Performance Modeling, Analysis and Optimization for Asynchronous Circuits: Static and Statistical Analysis Approaches

For sound transmission control inside a duct, acoustic silencers are considered whose modeling is systematically tackled by the proposed numerical tools. Reactive silencers with rigid internal partitions are studied for their parametric influences and noise attenuation mechanisms. With the introduction of MPPs as dissipative elements, a unit cell treatment is proposed to model the complex side-branch configuration, and investigations reveal the hybrid attenuation mechanism of such device, which combines the reflection and absorption effects. Benefiting from the modular nature of the sub-structuring approach, the size of the perforated hole and the perforation ratio can be optimized to strike a balance between the dissipative and reactive effect, for ultimately achieving a desired Transmission Loss (TL) within a prescribed frequency range. The calculation accuracy for both reactive and hybrid MPP silencers using the proposed approach have been confirmed with finite element method (FEM) simulations and experiments. For the tuning and optimization of a silencer, the broadband TL performance realized by a number of cascade-connected sub-chambers is investigated. A theoretical basis for the description of the overall system TL is presented. The characteristics of the sub-chambers, along with the understandings of influences of the parameters, provide guidelines for their optimizations, and a desired broadband performance is achieved by connecting sub-chambers with optimized TLs to tackle different frequency regions. Based on the sub-chamber strategy, a multi-level approach for the design, analysis and optimization of acoustic silencers with cascaded sub-chambers is proposed. Through numerical case studies
and a retrofitted design of a mining truck muffler, the effectiveness of the proposed methodology is demonstrated, which greatly reduces the design variables and computational costs compared with global design and optimization.

**Preventive Maintenance of Safety-related Systems - Modeling, Analysis, and Optimization**

**Modelling, Analysis and Optimization of Biosystems**

**Cyber-physical Modeling, Analysis, and Optimization**

**Performance Modeling, Analysis, and Optimization of Self-organized Packet Radio Ad Hoc Networks with Cellular Overlay**

