3d Flash Memories Springer

This book describes the life cycle process of IP cores, from specification to production, including IP modeling, verification, optimization, and protection. Various trade-offs in the design process are discussed, including those associated with many of the most common memory cores, controller IPs and system-on-chip (SoC) buses. Readers will also benefit from the author's practical coverage of new verification methodologies. such as bug localization, UVM, and scan-chain. A SoC case study is presented to compare traditional verification with the new verification methodologies. Discusses the entire life cycle process of IP cores, from specification to production, including IP modeling, verification, optimization, and protection; Introduce a deep introduction for Verilog for both implementation and verification point of view. Demonstrates how to use IP in applications such as memory controllers and SoC buses. Describes a new verification methodology called bug localization; Presents a novel scan-chain methodology for RTL debugging; Enables readers to employ UVM methodology in straightforward, practical terms.
Algorithms that have to process large data sets have to take into account that the cost of memory access depends on where the data is stored. Traditional

algorithm design is based on the von Neumann model where accesses to memory have uniform cost. Actual machines increasingly deviate from this model: while waiting for memory access, nowadays, microprocessors can in principle execute 1000 additions of registers; for hard disk access this factor can reach six orders of magnitude. The 16 coherent chapters in this monograph-like tutorial book introduce and survey algorithmic techniques used to achieve high performance on memory hierarchies; emphasis is placed on methods interesting from a theoretical as well as important from a practical point of view.

This book covers in detail the various aspects of joining materials to form parts. A conceptual overview of rapid prototyping and layered manufacturing is given, beginning with the fundamentals so that readers can get up to speed quickly. Unusual and emerging applications such as micro-scale manufacturing, medical applications, aerospace, and rapid manufacturing are also discussed. This book provides a comprehensive overview of rapid prototyping technologies as well as support technologies such as software systems, vacuum casting, investment casting, plating, infiltration and other systems. This book also: Reflects recent developments and trends and adheres to the ASTM, SI, and other standards Includes chapters on automotive technology, aerospace technology and low-cost AM technologies Provides a broad range of technical questions to ensure

comprehensive understanding of the concepts covered

Digital photography, MP3, digital video, etc. make extensive use of NAND-based Flash cards as storage media. To realize how much NAND Flash memories pervade every aspect of our life, just imagine how our recent habits would change if the NAND memories suddenly disappeared. To take a picture it would be necessary to find a film (as well as a traditional camera...), disks or even magnetic tapes would be used to record a video or to listen a song, and a cellular phone would return to be a simple mean of communication rather than a multimedia console. The development of NAND Flash memories will not be set down on the mere evolution of personal entertainment systems since a new killer application can trigger a further success: the replacement of Hard Disk Drives (HDDs) with Solid State Drives (SSDs). SSD is made up by a microcontroller and several NANDs. As NAND is the technology driver for IC circuits, Flash designers and technologists have to deal with a lot of challenges. Therefore, SSD (system) developers must understand Flash technology in order to exploit its benefits and countermeasure its weaknesses. Inside NAND Flash Memories is a comprehensive guide of the NAND world: from circuits design (analog and digital) to Flash reliability (including radiation effects), from testing issues to high-performance (DDR) interface, from error correction codes to NAND applications

like Flash cards and SSDs.

This book demonstrates how to use the Synopsys Sentaurus TCAD 2014 version for the design and simulation of 3D CMOS (complementary metal–oxide–semiconductor) semiconductor nanoelectronic devices, while also providing selected source codes (Technology Computer-Aided Design, TCAD). Instead of the built-in examples of Sentaurus TCAD 2014, the practical cases presented here, based on years of teaching and research experience, are used to interpret and analyze simulation results of the physical and electrical properties of designed 3D CMOSFET (metal–oxide–semiconductor field-effect transistor) nanoelectronic devices. The book also addresses in detail the fundamental theory of advanced semiconductor device design for the further simulation and analysis of electric and physical properties of semiconductor devices. The design and simulation technologies for nano-semiconductor devices explored here are more practical in nature and representative of the semiconductor industry, and as such can promote the development of pioneering semiconductor devices, semiconductor device physics, and more practically-oriented approaches to teaching and learning semiconductor engineering. The book can be used for graduate and senior undergraduate students alike, while also offering a reference guide for engineers and experts in the semiconductor industry. Readers are

expected to have some preliminary knowledge of the field.

