

# Modeling Analysis And Optimization Of Process And Energy

This book provides readers with a detailed reference regarding two of the most important long-term reliability and aging effects on nanometer integrated systems, electromigrations (EM) for interconnect and biased temperature instability (BTI) for CMOS devices. The authors discuss in detail recent developments in the modeling, analysis and optimization of the reliability effects from EM and BTI induced failures at the circuit, architecture and system levels of abstraction. Readers will benefit from a focus on topics such as recently developed, physics-based EM modeling, EM modeling for multi-segment wires, new EM-aware power grid analysis, and system level EM-induced reliability optimization and management techniques. Reviews classic Electromigration (EM) models, as well as existing EM failure models and discusses the limitations of those models; Introduces a dynamic EM model to address transient stress evolution, in which wires are stressed under time-varying current flows, and the EM recovery effects. Also includes new, parameterized equivalent DC current based EM models to address the recovery and transient effects; Presents a cross-layer approach to transistor aging modeling, analysis and mitigation, spanning multiple abstraction levels; Equips readers for EM-induced dynamic reliability management and energy or lifetime optimization techniques, for many-core dark silicon microprocessors, embedded systems, lower power many-core processors and datacenters.

Modeling, Analysis and Optimization of Process and Energy Systems John Wiley & Sons

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Modelling, Assessment, and Optimization of Energy Systems provides comprehensive methodologies for the thermal modelling of energy systems based on thermodynamic, exergoeconomic and exergoenvironmental approaches. It provides advanced analytical approaches, assessment criteria and the methodologies to obtain analytical expressions from the experimental data. The concept of single-objective and multi-objective optimization with application to energy systems is provided, along with decision-making tools for multi-objective problems, multi-criteria problems, for simplifying the optimization of large energy systems, and for exergoeconomic improvement integrated with a simulator EIS method. This book provides a comprehensive methodology for modeling, assessment, improvement of any energy system with guidance, and practical examples that provide detailed insights for energy engineering, mechanical engineering, chemical engineering and researchers in the field of analysis and optimization of energy systems. Offers comprehensive analytical tools for the modeling and simulation of energy systems with applications for decision-making tools Provides methodologies to obtain analytical models of energy systems for experimental data Covers decision-making tools in multi-objective problems

As our modern information-age society grows in complexity both in terms of embedded systems and applications, the problems and challenges in reliability become ever more complex. Bringing together many of the leading experts in the field, this volume presents a broad picture of current research on system modeling and optimization in reliability and its applications. The book comprises twenty-three chapters organized into four parts: Reliability Modeling, Software Quality Engineering, Software Reliability, and Maintenance and Inspection Policies. These sections cover a wide range of important topics, including system reliability

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modeling, optimization, software reliability and quality, maintenance theory and inspection, reliability failure analysis, sampling plans and schemes, software development processes and improvement, stochastic process modeling, statistical distributions and analysis, fault-tolerant performance, software measurements and cost effectiveness, queueing theory and applications, system availability, reliability of repairable systems, testing sampling inspection, software capability maturity model, accelerated life modeling, statistical control, and HALT testing.

A large number of mathematical models in many diverse areas of science and engineering have lead to the formulation of optimization problems where the best solution (globally optimal) is needed. Due to the interdisciplinary nature of global optimization, there has been astonishing progress in this field during the last few decades. Many powerful computational algorithms and new theoretical developments have been introduced to solve a spectrum of hard problems in several disciplines. This book covers a small subset of recent important topics in global optimization with emphasis on recent theoretical developments and scientific applications. The chapters are based on the talks presented at the workshop on 'Global Optimization: Methods and Applications' that was held at the Fields Institute from May 11-12, 2007. The target audience includes graduate students in mathematics, engineering, and sciences, academic researchers, as well as practitioners, who use global optimization for their specific needs and applications.

Recent years have seen rapid strides in the level of sophistication of VLSI circuits. On the performance front, there is a vital need for techniques to design fast, low-power chips with minimum area for increasingly complex systems, while on the economic side there is the vastly

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increased pressure of time-to-market. These pressures have made the use of CAD tools mandatory in designing complex systems. Timing Analysis and Optimization of Sequential Circuits describes CAD algorithms for analyzing and optimizing the timing behavior of sequential circuits with special reference to performance parameters such as power and area. A unified approach to performance analysis and optimization of sequential circuits is presented. The state of the art in timing analysis and optimization techniques is described for circuits using edge-triggered or level-sensitive memory elements. Specific emphasis is placed on two methods that are true sequential timing optimizations techniques: retiming and clock skew optimization. Timing Analysis and Optimization of Sequential Circuits covers the following topics: Algorithms for sequential timing analysis Fast algorithms for clock skew optimization and their applications Efficient techniques for retiming large sequential circuits Coupling sequential and combinational optimizations. Timing Analysis and Optimization of Sequential Circuits is written for graduate students, researchers and professionals in the area of CAD for VLSI and VLSI circuit design.

