

DIGITAL MICROFLUIDIC BIOCHIPS

Design Automation and Optimization

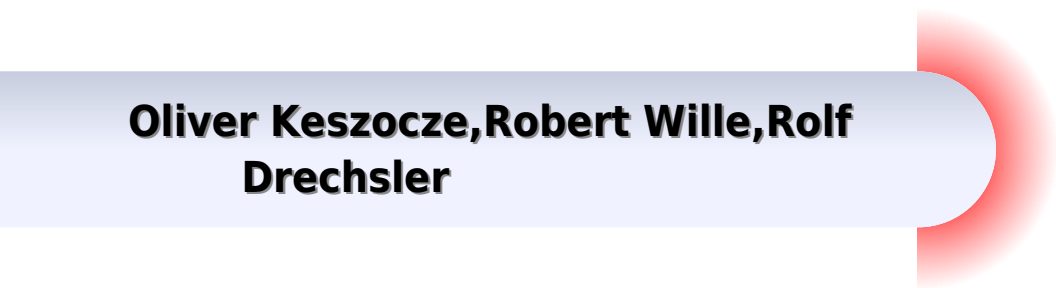
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**Oliver Keszocze, Robert Wille, Rolf
Drechsler**



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Micro-Electrode-Dot-Array Digital Microfluidic Biochips Zipeng Li, Krishnendu Chakrabarty, Tsung-Yi Ho, Chen-Yi Lee, 2018-12-14 This book provides an insightful guide to the design testing and optimization of micro electrode dot array MEDA digital microfluidic biochips The authors focus on the characteristics specific for MEDA biochips e g real time sensing and advanced microfluidic operations like lamination mixing and droplet shape morphing Readers will be enabled to enhance the automated design and use of MEDA and to develop a set of solutions to facilitate the full exploitation of design complexities that are possible with standard CMOS fabrication techniques The book provides the first set of design automation and test techniques for MEDA biochips The methods described in this book have been validated using fabricated MEDA biochips in the laboratory Readers will benefit from an in depth look at the MEDA platform and how to combine microfluidics with software e g applying biomolecular protocols to software controlled and cyberphysical microfluidic biochips

Design Automation Methods and Tools for Microfluidics-Based Biochips Jun Zeng, 2006-11-08 Design Automation Methods and Tools for Microfluidics Based Biochips deals with all aspects of design automation for microfluidics based biochips Experts have contributed chapters on many aspects of biochip design automation Topics covered include device modeling adaptation of bioassays for on chip implementations numerical methods and simulation tools architectural synthesis scheduling and binding of assay operations physical design and module placement fault modeling and testing and reconfiguration methods

Digital Microfluidic Biochips Krishnendu Chakrabarty, Fei Su, 2018-10-03 Digital Microfluidic Biochips focuses on the automated design and production of microfluidic based biochips for large scale bioassays and safety critical applications Bridging areas of electronic design automation with microfluidic biochip research the authors present a system level design automation framework that addresses key issues in the design analysis and testing of digital microfluidic biochips The book describes a new generation of microfluidic biochips with more complex designs that offer dynamic reconfigurability system scalability system integration and defect tolerance Part I describes a unified design methodology that targets design optimization under resource constraints Part II investigates cost effective testing techniques for digital microfluidic biochips that include test resource optimization and fault detection while running normal bioassays Part III