Until the late 1980s, information processing was associated with large mainframe computers and huge tape drives. During the 1990s, this trend shifted toward information processing with personal computers, or PCs. The trend toward miniaturization continues and in the future the majority of information processing systems will be small mobile computers, many of which will be embedded into larger products and interfaced to the physical environment. Hence, these kinds of systems are called embedded systems. Embedded systems together with their physical environment are called cyber-physical systems. Examples include systems such as transportation and fabrication equipment. It is expected that the total market volume of embedded systems will be significantly larger than that of traditional information processing systems such as PCs and mainframes. Embedded systems share a number of common characteristics. For example, they must be dependable, efficient, meet real-time constraints and require customized user interfaces (instead of generic keyboard and mouse interfaces). Therefore, it makes sense to consider common principles of embedded system design. Embedded System Design starts with an introduction into the area and a survey of specification models and languages for embedded and cyber-physical systems. It provides a brief overview of hardware devices used for such systems

and presents the essentials of system software for embedded systems, like real-time operating systems. The book also discusses evaluation and validation techniques for embedded systems. Furthermore, the book presents an overview of techniques for mapping applications to execution platforms. Due to the importance of resource efficiency, the book also contains a selected set of optimization techniques for embedded systems, including special compilation techniques. The book closes with a brief survey on testing. Embedded System Design can be used as a text book for courses on embedded systems and as a source which provides pointers to relevant material in the area for PhD students and teachers. It assumes a basic knowledge of information processing hardware and software. Courseware related to this book is available at http://ls12-www.cs.tu-dortmund.de/~marwedel.

This book covers fundamental aspects of spatial data modelling specifically on the aspect of three-dimensional (3D) modelling and structuring. Realisation of "true" 3D GIS spatial system needs a lot of effort, and the process is taking place in various research centres and universities in some countries. The development of spatial data modelling for 3D objects is the focus of this book.

This book describes the basic technologies and operation principles of charge-trapping non-volatile memories. The authors explain the device physics of each

device architecture and provide a concrete description of the materials involved as well as the fundamental properties of the technology. Modern material properties used as charge-trapping layers, for new applications are introduced. This book describes the technology of charge-trapping non-volatile memories and their uses. The authors explain the device physics of each device architecture and provide a concrete description of the materials involved and the fundamental properties of the technology. Modern material properties, used as charge-trapping layers, for new applications are introduced. Provides a comprehensive overview of the technology for charge-trapping non-volatile memories; Details new architectures and current modeling concepts for non-volatile memory devices; Focuses on conduction through multi-layer gate dielectrics stacks. New solutions are needed for future scaling down of nonvolatile memory. Advances in Non-volatile Memory and Storage Technology provides an overview of developing technologies and explores their strengths and weaknesses. After an overview of the current market, part one introduces improvements in flash technologies, including developments in 3D NAND flash technologies and flash memory for ultra-high density storage devices. Part two looks at the advantages of designing phase change memory and resistive random access memory technologies. It looks in particular at the fabrication, properties, and performance of nanowire phase change memory technologies. Later chapters also consider modeling of both metal oxide and resistive random access memory switching mechanisms, as well as conductive bridge random access memory technologies. Finally, part three looks to the future of alternative technologies. The areas covered include molecular, polymer, and hybrid organic

memory devices, and a variety of random access memory devices such as nano-electromechanical, ferroelectric, and spin-transfer-torque magnetoresistive devices. Advances in Non-volatile Memory and Storage Technology is a key resource for postgraduate students and academic researchers in physics, materials science, and electrical engineering. It is a valuable tool for research and development managers concerned with electronics, semiconductors, nanotechnology, solid-state memories, magnetic materials, organic materials, and portable electronic devices. Provides an overview of developing nonvolatile memory and storage technologies and explores their strengths and weaknesses Examines improvements to flash technology, charge trapping, and resistive random access memory Discusses emerging devices such as those based on polymer and molecular electronics, and nanoelectromechanical random access memory (RAM)

Computing systems are undergoing a transformation from logic-centric towards memory-centric architectures, where overall performance and energy efficiency at the system level are determined by the density, performance, functionality and efficiency of the memory, rather than the logic sub-system. This is driven by the requirements of data-intensive applications in artificial intelligence, autonomous systems, and edge computing. We are at an exciting time in the semiconductor industry where several innovative device and technology concepts are being developed to respond to these demands, and capture shares of the fast growing market for AI-related hardware. This special issue is devoted to highlighting, discussing and presenting the latest advancements in this area, drawing on the best work on emerging memory devices including magnetic, resistive, phase change, and other types of memory. The special issue is interested in work that presents concepts, ideas, and recent progress ranging

from materials, to memory devices, physics of switching mechanisms, circuits, and system applications, as well as progress in modeling and design tools. Contributions that bridge across several of these layers are especially encouraged.