Efficient management of product information is vital for manufacturing enterprises in this information age. Considering the proliferation of product information, tight production schedules, and intense market competition, human intelligence alone cannot meet the requirements of efficient product development. Technologies and tools that support information management are urgently needed. This volume presents the design reuse methodology to support product development. Significant efforts have been made to create an intelligent and optimal design environment by incorporating the contemporary technologies in product family design, artificial intelligence, neural networks, information theories, etc. This volume covers

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both theoretical topics and implementation strategies, with detailed case studies to help readers gain an insight in areas such as product information modeling, information analysis, engineering optimization, production cost estimation, and product performance evaluation. Written by renowned experts in the field, this book assesses the status of groundwater models and defines models and modeling needs in the 21st century. It reviews the state of the art in model development and application in regional groundwater management, unsaturated flow/multiphase flow and transport, island modeling, biological and virus transport, and fracture flow. Both deterministic and stochastic aspects of unsaturated flow and transport are covered. The book also introduces a unique assessment of models as analysis and management tools for groundwater resources. Topics covered include model vs. data uncertainty, accuracy of the dispersion/convection equation, protocols for model testing and validation, post-audit studies, and applying models to karst aquifers.

Reviews state-of-the-art technologies in modern heuristic optimization techniques and presents case studies showing how they have been applied in complex power and energy systems problems. Written by a team of international experts, this book describes the use of metaheuristic applications in the analysis and design of electric power systems. This includes a discussion of optimum energy and commitment of generation (nonrenewable & renewable) and load resources during day-to-day operations and control activities in regulated and competitive market structures, along with transmission and distribution systems. Applications of Modern Heuristic Optimization Methods in Power and Energy Systems begins with an introduction and overview of applications in power and energy systems before moving on to planning and operation, control, and distribution. Further chapters cover the integration of renewable energy

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and the smart grid and electricity markets. The book finishes with final conclusions drawn by the editors. Applications of Modern Heuristic Optimization Methods in Power and Energy Systems: Explains the application of differential evolution in electric power systems' active power multi-objective optimal dispatch Includes studies of optimization and stability in load frequency control in modern power systems Describes optimal compliance of reactive power requirements in near-shore wind power plants Features contributions from noted experts in the field Ideal for power and energy systems designers, planners, operators, and consultants, Applications of Modern Heuristic Optimization Methods in Power and Energy Systems will also benefit engineers, software developers, researchers, academics, and students.

Energy costs impact the profitability of virtually all industrial processes. Stressing how plants use power, and how that power is actually generated, this book provides a clear and simple way to understand the energy usage in various processes, as well as methods for optimizing these processes using practical hands-on simulations and a unique approach that details solved problems utilizing actual plant data. Invaluable information offers a complete energy-saving approach essential for both the chemical and mechanical engineering curricula, as well as for practicing engineers.

Sequential Analysis: Hypothesis Testing and Change-point Detection systematically develops the theory of sequential hypothesis testing and quickest change-point detection. It also describes important applications in which theoretical results can be used efficiently. The book reviews recent accomplishments in hypothesis testing and change-point detection both in

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decision-theoretic (Bayesian) and non-decision-theoretic (non-Bayesian) contexts. The authors not only emphasize traditional binary hypotheses but also substantially more difficult multiple decision problems. They address scenarios with simple hypotheses and more realistic cases of two and finitely many composite hypotheses. The book primarily focuses on practical discrete-time models, with certain continuous-time models also examined when general results can be obtained very similarly in both cases. It treats both conventional i.i.d. and general non-i.i.d. stochastic models in detail, including Markov, hidden Markov, state-space, regression, and autoregression models. Rigorous proofs are given for the most important results. Written by leading authorities in the field, this book covers the theoretical developments and applications of sequential hypothesis testing and sequential quickest changepoint detection in a wide range of engineering and environmental domains. It explains how the theoretical aspects influence the hypothesis testing and changepoint detection problems as well as the design of algorithms.

This document contains the proceedings of the Air Force/NASA Workshop on Modeling, Analysis, and Optimization Issues for Large Space Structures held in Williamsburg, Virginia, May 13-14 1982. The theme of the workshop was modeling, analysis, and optimization of large space structures, including structure

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control interaction. Speakers were drawn primarily from industry, with participation from universities and government. The workshop was organized into three sessions: mathematical modeling, analysis methodology, and optimization for controllability. Results of the workshop were discussed in a final session. The workshop presentations ranged over many topics in large space structures, including structure-control interaction, structural and structural dynamics modeling, thermal analysis, testing, design, and optimization. The interdisciplinary area of structure-control interaction, which is a challenge to analysts, designers, and test engineers, was clearly emphasized. Not addressed in the workshop was the important subject of structural deployment.

