a solution to a mathematical problem by a shape of its body, next moment it changes its shape and the solution ,disappears.

Slime Mould in Arts and Architecture presents a set of unique chapters written by leading artists, architects and scientists, which resulted from creative translations of the slime mould behaviour into forms and sounds, unconventional investigations and sensorial experiences and the slime mould ability to remove boundaries between living and artificial, solid and fluid, science and arts. The book gives readers unique tools for designing architectural forms and creative works using the slime mould, understanding how pro-cognitive living substrates can be used in everyday life, it sparks new ideas and initiates further progress in many fields or arts, architecture, science and engineering.

Keywords: Arts, architecture, slime mould, arts and science



River Publishers Series in Biomedical Engineering

Algorithms for Sample Preparation with Microfluidic Lab-on-Chip

Authors:
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ISBN: 9788770220552
e-ISBN: 9788770220545
Available From: February 2019
Price: € 95.00

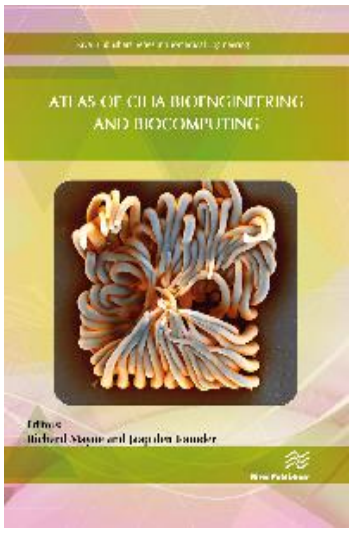
Description:
Recent microfluidic technologies have brought a complete paradigm shift in automating biochemical processing on a tiny lab-on-chip (a.k.a. biochip) that replaces expensive and bulky instruments traditionally used in implementing bench-top laboratory protocols. Biochips have already made a profound impact on various application domains such as clinical diagnostics, DNA analysis, genetic engineering, and drug discovery, among others. They are capable of precisely manipulating micro-/pico-liter quantities of fluids, and provide integrated support for mixing, storage, transportation, and sensing, on-chip. In almost all bioprotocols, sample preparation plays an important role, which includes dilution and mixing of several fluids satisfying certain volumetric ratios. However, designing algorithms that minimize reactant-cost and sample-preparation time suited for microfluidic chips poses a great challenge from the perspective of protocol mapping, scheduling, and physical design.

Algorithms for Sample Preparation with Microfluidic Lab-on-Chip attempts to bridge the widening gap between biologists and engineers by introducing, from the fundamentals, several state-of-the-art computer-aided-design (CAD) algorithms for sample preparation with digital and flow-based microfluidic biochips.

Technical topics discussed in the book include:

- Basics of digital and flow-based microfluidic lab-on-chip
- Comprehensive review of state-of-the-art sample preparation algorithms
- Sample-preparation algorithms for digital microfluidic lab-on-chip
- Sample-preparation algorithms for flow-based microfluidic lab-on-chip

Keywords: Algorithmic Microfluidics, Lab-on-Chip, Sample Preparation, Satisfiability



River Publishers Series in Biomedical Engineering

Atlas of Cilia Bioengineering and Biocomputing

Editors:
Richard Mayne, University of the West of England, UK
Jaap den Toonder, Technische Universiteit Eindhoven, The Netherlands
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e-ISBN: 9788770220033
Available From: September 2018
Price: € 95.00

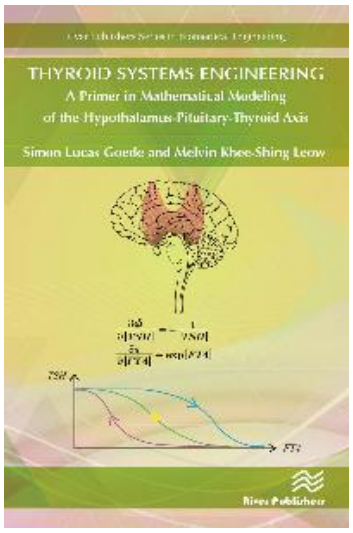
Description:
Cilia are microscopic finger-like cell-surface organelles possessed by a great many eukaryotic organisms, including humans, whose purposes include generating local fluid movements via rhythmic whip-like beating and environmental sensing. Despite intense research efforts since their discovery by van Leeuwenhoek in the 1670's, several key questions regarding ciliary functions, experimental manipulation and in silico imitation remain unanswered. Major justifications for cilia research lie in their involvement in various forms of human disease (ciliopathies) and their ability to instantiate decentralised, asynchronous sensorial-actuation of adjacent matter through modulation of beating characteristics. Further elucidation of these characteristics, which is a problem requiring the combined expertise of mathematicians, computer scientists, engineers and life scientists, will lead to novel biomedical therapies, creation of `smart' actuating surfaces for microfluidics/lab-on-chip applications and a greater understanding of fluid mechanics in real-world scenarios.

This lavishly-illustrated anthology presents recent advances in the fields of ciliary investigation, manipulation, emulation, mimesis and modelling from key researchers in their fields: its goal is to explain the state-of-the-art in cilia bioengineering and bio-computation in a uniquely creative, accessible manner, towards encouraging further transdisciplinary work in the field as well as educating a broad spectrum of scientists and lay people.