Statistical Signal Processing for Wireless Networks Groundwater is considered the major source of domestic water supply in many countries worldwide. In the absence of surface water supplies, the use of groundwater for domestic, agricultural, and even for industrial purposes becomes essential, especially in rural communities. Groundwater supplies typically are of good quality, and the quality is reasonably uniform throughout the year compared to that of surface water, thus making it suitable for direct use, or simple to treat. A disadvantage of groundwater is the content of dissolved salt as many have a moderate-to-high salinity. The high salinity makes water brackish and thus it requires desalination before use. This has led to wide use of groundwater desalination to produce good-quality water in many regions around the world. Nevertheless, a problem of desalination processes is the generation of a concentrate stream, sometimes called brine or reject, which must be properly managed. The management of brine from brackish groundwater desalination is a significant issue if located far from the coast (i.e. inland plants) or far from public channel to discharge such brine. Some options for brine disposal from inland desalination plants are evaporation ponds, deep-well injection, disposal to municipal sewers, and irrigation of plants tolerant to high salinities. Each of these disposal methods may result in many environmental problems such as groundwater contamination, the decline in crop yields from agricultural lands, the formation of eyesores, decreasing the efficiency of biological wastewater treatment, and making treated sewage effluent unsuitable for irrigation. As a result, the brine management from inland desalination of brackish groundwater is very critical, and the need for affordable and environmentally benign inland desalination has become crucial in many regions worldwide. This work aims to develop an efficient and environmentally benign process for inland desalination of brackish groundwater, which approaches zero liquid discharge (ZLD), maximizing the water produced and minimizing the volume of concentrate effluent. The technical approach involves utilization of two-stage reverse osmosis (RO) units with the intermediate chemical treatment of brine stream that is designed to remove most of the scale-forming constituents, which foul membrane surface in RO and limits its water recovery and hence enable further recovery of water in the secondary RO unit. The treatment process proposed in this work is based on advanced lime softening processes, which have the ability to effectively remove scale-forming constituents, in addition to heavy metals and natural organic matters that might be present in the brine. The process has been applied to the brine produced from 1st stage RO i.e. primary brine stream, to minimize the volume of the stream to be treated chemically, which in turn reduces the capacity of the treatment equipment. Analysis of groundwater quality and scale-forming constituents that are present in the brine stream upon desalination of groundwater has been performed. The analysis has revealed that in most cases of brackish groundwater desalination the recovery is limited by scaling due to calcium sulfate i.e. gypsum, and amorphous silica. Thus, the main objective set for the chemical treatment of the brine stream focused on removal of calcium, sulfate, and silica. Advanced lime softening based on high lime doses along with sodium aluminate, as in ultra-high lime with alumina UHLA process, has been proposed for chemical treatment of brine. Bench-scale experiments conducted to evaluate the effectiveness of the proposed chemical treatment for removal of scale-forming constituents, particularly calcium, sulfate, and silica by studying the different factors affecting the removals efficiency from synthetic solutions containing sulfate-only, silica-only, and model brine solution. The results obtained have revealed that the proposed process was very effective and results generally in high and quick removals of calcium, sulfate, and silica of more than 80% within 2 hrs under different experimental
conditions. In addition, beneficial uses of different solid byproducts formed are investigated, by analyzing the solids resulted to qualitatively and quantitatively to identify the different solids present. This offers the potential to lower both costs and solid disposal problems of solids formed being considered as added value product rather than solid waste that has to be properly managed. Results have shown that the solid precipitate contains a wide range of solids that generally composed of calcium, magnesium, aluminum along with carbonate, sulfate, and silicate, which have several potential applications as soil sub-grade, and in cement industry. Equilibrium model to simulate the chemical treatment process that is able to predict the required chemical reagents doses, effluent water quality for a given influent water quality and treatment levels has been developed utilizing OLI stream analyzer, the developed model was found to well predict the performance of the chemical treatment at equilibrium conditions. Rigorous membrane separation model has developed in Aspen Custom Modeler to more accurately model RO desalination, which is to be combined with the developed equilibrium model to formulate a complete 1st Stage RO-Chemical Treatment-2nd Stage RO process model. The developed complete and validated model has been then used to fully and accurately simulate the performance of the proposed Zero Liquid Discharge desalination process. The present work results in three novel achievements: first, introducing a very effective intermediate chemical treatment, which efficiently remove sulfate, particularly from brine. Most of the previously proposed intermediate treatment processes remove sulfate as calcium sulfate i.e. gypsum, however in the introduced process, sulfate is removed in calcium-aluminum-sulfate complexes, which has very low solubility, making the brine highly undersaturated with respect to gypsum, and hence lowering the fouling propensity in the secondary RO, leading to maximizing the overall recovery. In addition, the chemical treatment has been successfully modeled for better simulate of its performance for different brine qualities, which are usually encountered in brackish ground desalination due to the high location-specific nature of groundwater quality. Second, the developed membrane model has treated the species present in water as ions, accounting for monovalent and divalent ions separately, and obtaining a different permeability coefficient for their transport through the membrane. This is different from most developed RO models, which simplify the transport through the membranes to only water and salt permeability coefficients. This treatment results in better and more refined modeling and simulation of the RO membrane separation, as the RO membrane interact differently to ions present in water. Third, the complete process model, results from combining the developed equilibrium model of the chemical treatment, and membrane separation model, has revealed very promising results of achieving high recovery desalination of about 93.5% suitable for drinking water purposes, which is higher by about 90% than most of the reported literature, whose result in reducing the brine volume from 25% in conventional desalination to only 6.5% in the proposed process, i.e. brine volume reduction of 74% relative to conventional inland desalination, and 35% relative to other high recovery processes, at reasonable chemical treatment levels.

Modeling, Analysis, and Optimization Issues for Large Space Structures Methanol synthesis has been the subject of many improvements over the last decades since it became more cost effective and scalable than earlier high pressure technology. The synthesis of methanol from syngas has conventionally been carried out in adiabatic quench-type reactor in the gas phase where the only way to moderate the temperature is to inject shots of syngas at various position of the reactor. However, because of the highly exothermic behavior of methanol synthesis reactions, the dissipation of heat has been a bottle-neck in the reactor design, and reactor configurations have a tendency to be complicated. This dissertation is divided into three parts presents a mathematical model of double-tube methanol reactor which was developed through cooperation between Mitsubishi Heavy Industries (MHI) and Mitsubishi Gas Company (MGC), methanol synthesis process flowsheet was developed and fully integrated with the Genetic Algorithms that generated a set of optimal operating conditions with respect to upper and lower limits and several constraints, and a dynamic optimization approaches to derive the ideal operating conditions for a Lurgi type reactor in the presence of catalyst deactivation. This study proposes a new approach based on a hybrid algorithm combining genetic algorithm (GA) and generalized pattern search (GPS) derivative-free methodologies to provide a sufficiently good solution to this dynamic optimization problem. The hybrid GA-GPS algorithm has the advantage of sequentially combining GA and GPS logics; while GA, as the most popular evolutionary algorithm, effectively explore the landscape of the fitness function and identify promising areas of the search space, GPS efficiently search existing basins in order to find an approximately optimal solution. The simulation results showed that implementing the shell temperature trajectory derived by the proposed approach with 5% recycle ratio of CO2
increased the production of methanol by approximately 2.5% compared to the existing operating conditions.