Asynchronous circuits provide efficient solutions for many of the recent nanometric technologies, although the lack of analysis and optimization tools has limited the commercial spread of this technology. This book helps readers to understand the difficulties of modeling and analyzing asynchronous circuits. A new modeling methodology is introduced; it is used to build Asynchronous Static Timing Analysis (ASTA) and Asynchronous Statistical Static Timing Analysis (ASSTA). These fast and accurate methods are used to optimize the circuit speed against its hardware size. In addition, the book investigates the handshaking protocol effect on different asynchronous circuit performance



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metrics (speed, power consumption, EMI and robustness against process variability). The book is accompanied by AHMOSE (Asynchronous High-speed Modeling and Optimization Tool-set), a demonstrative software, which provides to the user a better understanding and usage of the explained methods.

In packet communication systems, a header is attached to the transmitted packet at each layer. The overhead due to the transmission of the individual header can have a significant impact on the performance of the communication system especially when the system operates in heavy load. In order to increase data throughput, a number of packets sharing a single header can be aggregated into a frame. In this dissertation, we present a mathematical model for a packet aggregation system assuming a general distribution for the packet length. For a given header size, we obtain the minimum system utilization where packet aggregation improves the system performance. We also analyze the asymptotic behavior of such systems leading to a simple heuristic policy on the optimum aggregation level. It is shown that the impact of the variability of the packet length distribution on different system performance measures is rather insignificant when the system load is low or moderate. In many applications, it would be necessary or desirable to group together a number of demands before it is worthwhile to allocate system resources to serve them. In the second part of this

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dissertation, we propose to use a threshold-based timer which dynamically controls the size of the batches and their release times. A complete characterization and a clear understanding of the stochastic characteristics of the timer behavior and its departure processes are presented. Such processes are inherently "friendlier" than their classical counterparts due to the positive correlation between the size of the released batches and the time interval between them. In traditional batch arrival models, such a dependency is absent. We examine the departure process of the timer by analyzing its queue response and the peakedness.

This latest Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) will again form the standard reference for all those concerned with climate change and its consequences, including students, researchers and policy makers in environmental science, meteorology, climatology, biology, ecology, atmospheric chemistry and environmental policy.

The book focuses on the modeling, analysis and optimization of Automatic Retransmission reQuest (ARQ) protocols as part of a wireless communications system. The work considers systems in increasing complexity and is divided into two parts. The first considers single link communications while the second investigates point-to-multipoint systems and wireless networks. The first part

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provides a thorough discussion on performance measures in ARQ communications. A definition for reliable protocols and conditions to achieve this are provided. In case that, due to delay constraints, reliability cannot be guaranteed, conditions for the optimal truncation of the ARQ chain are derived, considering both ARQ protocols in isolation as well as at the server of a single queue. The second part investigates power control policies to maximize the amount of data being transferred at the downlink of a cellular communications system as well as at a network with per hop retransmissions, taking interference between nodes into account. The stability regions of such systems is explicitly provided, while algorithms that can achieve this are provided and their performance is analyzed.

Now in its Third Edition, *Alternative Energy Systems: Design and Analysis with Induction Generators* has been renamed *Modeling and Analysis with Induction Generators* to convey the book's primary objective—to present the fundamentals of and latest advances in the modeling and analysis of induction generators. New to the Third Edition Revised equations and mathematical modeling Addition of solved problems as well as suggested problems at the end of each chapter New modeling and simulation cases Mathematical modeling of the Magnus turbine to be used with induction generators Detailed comparison between the induction

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generators and their competitors Modeling and Analysis with Induction Generators, Third Edition aids in understanding the process of self-excitation, numerical analysis of stand-alone and multiple induction generators, requirements for optimized laboratory experimentation, application of modern vector control, optimization of power transference, use of doubly fed induction generators, computer-based simulations, and social and economic impacts. An essential resource for optimizing energy systems to enhance design capability, performance and sustainability Optimization of Energy Systems comprehensively describes the thermodynamic modelling, analysis and optimization of numerous types of energy systems in various applications. It provides a new understanding of the system and the process of defining proper objective functions for determination of the most suitable design parameters for achieving enhanced efficiency, cost effectiveness and sustainability. Beginning with a general summary of thermodynamics, optimization techniques and optimization methods for thermal components, the book goes on to describe how to determine the most appropriate design parameters for more complex energy systems using various optimization methods. The results of each chapter provide potential tools for design, analysis, performance improvement, and greenhouse gas emissions reduction. Key features: Comprehensive coverage of the

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modelling, analysis and optimization of many energy systems for a variety of applications. Examples, practical applications and case studies to put theory into practice. Study problems at the end of each chapter that foster critical thinking and skill development. Written in an easy-to-follow style, starting with simple systems and moving to advanced energy systems and their complexities. A unique resource for understanding cutting-edge research in the thermodynamic analysis and optimization of a wide range of energy systems, Optimization of Energy Systems is suitable for graduate and senior undergraduate students, researchers, engineers, practitioners, and scientists in the area of energy systems.