Solid State Drives (SSDs) are gaining momentum in enterprise and client applications, replacing Hard Disk Drives (HDDs) by offering higher performance and lower power. In the enterprise, developers of data center server and storage systems have seen CPU performance growing exponentially for the past two decades, while HDD performance has improved linearly for the same period. Additionally, multi-core CPU designs and virtualization have increased randomness of storage I/Os. These trends have shifted performance bottlenecks to enterprise storage systems. Business critical applications such as online transaction processing, financial data processing and database mining are increasingly limited by storage performance. In client applications, small mobile platforms are leaving little room for batteries while demanding long life out of them. Therefore, reducing both idle and active power consumption has become critical. Additionally, client storage systems are in need of significant performance improvement as well as supporting small robust form factors. Ultimately, client systems are optimizing for best performance/power ratio as well as performance/cost ratio. SSDs promise to address both enterprise and client storage requirements by drastically improving performance while at the same time reducing power. Inside Solid State Drives walks the reader through all the main topics related to SSDs: from NAND Flash to memory controller (hardware and software), from I/O interfaces (PCIe/SAS/SATA) to reliability, from error correction codes (BCH and LDPC) to encryption, from Flash signal processing to hybrid storage. We hope you enjoy this tour inside Solid State Drives.

There are many distinct pleasures associated with computer programming. Craftsmanship has its quiet rewards, the satisfaction that comes from building a useful object and making it work. Excitement arrives with the flash of insight that cracks a previously intractable problem. The spiritual quest for elegance can turn the hacker into an artist. There are pleasures in parsimony, in squeezing the last drop of performance out of clever algorithms and tight coding. The games, puzzles, and challenges of problems from international programming competitions are a great way to experience these pleasures while improving your algorithmic and coding skills. This book contains over 100 problems that have appeared in previous programming contests, along with discussions of the theory and ideas necessary to attack them. Instant online grading for all of these problems is available from two WWW robot judging sites. Combining this book with a judge gives an exciting new way to challenge and improve your programming skills. This book can be used for self-study, for teaching innovative courses in algorithms and programming, and in training for international competition. The problems in this book have been selected from over 1,000 programming problems at the Universidad de Valladolid online judge. The judge has ruled on well over one million submissions from 27,000 registered users around the world to date. We have taken only the best of the best, the most fun, exciting, and interesting problems available.

This fully revised and updated new edition of the definitive text/reference on computer network and information security presents a comprehensive guide to the repertoire of security tools, algorithms and best practices mandated by the technology we depend on. Topics and features: highlights the magnitude of the vulnerabilities, weaknesses and loopholes inherent in computer networks; discusses how to develop effective security solutions, protocols, and best practices

for the modern computing environment; examines the role of legislation, regulation, and enforcement in securing computing and mobile systems; describes the burning security issues brought about by the advent of the Internet of Things and the eroding boundaries between enterprise and home networks (NEW); provides both quickly workable and more thought-provoking exercises at the end of each chapter, with one chapter devoted entirely to hands-on exercises; supplies additional support materials for instructors at an associated website.

For the technological progress in communication technology it is necessary that the advanced studies in circuit and software design are accompanied with recent results of the technological research and physics in order to exceed its limitations. This book is a guide which treats many components used in mobile communications, and in particular focuses on non-volatile memories. It emerges following the conducting line of the non-volatile memory in the wireless system: On the one hand it develops the foundations of the interdisciplinary issues needed for design analysis and testing of the system. On the other hand it deals with many of the problems appearing when the systems are realized in industrial production. These cover the difficulties from the mobile system to the different types of non-volatile memories. The book explores memory cards, multichip technologies, and algorithms of the software management as well as error handling. It also presents techniques of assurance for the single components and a guide through the Datasheet lectures.

3D Flash MemoriesSpringer

This book summarizes the state-of-the-art, regarding noise in nanometer semiconductor devices. Readers will benefit from this leading-edge research, aimed at increasing reliability based on physical microscopic models. Authors discuss the most

recent developments in the understanding of point defects, e.g. via ab initio calculations or intricate measurements, which have paved the way to more physics-based noise models which are applicable to a wider range of materials and features, e.g. III-V materials, 2D materials, and multi-state defects. Describes the state-of-the-art, regarding noise in nanometer semiconductor devices; Enables readers to design more reliable semiconductor devices; Offers the most up-to-date information on point defects, based on physical microscopic models.