Modeling, Analysis and Optimization of the Gas-phase Methanol Synthesis Process

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 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.

Design Reuse in Product Development Modeling, Analysis and Optimization

Modeling, Analysis, and Optimization Issues for Large Space Structures 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 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.

Long-Term Reliability of Nanometer VLSI Systems 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.

Modeling, Analysis and Optimization of a Scissors Linkage Seat Suspension 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.
Reliability Modeling, Analysis and Optimization 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 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.

Preventive Maintenance of Safety-related Systems - Modeling, Analysis, and Optimization 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 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.

Modeling, Analysis and Optimization of Flourescenated Antibody Based Imaging

Modeling, Analysis and Optimization of Process and Energy Systems


Modeling, Analysis and Optimization of Network-on-Chip Communication Architectures Discover the latest research results for both uncoded and coded caching techniques in future wireless network design.

Modeling, Analysis, and Optimization of Mechanical Tolerances in Design and Manufacturing Using Fuzzy and Interval Methods

Wireless Edge Caching 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 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.

**Modeling, Analysis and Optimization in Parameter Design**

This dissertation presents improvements to the modeling and efficient execution of scientific workflows. Many scientific workflow systems have been developed to solve a specific problem well, but many fail to address needs of a broader group of scientists. While there may never be a system that can satisfy all needs completely, a better balance between diverging design goals can be found. To this end, this work identifies a number of desiderata that occur in the design of a scientific workflow system and discusses to which degree they are addressed in current scientific workflow systems. A selection of systems is presented in detail and strengths and weaknesses with respect to the desiderata are described. From this discussion, beneficial characteristics, properties and implementation details of scientific workflow systems are derived, yielding a proposal for an improved scientific workflow system. Recently, the declarative database language Datalog gained popularity in research and was used in workflow-oriented projects. Therefore, the use of Datalog as (i) a workflow description language and (ii) as a tool for implementing components is investigated. Different and novel approaches to understand, visualize and profile the evaluation of a Datalog program are developed and demonstrated. Finally, new techniques for capturing and employing data and workflow provenance are developed. For example, provenance information is used to understand and debug database queries and workflow execution traces, or to more efficiently resume workflow execution after parameter changes or even system crashes. Provenance is critical for scientists using workflow systems and is therefore studied extensively. This dissertation presents an overview of current research topics in the field of provenance and some methods used to analyze provenance data using Datalog. When Datalog is used as a workflow description language, provenance of data has to be defined and available. Conversely, research in the field of database systems and Datalog can be extended to scientific workflow systems, for example to capture and analyze provenance. A new game-theoretic notion of provenance is presented that yields a detailed visual description of Why/How provenance for facts but also provide answers to Why-Not questions for missing facts in the result. A novel modification of the provenance game construction is sketched that removes dependencies on the active domain from the provenance explanations. Returning to classical workflow systems, some approaches to model and automate scientific problem solving are studied and discussed. This ultimately leads to the definition of a new scientific workflow system that is based on existing concepts that were identified as beneficial earlier but strives to improve on weaknesses identified in the presented case studies. Finally, a new method to improve fault tolerance of a scientific workflow system, which demonstrates all technologies discussed, is presented. Provenance of the workflow execution is analyzed, for example using Datalog, and used to speed up recovery of the workflow execution after a failure.
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.

**Modeling, Analysis, and Optimization for Wireless Networks in the Presence of Heavy Tails**

System-level Modeling, Analysis and Optimization of DRAM Memories and Controller Architectures

Modelling, Analysis and Optimization of Data-driven Scientific Workflows

Modelling, Analysis and Optimization of Biosystems The heavy-tailed traffic from wireless users, caused by the emerging Internet and multimedia applications, induces extremely dynamic and variable network environment, which can fundamentally change the way in which wireless networks are conceived, designed, and operated. This thesis is concerned with modeling, analysis, and optimization of wireless networks in the presence of heavy tails. First, a novel traffic model is proposed, which captures the inherent relationship between the traffic dynamics and the joint effects of the mobility variability of network users and the spatial correlation in their observed physical phenomenon. Next, the asymptotic delay distribution of wireless users is analyzed under different traffic patterns and spectrum conditions, which reveals the critical conditions under which wireless users can experience heavy-tailed delay with significantly degraded QoS performance. Based on the delay analysis, the fundamental impact of heavy-tailed environment on network stability is studied. Specifically, a new network stability criterion, namely moment stability, is introduced to better characterize the QoS performance in the heavy-tailed environment. Accordingly, a throughput-optimal scheduling algorithm is proposed to maximize network throughput while guaranteeing moment stability. Furthermore, the impact of heavy-tailed spectrum on network connectivity is investigated. Towards this, the necessary conditions on the existence of delay-bounded connectivity are derived. To enhance network connectivity, the mobility-assisted data forwarding scheme is exploited, whose important design parameters, such as critical mobility radius, are derived. Moreover, the latency in wireless mobile networks is analyzed, which exhibits asymptotic linearity in the initial distance between mobile users.