focuses on different reconfiguration based defect tolerance techniques designed to increase the yield and dependability of digital microfluidic biochips Expanding upon results from ongoing research on CAD for biochips at Duke University this book presents new design methodologies that address some of the limitations in current full custom design techniques Digital Microfluidic Biochips is an essential resource for achieving the integration of microfluidic components in the next generation of system on chip and system in package designs Hardware/Software Co-Design and Optimization for Cyberphysical Integration in Digital Microfluidic Biochips Yan Luo,Krishnendu Chakrabarty,Tsung-Yi Ho,2014-08-06 This book describes a comprehensive framework for hardware software co design optimization and use of robust low cost and cyberphysical digital microfluidic systems Readers with a background in electronic design automation will find this book to be a valuable reference for leveraging conventional VLSI CAD techniques for emerging technologies e g biochips or bioMEMS Readers from the circuit system design community will benefit from methods presented to extend design and testing techniques from microelectronics to mixed technology microsystems For readers from the microfluidics domain this book presents a new design and development strategy for cyberphysical microfluidics based biochips suitable for large scale bioassay applications Takes a transformative cyberphysical approach towards achieving closed loop and sensor feedback driven biochip operation under program control Presents a physically aware system reconfiguration technique that uses sensor data at intermediate checkpoints to dynamically reconfigure biochips Enables readers to simplify the structure of biochips while facilitating the general purpose use of digital microfluidic biochips for a wider range of applications *Design and Testing of Digital Microfluidic Biochips* Yang Zhao,Krishnendu Chakrabarty,2012-07-25 This book provides a comprehensive methodology for automated design test and diagnosis and use of robust low cost and manufacturable digital microfluidic systems It focuses on the development of a comprehensive CAD optimization framework for digital microfluidic biochips that unifies different design problems With the increase in system complexity and integration levels biochip designers can utilize the design methods described in this book to evaluate different design alternatives and carry out design space exploration to obtain the best design point **Exact Design of Digital Microfluidic Biochips** Oliver Keszocze,Robert Wille,Rolf Drechsler,2018-06-11 This book presents exact that is minimal solutions to individual steps in the design process for Digital Microfluidic Biochips DMFBs as well as a one pass approach that combines all these steps in a single process All of the approaches discussed are based on a formal model that can easily be extended to cope with further design problems In addition to the exact methods heuristic approaches are provided and the complexity classes of various design problems are determined Presents exact methods to tackle a variety of design problems for Digital Microfluidic Biochips DMFBs Describes an holistic one pass approach solving different design steps all at once Based on a formal model of DMFBs that is easily adaptable to deal with further design tasks *Microfluidic Very Large Scale Integration (VLSI)* Paul Pop,Wajid Hassan Minhass,Jan Madsen,2016-02-08 This book presents the state of the art techniques for the modeling simulation testing

compilation and physical synthesis of mVLSI biochips The authors describe a top down modeling and synthesis methodology for the mVLSI biochips inspired by microelectronics VLSI methodologies They introduce a modeling framework for the components and the biochip architecture and a high level microfluidic protocol language Coverage includes a topology graph based model for the biochip architecture and a sequencing graph to model for biochemical application showing how the application model can be obtained from the protocol language The techniques described facilitate programmability and automation enabling developers in the emerging large biochip market

Optimization of Trustworthy Biomolecular Quantitative Analysis Using Cyber-Physical Microfluidic Platforms Mohamed Ibrahim, Krishnendu

Chakrabarty, 2020-05-31 A microfluidic biochip is an engineered fluidic device that controls the flow of analytes thereby enabling a variety of useful applications According to recent studies the fields that are best set to benefit from the microfluidics technology also known as lab on chip technology include forensic identification clinical chemistry point of care PoC diagnostics and drug discovery The growth in such fields has significantly amplified the impact of microfluidics technology whose market value is forecast to grow from 4 billion in 2017 to 13.2 billion by 2023 The rapid evolution of lab on chip technologies opens up opportunities for new biological or chemical science areas that can be directly facilitated by sensor based microfluidics control For example the digital microfluidics based ePlex system from GenMarkDx enables automated disease diagnosis and can bring syndromic testing near patients everywhere However as the applications of molecular biology grow the adoption of microfluidics in many applications has not grown at the same pace despite the concerted effort of microfluidic systems engineers Recent studies suggest that state of the art design techniques for microfluidics have two major drawbacks that need to be addressed appropriately 1 current lab on chip systems were only optimized as auxiliary components and are only suitable for sample limited analyses therefore their capabilities may not cope with the requirements of contemporary molecular biology applications 2 the integrity of these automated lab on chip systems and their biochemical operations are still an open question since no protection schemes were developed against adversarial contamination or result manipulation attacks Optimization of Trustworthy Biomolecular Quantitative Analysis Using Cyber Physical Microfluidic Platforms provides solutions to these challenges by introducing a new design flow based on the realistic modeling of contemporary molecular biology protocols It also presents a microfluidic security flow that provides a high level of confidence in the integrity of such protocols In summary this book creates a new research field as it bridges the technical skills gap between microfluidic systems and molecular biology protocols but it is viewed from the perspective of an electronic systems engineer

Decoding **Digital Microfluidic Biochips Design Automation And Optimization**: Revealing the Captivating Potential of Verbal Expression

In a time characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its power to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Digital Microfluidic Biochips Design Automation And Optimization**," a mesmerizing literary creation penned by a celebrated wordsmith, readers attempt an enlightening odyssey, unraveling the intricate significance of language and its enduring affect our lives. In this appraisal, we shall explore the book is central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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