This is part one of a two-volume book on real analysis and is intended for senior undergraduate students of mathematics who have already been exposed to calculus. The emphasis is on rigour and foundations of analysis. Beginning with the construction of the number systems and set theory, the book discusses the basics of analysis (limits, series, continuity, differentiation, Riemann integration), through to power series, several variable calculus and Fourier analysis, and then finally the Lebesgue integral. These are almost entirely set in the concrete setting of the real line and Euclidean spaces, although there is some material on abstract metric and topological spaces. The book also has appendices on mathematical logic and the decimal system. The entire text (omitting some less central topics) can be taught in two quarters of 25–30 lectures each. The course material is deeply intertwined with the exercises, as it is intended that the student actively learn the material (and practice thinking and writing rigorously) by proving several of the key results in the theory.

Offering thorough coverage of atomic layer deposition (ALD), this book moves from basic chemistry of ALD and modeling of processes to examine ALD in memory, logic devices and machines. Reviews history, operating principles and ALD processes for each device.

Offers a comprehensive overview of NAND flash memories, with insights into NAND history, technology, challenges, evolutions, and perspectives Describes new program disturb issues, data retention, power consumption, and possible solutions for the challenges of 3D NAND flash memory Written by an authority in NAND flash memory technology, with over 25 years' experience

The revised second edition of this respected text provides a state-of-the-art overview of the main topics relating to solid state drives (SSDs), covering NAND flash memories, memory controllers (including booth hardware and software), I/O interfaces (PCIe/SAS/SATA), reliability, error correction codes (BCH and LDPC), encryption, flash signal processing and hybrid storage. Updated throughout to include all recent work in the field, significant changes for the new edition include: A new chapter on flash memory errors and data recovery procedures in SSDs for reliability and lifetime improvement Updated coverage of SSD Architecture and PCI Express Interfaces moving from PCIe Gen3 to PCIe Gen4 and including a section on NVMe over fabric (NVMf) An additional section on 3D flash memories An update on standard reliability procedures for SSDs Expanded coverage of BCH for SSDs, with a specific section on

detection A new section on non-binary Low-Density Parity-Check (LDPC) codes, the most recent advancement in the field A description of randomization in the protection of SSD data against attacks, particularly relevant to 3D architectures The SSD market is booming, with many industries placing a huge effort in this space, spending billions of dollars in R&D and product development. Moreover, flash manufacturers are now moving to 3D architectures, thus enabling an even higher level of storage capacity. This book takes the reader through the fundamentals and brings them up to speed with the most recent developments in the field, and is suitable for advanced students, researchers and engineers alike.

Beginning and experienced programmers will use this comprehensive guide to persistent memory programming. You will understand how persistent memory brings together several new software/hardware requirements, and offers great promise for better performance and faster application startup times—a huge leap forward in byte-addressable capacity compared with current DRAM offerings. This revolutionary new technology gives applications significant performance and capacity improvements over existing technologies. It requires a new way of thinking and developing, which makes this highly disruptive to the IT/computing industry. The full spectrum of industry sectors that will benefit from this technology include, but are not limited to, in-memory and traditional databases, AI, analytics, HPC, virtualization, and big data. Programming Persistent Memory describes the technology and why it is exciting the industry. It

covers the operating system and hardware requirements as well as how to create development environments using emulated or real persistent memory hardware. The book explains fundamental concepts; provides an introduction to persistent memory programming APIs for C, C++, JavaScript, and other languages; discusses RMDA with persistent memory; reviews security features; and presents many examples. Source code and examples that you can run on your own systems are included. What You'll Learn Understand what persistent memory is, what it does, and the value it brings to the industry Become familiar with the operating system and hardware requirements to use persistent memory Know the fundamentals of persistent memory programming: why it is different from current programming methods, and what developers need to keep in mind when programming for persistence Look at persistent memory application development by example using the Persistent Memory Development Kit (PMDK)Design and optimize data structures for persistent memoryStudy how real-world applications are modified to leverage persistent memoryUtilize the tools available for persistent memory programming, application performance profiling, and debugging Who This Book Is For C, C++, Java, and Python developers, but will also be useful to software, cloud, and hardware architects across a broad spectrum of sectors, including cloud service providers, independent software vendors, high performance compute, artificial intelligence, data analytics, big data, etc.