Traditionally, design space exploration for Systems-on-Chip (SoCs) has focused on the computational aspects of the problem at hand. However, as the number of components on a single chip and their performance continue to increase, the communication architecture plays a major role in the area, performance and energy consumption of the overall system. As a result, a shift from computation-based to communication-based design becomes mandatory. Towards this end, network-on-chip (NoC) communication architectures have emerged recently as a promising alternative to classical bus and point-to-point communication architectures. In this dissertation, we study outstanding research problems

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related to modeling, analysis and optimization of NoC communication architectures. More precisely, we present novel design methodologies, software tools and FPGA prototypes to aid the design of application-specific NoCs. This book introduces the state-of-the-art in research in parallel and distributed embedded systems, which have been enabled by developments in silicon technology, micro-electro-mechanical systems (MEMS), wireless communications, computer networking, and digital electronics. These systems have diverse applications in domains including military and defense, medical, automotive, and unmanned autonomous vehicles. The emphasis of the book is on the modeling and optimization of emerging parallel and distributed embedded systems in relation to the three key design metrics of performance, power and dependability. Key features: Includes an embedded wireless sensor networks case study to help illustrate the modeling and optimization of distributed embedded systems. Provides an analysis of multi-core/many-core based embedded systems to explain the modeling and optimization of parallel embedded systems. Features an application metrics estimation model; Markov modeling for fault tolerance and analysis; and queueing theoretic modeling for performance evaluation. Discusses optimization approaches for distributed wireless sensor networks; high-performance and energy-efficient techniques at

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the architecture, middleware and software levels for parallel multicore-based embedded systems; and dynamic optimization methodologies. Highlights research challenges and future research directions. The book is primarily aimed at researchers in embedded systems; however, it will also serve as an invaluable reference to senior undergraduate and graduate students with an interest in embedded systems research.

Spotlighting the field of Multidisciplinary Design Optimization (MDO), this book illustrates and implements state-of-the-art methodologies within the complex process of aerospace system design under uncertainties. The book provides approaches to integrating a multitude of components and constraints with the ultimate goal of reducing design cycles. Insights on a vast assortment of problems are provided, including discipline modeling, sensitivity analysis, uncertainty propagation, reliability analysis, and global multidisciplinary optimization. The extensive range of topics covered include areas of current open research. This Work is destined to become a fundamental reference for aerospace systems engineers, researchers, as well as for practitioners and engineers working in areas of optimization and uncertainty. Part I is largely comprised of fundamentals. Part II presents methodologies for single discipline problems with a review of existing uncertainty propagation, reliability analysis, and optimization techniques. Part III is dedicated to the uncertainty-based MDO and related issues. Part IV deals with three MDO related issues: the multifidelity, the multi-objective optimization and the mixed continuous/discrete optimization and Part V is devoted to test cases for aerospace vehicle design.

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Energy Storage in Energy Markets reviews the modeling, design, analysis, optimization and impact of energy storage systems in energy markets in a way that is ideal for an audience of researchers and practitioners. The book provides deep insights on potential benefits and revenues, economic evaluation, investment challenges, risk analysis, technical requirements, and the impacts of energy storage integration. Heavily referenced and easily accessible to policymakers, developers, engineer, researchers and students alike, this comprehensive resource aims to fill the gap in the role of energy storage in pool/local energy/ancillary service markets and other multi-market commerce. Chapters elaborate on energy market fundamentals, operations, energy storage fundamentals, components, and the role and impact of storage systems on energy systems from different aspects, such as environmental, technical and economics, the role of storage devices in uncertainty handling in energy systems and their contributions in resiliency and reliability improvement. Provides integrated techno-economic analysis of energy storage systems and the energy markets Reviews impacts of electric vehicles as moving energy storage and loads on the electricity market Analyzes the role and impact of energy storage systems in the energy, ancillary, reserve and regulatory multi-market business Applies advanced methods to the economic integration of large-scale energy storage systems Develops an evaluation framework for energy market storage systems Discover the latest research results for both uncoded and coded caching techniques in future wireless network design.

In general, several mathematical models can be designed in order to describe a biological or medical process and there is no unique criterion which model gives the best description. This book presents several of these models and shows applications of them to different biological



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and medical problems. The book shows that operations research expertise is necessary in respect to modeling, analysis and optimization of biosystems.

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