The volume is split into three distinct but interwoven themes:

- Biology: Biological preliminaries for the study of cilia; the state-of-the-art in genetic engineering of ciliated cells for biomedical purposes; reprogramming of cilia dynamics in live cells.
- Engineering: Creation of macro cilia robots for object sorting applications; pneumatic cilia for the optimization of fluid motion; electrostatic, magnetic and MEMS cilia for microfluidic mixing; reviews in artificial cilia fabrication, actuation and flow induction methods.
- Numerical and computational modelling. Analyses of thin film cilia for `lab on chip' microfluidic mixing applications; modelling of gel-based artificial cilia towards simulating dynamic behaviors of responsive cilia layers in complex fluids across a wide range of potential applications.

Keywords: Microfluidics, Genetic Engineering, MEMS, Numerical Simulation, Fluid Mechanics, Parallel Actuation, Biocomputing, Unconventional Computing



River Publishers Series in Biomedical Engineering

Thyroid Systems Engineering

A Primer in Mathematical Modeling of the Hypothalamus-Pituitary-Thyroid Axis

Authors:
Simon Goede, Systems Research NL and TU Delft, The Netherlands
Melvin Khee-Shing Leow, Tan Tock Seng Hospital, Yong Loo Lin School of Medicine at the National University of Singapore, and Duke-NUS Medical School, Singapore, and Agency for Science, Technology and Research (A*STAR), Singapore and Nanyang Technological University, Singapore

ISBN: 9788793609594
e-ISBN: 9788793609587
Available From: February 2018

Description:
In recent years, a considerable amount of effort has been devoted, both in industry and academia, towards the behavioral modeling, evaluation and prediction of the hypothalamus pituitary thyroid system.

Thyroid Systems Engineering targets an optimal treatment of people suffering from thyroid hormone disorders. The content is motivated by in-depth observations of such patients whose rich data supported the theoretical framework arising from formal mathematical reasoning, guided by the nature of thyroid physiology. Leveraging on the insights emerging from the unique combination of an electrical engineer working with a clinical thyroidologist, and both being scientists skilled in mathematics, the authors introduce this new discipline and field of scientific investigation aptly designated as Thyroid Systems Engineering.

Readers will discover that mathematics can indeed model the behavior of the hypothalamus-pituitary-thyroid (HPT) axis. Focused on modeling, each of the eighteen chapters gives the reader a notion of the application of relevant mathematics to pertinent issues encountered in mainstream thyroidology. Many cellular processes resemble the flux of variables and states in a complex multi-parameter space through time analogous to current flow in electrical networks. It is then logical to apply the principles and physical laws of electrodynamics, electrical network theory, control systems theory and signal theory to many of the biological phenomena encountered in endocrinology. Such an approach is used liberally throughout the book and successfully yields elegant solutions to a number of models presented within.

This book can serve as a reference to mathematical modeling in other aspects of endocrine physiology, and as the starting point for a fundamental course in medical modeling. It will appeal to postgraduates in electrical engineering, academic physicians and biomedical researchers. Further, readers equipped with advanced calculus, electrical network theory, control theory and signal theory should be able to follow the mathematical expositions that describe thyrotropic control. They represent a new discipline based on mathematical modeling in physiology applicable to medical diagnostics, measurement and treatment to cooperate in the clinical team and realize an optimized treatment for patients.

Keywords: Hypothalamus-pituitary-thyroid system, physiological networks, systems theory, mathematical modeling and analysis, model validation, model parameter identification, thyroid function tests, systems engineering, circadian feedback dynamics.

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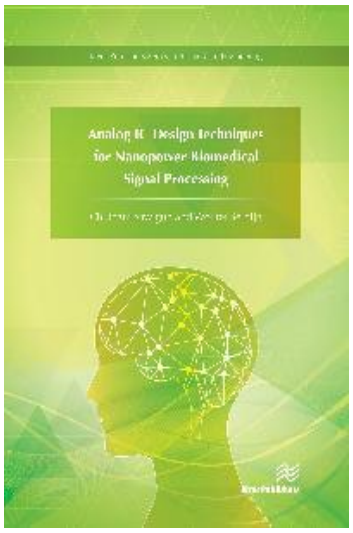

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Analog IC Design Techniques for Nanopower Biomedical Signal Processing

Authors:
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Wouter A. Serdijn, Delft University of Technology, The Netherlands

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e-ISBN: 9788793379282
Available From: May 2016
Price: € 80.00

Description:
As the requirements for low power consumption and very small physical dimensions in portable, wearable and implantable medical devices are calling for integrated circuit design techniques using MOSFETs operating in the subthreshold regime, this book first revisits some well-known circuit techniques that use CMOS devices biased in subthreshold in order to establish nanopower integrated circuit designs. Based on the these findings, this book shows the development of a class-AB current-mode sample-and-hold circuit with an order of magnitude improvement in its figure of merit compared to other state-of-the-art designs. Also, the concepts and design procedures of 1) single-branch filters 2) follower-integrator-based lowpass filters and 3) modular transconductance reduction techniques for very low frequency filters are presented. Finally, to serve the requirement of a very large signal swing in an energy-based action potential detector, a nanopower class-AB current-mode analog multiplier is designed to handle input current amplitudes of more than 10 times the bias current of the multiplier circuit. The invented filter circuits have been fabricated in a standard 0.18 µ CMOS process in order to verify our circuit concepts and design procedures. Their experimental results are reported.

Keywords: Analog integrated circuit, Biomedical electronics, Bionic ear, Bio-potential, CMOS, Current-mode, Cochlear implant, ECG, Filter, Gm-C, Multiplier, Neural recording, Sample-and-hold, Signal processing, Subthreshold, Switched-current, Transconductance reduction, Transconductor, Weak inversion