This book walks the reader through the next step in the evolution of NAND flash

memory technology, namely the development of 3D flash memories, in which multiple layers of memory cells are grown within the same piece of silicon. It describes their working principles, device architectures, fabrication techniques and practical implementations, and highlights why 3D flash is a brand new technology. After reviewing market trends for both NAND and solid state drives (SSDs), the book digs into the details of the flash memory cell itself, covering both floating gate and emerging charge trap technologies. There is a plethora of different materials and vertical integration schemes out there. New memory cells, new materials, new architectures (3D Stacked, BiCS and P-BiCS, 3D FG, 3D VG, 3D advanced architectures); basically, each NAND manufacturer has its own solution. Chapter 3 to chapter 7 offer a broad overview of how 3D can materialize. The 3D wave is impacting emerging memories as well and chapter 8 covers 3D RRAM (resistive RAM) crosspoint arrays. Visualizing 3D structures can be a challenge for the human brain: this is way all these chapters contain a lot of bird's-eye views and cross sections along the 3 axes. The second part of the book is devoted to other important aspects, such as advanced packaging technology (i.e. TSV in chapter 9) and error correction codes, which have been leveraged to improve flash reliability for decades. Chapter 10 describes the evolution from legacy BCH to the most recent LDPC codes, while chapter 11 deals with some of the most recent advancements in the ECC field. Last but not least, chapter 12 looks at 3D flash memories from a system perspective. Is 14nm the last step for planar cells? Can 100

layers be integrated within the same piece of silicon? Is 4 bit/cell possible with 3D? Will 3D be reliable enough for enterprise and datacenter applications? These are some of the questions that this book helps answering by providing insights into 3D flash memory design, process technology and applications.

This thesis presents the first direct observations of the 3D-shape, size and electrical properties of nanoscale filaments, made possible by a new Scanning Probe Microscopy-based tomography technique referred to as scalpel SPM. Using this innovative technology and nm-scale observations, the author achieves essential insights into the filament formation mechanisms, improves the understanding required for device optimization, and experimentally observes phenomena that had previously been only theoretically proposed.

Rising consumer demand for low power consumption electronics has generated a need for scalable and reliable memory devices with low power consumption. At present, scaling memory devices and lowering their power consumption is becoming more difficult due to unresolved challenges, such as short channel effect, Drain Induced Barrier Lowering (DIBL), and sub-surface punch-through effect, all of which cause high leakage currents. As a result, the introduction of different memory architectures or materials is crucial. Nanomaterials-based Charge Trapping Memory Devices provides a detailed explanation of memory device operation and an in-depth analysis of the requirements of future scalable and low powered memory devices in terms of new materials properties. The book presents techniques to fabricate nanomaterials with the desired properties. Finally, the book highlights the effect of

incorporating such nanomaterials in memory devices. This book is an important reference for materials scientists and engineers, who are looking to develop low-powered solutions to meet the growing demand for consumer electronic products and devices. Explores in depth memory device operation, requirements and challenges Presents fabrication methods and characterization results of new nanomaterials using techniques, including laser ablation of nanoparticles, ALD growth of nano-islands, and agglomeration-based technique of nanoparticles Demonstrates how nanomaterials affect the performance of memory devices This book provides students and practicing chip designers with an easy-to-follow yet thorough, introductory treatment of the most promising emerging memories under development in the industry. Focusing on the chip designer rather than the end user, this book offers expanded, up-to-date coverage of emerging memories circuit design. After an introduction on the old solid-state memories and the fundamental limitations soon to be encountered, the working principle and main technology issues of each of the considered technologies (PCRAM, MRAM, FeRAM, ReRAM) are reviewed and a range of topics related to design is explored: the array organization, sensing and writing circuitry, programming algorithms and error correction techniques are reviewed comparing the approach followed and the constraints for each of the technologies considered. Finally the issue of radiation effects on memory devices has been briefly treated. Additionally some considerations are entertained about how emerging memories can find a place in the new memory paradigm required by future electronic systems. This book is an up-to-date and comprehensive introduction for students in courses on memory circuit design or advanced digital courses in VLSI or CMOS circuit design. It also serves as an essential, one-stop resource for academics, researchers and practicing engineers.