**Numerical Modeling, Analysis and Optimization in Engineering**

Modelling, Analysis and Optimization of Automotive Networks 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 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 are explicitly provided, while algorithms that can achieve this are provided and their performance is analyzed.

**Modeling, Analysis, Optimization and Decision Making in Engineering Curricula** 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 and medical problems. The book shows that operations research expertise is necessary in respect to modeling, analysis and optimization of biosystems.
Modeling, Analysis and Optimization of Integrated Energy Systems for Multigeneration Purposes

Many physical and engineered systems (e.g., smart grid, transportation and biomedical systems) are increasingly being monitored and controlled over a communication network. These systems where sensing, communication, computation and real time control are closely integrated are referred to as cyber physical systems (CPS). Cyber physical systems present a plethora of challenges related to their design, analysis, optimization and control. In this dissertation, we present some fundamental methodologies to analyze the optimization of physical systems over a communication network. Specifically, we consider a medium voltage DC shipboard smart grid (SSG) reconfiguration problem as a test case to demonstrate our approach. The main goal of SSG reconfiguration is to change the topology of the physical power system by switching circuit breakers, switches, and other devices in the system in order to route power effectively to loads especially in the event of faults/failures. A majority of the prior work has focused on centralized approaches to optimize the switch configuration to maximize specific objectives. These methods are prohibitively complex and not suited for agile reconfiguration in mission critical situations. Decentralized solutions proposed do reduce complexity and implementation time at the cost of optimality. Unfortunately, none of the prior efforts in this arena address the cyber physical aspects of an SSG. This dissertation aims to bridge this gap by proposing a suite of methods to analyze both centralized and decentralized SSG reconfigurations that incorporate the effect of the underlying cyber infrastructure. The SSG reconfiguration problem is a mixed integer non convex optimization problem for which branch and bound based solutions have been proposed earlier. Here, optimal reconfiguration strategies prioritize the power delivered to vital loads over semi-vital and non vital loads.

In this work, we propose a convex approximation to the original non convex problem that significantly reduces complexity of the SSG reconfiguration. Tradeoff between power delivered and number of switching operations after reconfiguration is discussed at steady state. Second, the distribution of end-to-end delay associated with fault diagnosis and reconfiguration in SSG is investigated from a cyber-physical system perspective. Specifically, a cross-layer total (end-to-end) delay analysis framework is introduced for SSG reconfiguration. The proposed framework stochastically models the heterogeneity of actions of various sub-systems viz., the reconfiguration of power systems, generation of fault information by sensor nodes associated to the power system, processing actions at control center to resolve fault locations and reconfiguration, and information flow through communication network to: (1) analyze the distribution of total delay in SSG reconfiguration after the occurrence of faults; and (2) propose design options for real-time reconfiguration solutions for shipboard CPS, that meet total delay requirements. Finally, the dissertation focuses on the quality of SSG reconfiguration solution with incomplete knowledge of the overall system state, and communication costs that may affect the quality (optimality) of the resulting reconfiguration. A dual decomposition based decentralized optimization in which the shipboard system is decomposed into multiple separable subsystems with agents is proposed. Specifically, agents monitoring each subsystem solve a local concave dual function of the original objective while neighboring agents share information over a communication network to obtain a global solution. The convergence of the proposed approach under varying network delays and quantization noise is analyzed and comparisons with centralized approaches are presented. Results demonstrate the effectiveness as well as tradeoffs involved in centralized and decentralized SSG reconfiguration approaches.

Design Reuse in Product Development Modeling, Analysis and Optimization

Driver Modeling

Development, Modeling, Analysis, and Optimization of a Novel Inland Desalination with Zero Liquid Discharge for Brackish Groundwaters

Modeling, Analysis, and Optimization of Complex Vibroacoustic Systems with Micro-perforates

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 and medical problems. The book shows that operations research expertise is necessary in respect to modeling, analysis and optimization of biosystems.
Modeling, Analysis and Optimization of Network-on-Chip Communication Architectures

Modeling, Analysis, and Optimization of Aggregation Systems

Copyright code: 24e37ddb7c3b2bcbb25bbfaf2286feaf