This book highlights recent advances in soft and stretchable biointegrated electronics. A renowned group of authors address key ideas in the materials, processes, mechanics, and devices of soft and stretchable electronics; the wearable electronics systems; and bioinspired and implantable biomedical electronics. Among the topics discussed are liquid metals, stretchable and flexible energy sources, skin-like devices, in vitro neural recording, and more. Special focus is given to recent advances in extremely soft and stretchable bio-inspired electronics with real-world clinical studies that validate the technology. Foundational theoretical and experimental aspects are also covered in relation to the design and application of these biointegrated electronics systems. This is an ideal book for researchers, engineers, and industry professionals involved in developing healthcare devices, medical tools and related instruments relevant to various clinical practices.

This book presents computer programming as a key method for solving mathematical problems. There are two versions of the book, one for MATLAB and one for Python. The book was inspired by the Springer book TCSE 6: A Primer on Scientific Programming with Python (by Langtangen), but the style is more accessible and concise, in keeping with the needs of engineering students. The book outlines the shortest possible path from no previous experience with programming to a set of skills that allows the students to write simple programs for solving common mathematical problems with numerical methods in engineering and science courses. The emphasis is on generic algorithms, clean design of programs, use of functions, and automatic tests for verification.

This book provides an introduction to digital storage for consumer electronics. It discusses the various types of digital storage, including emerging non-volatile solid-state storage

technologies and their advantages and disadvantages. It discusses the best practices for selecting, integrating, and using storage devices for various applications. It explores the networking of devices into an overall organization that results in always-available home storage combined with digital storage in the cloud to create an infrastructure to support emerging consumer applications and the Internet of Things. It also looks at the role of digital storage devices in creating security and privacy in consumer products.
Nowadays it is hard to find an electronic device which does not use codes: for example, we listen to music via heavily encoded audio CD's and we watch movies via encoded DVD's. There is at least one area where the use of encoding/decoding is not so developed, yet: Flash non-volatile memories. Flash memory high-density, low power, cost effectiveness, and scalable design make it an ideal choice to fuel the explosion of multimedia products, like USB keys, MP3 players, digital cameras and solid-state disk. In ECC for Non-Volatile Memories the authors expose the basics of coding theory needed to understand the application to memories, as well as the relevant design topics, with reference to both NOR and NAND Flash architectures. A collection of software routines is also included for better understanding. The authors form a research group (now at Qimonda) which is the typical example of a fruitful collaboration between mathematicians and engineers.
This book provides readers with a broad overview of integrated circuits, also generally referred to as micro-electronics. The presentation is designed to be accessible to readers with limited, technical knowledge and coverage includes key aspects of integrated circuit design, implementation, fabrication and application. The author complements his discussion with a large number of diagrams and photographs, in order to reinforce the explanations. The book is

divided into two parts, the first of which is specifically developed for people with almost no or little technical knowledge. It presents an overview of the electronic evolution and discusses the similarity between a chip floor plan and a city plan, using metaphors to help explain concepts. It includes a summary of the chip development cycle, some basic definitions and a variety of applications that use integrated circuits. The second part digs deeper into the details and is perfectly suited for professionals working in one of the semiconductor disciplines who want to broaden their semiconductor horizon.

The subject of this book is to introduce a model-based quantitative performance indicator methodology applicable for performance, cost and reliability optimization of non-volatile memories. The complex example of flash memories is used to introduce and apply the methodology. It has been developed by the author based on an industrial 2-bit to 4-bit per cell flash development project. For the first time, design and cost aspects of 3D integration of flash memory are treated in this book. Cell, array, performance and reliability effects of flash memories are introduced and analyzed. Key performance parameters are derived to handle the flash complexity. A performance and array memory model is developed and a set of performance indicators characterizing architecture, cost and durability is defined. Flash memories are selected to apply the Performance Indicator Methodology to quantify design and technology innovation. A graphical representation based on trend lines is introduced to support a requirement based product development process. The Performance Indicator methodology is applied to demonstrate the importance of hidden memory parameters for a successful product and system development roadmap. Flash Memories offers an opportunity to enhance your understanding of product development key topics such as: · Reliability optimization of flash

memories is all about threshold voltage margin understanding and definition; · Product performance parameter are analyzed in-depth in all aspects in relation to the threshold voltage operation window; · Technical characteristics are translated into quantitative performance indicators; · Performance indicators are applied to identify and quantify product and technology innovation within adjacent areas to fulfill the application requirements with an overall cost optimized solution; · Cost, density, performance and durability values are combined into a common factor – performance indicator - which fulfills the application requirements

The primary focus of this book is on basic device concepts, memory cell design, and process technology integration. The first part provides in-depth coverage of conventional nonvolatile memory devices, stack structures from device physics, historical perspectives, and identifies limitations of conventional devices. The second part reviews advances made in reducing and/or eliminating existing limitations of NVM device parameters from the standpoint of device scalability, application extendibility, and reliability. The final part proposes multiple options of silicon based unified (nonvolatile) memory cell concepts and stack designs (SUMs). The book provides Industrial R&D personnel with the knowledge to drive the future memory technology with the established silicon FET-based establishments of their own. It explores application potentials of memory in areas such as robotics, avionics, health-industry, space vehicles, space sciences, bio-imaging, genetics etc.

This book introduces simulation tools and strategies for complex systems of solid-state-drives (SSDs) which consist of a flash multi-core microcontroller plus NAND flash

memories. It provides a broad overview of the most popular simulation tools, with special focus on open source solutions. VSSIM, NANDFlashSim and DiskSim are benchmarked against performances of real SSDs under different traffic workloads. PROs and CONs of each simulator are analyzed, and it is clearly indicated which kind of answers each of them can give and at a what price. It is explained, that speed and precision do not go hand in hand, and it is important to understand when to simulate what, and with which tool. Being able to simulate SSD's performances is mandatory to meet time-to-market, together with product cost and quality. Over the last few years the authors developed an advanced simulator named "SSDExplorer" which has been used to evaluate multiple phenomena with great accuracy, from QoS (Quality Of Service) to Read Retry, from LDPC Soft Information to power, from Flash aging to FTL. SSD simulators are also addressed in a broader context in this book, i.e. the analysis of what happens when SSDs are connected to the OS (Operating System) and to the end-user application (for example, a database search). The authors walk the reader through the full simulation flow of a real system-level by combining SSD Explorer with the QEMU virtual platform. The reader will be impressed by the level of know-how and the combination of models that such simulations are asking for.

This handbook provides comprehensive treatment of the current state of glass science from the leading experts in the field. Opening with an enlightening contribution on the history of glass, the volume is then divided into eight parts. The first part covers

fundamental properties, from the current understanding of the thermodynamics of the amorphous state, kinetics, and linear and nonlinear optical properties through colors, photosensitivity, and chemical durability. The second part provides dedicated chapters on each individual glass type, covering traditional systems like silicates and other oxide systems, as well as novel hybrid amorphous materials and spin glasses. The third part features detailed descriptions of modern characterization techniques for understanding this complex state of matter. The fourth part covers modeling, from first-principles calculations through molecular dynamics simulations, and statistical modeling. The fifth part presents a range of laboratory and industrial glass processing methods. The remaining parts cover a wide and representative range of applications areas from optics and photonics through environment, energy, architecture, and sensing. Written by the leading international experts in the field, the Springer Handbook of Glass represents an invaluable resource for graduate students through academic and industry researchers working in photonics, optoelectronics, materials science, energy, architecture, and more.

The realization that the use of components off the shelf (COTS) could reduce costs sparked the evolution of the massive parallel computing systems available today. The main problem with such systems is the development of suitable operating systems, algorithms and application software that can utilise the potential processing power of large numbers of processors. As a result, systems comprising millions of processors

are still limited in the applications they can efficiently solve. Two alternative paradigms that may offer a solution to this problem are Quantum Computers (QC) and Brain Inspired Computers (BIC). This book presents papers from the 14th edition of the biennial international conference on High Performance Computing - From Clouds and Big Data to Exascale and Beyond, held in Cetraro, Italy, from 2 - 6 July 2018. It is divided into 4 sections covering data science, quantum computing, high-performance computing, and applications. The papers presented during the workshop covered a wide spectrum of topics on new developments in the rapidly evolving supercomputing field – including QC and BIC – and a selection of contributions presented at the workshop are included in this volume. In addition, two papers presented at a workshop on Brain Inspired Computing in 2017 and an overview of work related to data science executed by a number of universities in the USA, parts of which were presented at the 2018 and previous workshops, are also included. The book will be of interest to all those whose work involves high-performance computing.

This book explores the design implications of emerging, non-volatile memory (NVM) technologies on future computer memory hierarchy architecture designs. Since NVM technologies combine the speed of SRAM, the density of DRAM, and the non-volatility of Flash memory, they are very attractive as the basis for future universal memories. This book provides a holistic perspective on the topic, covering modeling, design, architecture and applications. The practical information included in this book will enable

designers to exploit emerging memory technologies to improve significantly the performance/power/reliability of future, mainstream integrated circuits.

Computer Vision: Algorithms and Applications explores the variety of techniques commonly used to analyze and interpret images. It also describes challenging real-world applications where vision is being successfully used, both for specialized applications such as medical imaging, and for fun, consumer-level tasks such as image editing and stitching, which students can apply to their own personal photos and videos. More than just a source of "recipes," this exceptionally authoritative and comprehensive textbook/reference also takes a scientific approach to basic vision problems, formulating physical models of the imaging process before inverting them to produce descriptions of a scene. These problems are also analyzed using statistical models and solved using rigorous engineering techniques. Topics and features: structured to support active curricula and project-oriented courses, with tips in the Introduction for using the book in a variety of customized courses; presents exercises at the end of each chapter with a heavy emphasis on testing algorithms and containing numerous suggestions for small mid-term projects; provides additional material and more detailed mathematical topics in the Appendices, which cover linear algebra, numerical techniques, and Bayesian estimation theory; suggests additional reading at the end of each chapter, including the latest research in each sub-field, in addition to a full Bibliography at the end of the book; supplies supplementary course material for

students at the associated website, http://szeliski.org/Book/. Suitable for an upper-level undergraduate or graduate-level course in computer science or engineering, this textbook focuses on basic techniques that work under real-world conditions and encourages students to push their creative boundaries. Its design and exposition also make it eminently suitable as a unique reference to the fundamental techniques and current research literature in computer vision.

The chips in present-day cell phones already contain billions of sub-100-nanometer transistors. By 2020, however, we will see systems-on-chips with trillions of 10-nanometer transistors. But this will be the end of the miniaturization, because yet smaller transistors, containing just a few control atoms, are subject to statistical fluctuations and thus no longer useful. We also need to worry about a potential energy crisis, because in less than five years from now, with current chip technology, the internet alone would consume the total global electrical power! This book presents a new, sustainable roadmap towards ultra-low-energy (femto-Joule), high-performance electronics. The focus is on the energy-efficiency of the various chip functions: sensing, processing, and communication, in a top-down spirit involving new architectures such as silicon brains, ultra-low-voltage circuits, energy harvesting, and 3D silicon technologies. Recognized world leaders from industry and from the research community share their views of this nanoelectronics future. They discuss, among other things, ubiquitous communication based on mobile companions, health and care

supported by autonomous implants and by personal carebots, safe and efficient mobility assisted by co-pilots equipped with intelligent micro-electromechanical systems, and internet-based education for a billion people from kindergarden to retirement. This book should help and interest all those who will have to make decisions associated with future electronics: students, graduates, educators, and researchers, as well as managers, investors, and policy makers. Introduction: Towards Sustainable 2020 Nanoelectronics.- From Microelectronics to Nanoelectronics.- The Future of Eight Chip Technologies.- Analog–Digital Interfaces.- Interconnects and Transceivers.- Requirements and Markets for Nanoelectronics.- ITRS: The International Technology Roadmap for Semiconductors.- Nanolithography.- Power-Efficient Design Challenges.- Superprocessors and Supercomputers.- Towards Terabit Memories.- 3D Integration for Wireless Multimedia.- The Next-Generation Mobile User-Experience.- MEMS (Micro-Electro-Mechanical Systems) for Automotive and Consumer.- Vision Sensors and Cameras.- Digital Neural Networks for New Media.- Retinal Implants for Blind Patients.- Silicon Brains.- Energy Harvesting and Chip Autonomy.- The Energy Crisis.- The Extreme-Technology Industry.- Education and Research for the Age of Nanoelectronics.- 2020 World with Chips.

This book presents scientific interactions between the three interwoven and challenging areas of research and development of future ICT-enabled applications: software, complex systems and intelligent systems. Software intensive systems heavily interact

with other systems, sensors, actuators, and devices, as well as other software systems and users. More and more domains involve software intensive systems, e.g. automotive, telecommunication systems, embedded systems in general, industrial automation systems and business applications. Moreover, web services offer a new platform for enabling software intensive systems. Complex systems research focuses on understanding overall systems rather than their components. Such systems are characterized by the changing environments in which they act, and they evolve and adapt through internal and external dynamic interactions. The development of intelligent systems and agents features the use of ontologies, and their logical foundations provide a fruitful impulse for both software intensive systems and complex systems. Research in the field of intelligent systems, robotics, neuroscience, artificial intelligence, and cognitive sciences is a vital factor in the future development and innovation of software intensive and complex systems.

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