High Performance Silicon Imaging Fundamentals And Applications Of Cmos And Ccd Sensors Woodhead Publishing Series In Electronic And Optical Materials

Metallic films play an important role in modern technologies such as integrated circuits, information storage, displays, sensors, and coatings. Metallic Films for Electronic, Optical and Magnetic Applications reviews the structure, processing and properties of metallic films. Part one explores the structure of metallic films using characterization methods such as x-ray diffraction and transmission electron microscopy. This part also encompasses the processing of metallic films, including structure formation during deposition and post-deposition reactions and phase transformations. Chapters in part two focus on the properties of metallic films, including mechanical, electrical, magnetic, optical, and thermal properties. Metallic Films for Electronic, Optical and Magnetic Applications is a technical resource for electronics components manufacturers, scientists, and engineers working in the semiconductor industry, product developers of sensors, displays, and other optoelectronic devices, and academics working in the field. Explores the structure of metallic films using characterization methods such as x-ray diffraction and transmission electron microscopy Discusses processing of metallic films, including structure formation during deposition and post-deposition reactions and phase transformations Focuses on the properties of metallic films, including mechanical, electrical, magnetic, optical, and thermal properties

Magnetic nanowires and microwires are key tools in the development of enhanced devices for information technology (memory and data processing) and sensing. Offering the combined characteristics of high density, high speed, and non-volatility, they facilitate reliable control of the motion of magnetic domain walls; a key requirement for the development of novel classes of logic and storage devices. Part One introduces the design and synthesis of magnetic nanowires and microwires, reviewing the growth and processing of nanowires and nanowire heterostructures using such methods as sol-gel and electrodepositional combinations, focused-electron/ion-beam-induced deposition, chemical vapour transport, quenching and drawing and magnetic interactions. Magnetic and transport properties, alongside domain walls, in nano- and microwires are then explored in Part Two, before Part Three goes on to explore a wide range of applications for magnetic nano- and microwire devices, including memory, microwave and electrochemical applications, in addition to thermal spin polarization and configuration, magnetocaloric effects and Bloch point dynamics. Detailed coverage of multiple key techniques for the growth and processing of nanowires and microwires Reviews the principles and difficulties involved in applying magnetic nano- and microwires to a wide range of applications Combines the expertise of specialists from around the globe to give a broad overview of current and future trends

Integrated circuits, and devices fabricated using the techniques developed for integrated circuits, have steadily gotten smaller, more complex, and more powerful. The rate of shrinking is astonishing – some components are now just a few dozen atoms wide. This book attempts to answer the questions, “What comes next?” and “How do we get there?” Nanolithography outlines the present state of the art in lithographic techniques, including optical projection in both deep and extreme ultraviolet, electron and ion beams, and imprinting. Special attention is paid to related issues, such as the resists used in lithography, the masks (or lack thereof), the metrology needed for nano-features, modeling, and the limitations caused by feature edge roughness. In addition emerging technologies are described, including the directed assembly of wafer features, nanostructures and devices, nano-photonics, and nano-fluidics. This book is intended as a guide to the researcher new to this field, reading related journals or facing the complexities of a technical conference. Its goal is to give enough background information to enable such a researcher to understand, and appreciate, new developments in nanolithography, and to go on to make advances of his/her own. Outlines the current state of the art in alternative nanolithography technologies in order to cope with the future reduction in size of semiconductor chips to nanoscale dimensions Covers lithographic techniques, including optical projection, extreme ultraviolet (EUV), nanoimprint, electron beam and ion beam lithography Describes the emerging applications of nanolithography in nanoelectronics, nanophotonics and microfluidics Materials Characterization Using Nondestructive Evaluation (NDE) Methods discusses NDT methods and how they are highly desirable for both long-term monitoring and short-term assessment of materials, providing crucial early warning that the fatigue life of a material has elapsed, thus helping to prevent service failures. Materials Characterization Using Nondestructive Evaluation (NDE) Methods gives an overview of established and new NDT techniques for the characterization of materials, with a focus on materials used in the automotive, aerospace, power plants, and infrastructure construction industries. Each chapter focuses on a different NDT technique and indicates the potential of the method by selected examples of applications. Methods covered include scanning and transmission electron microscopy, X-ray microtomography and diffraction, ultrasonic, electromagnetic, microwave, and hybrid techniques. The authors review both the determination of microstructure properties, including phase content and grain size, and the determination of mechanical properties, such as hardness, toughness, yield strength, texture, and residual stress. Gives an overview of established and new NDT techniques, including scanning and transmission electron microscopy, X-ray microtomography and diffraction, ultrasonic, electromagnetic, microwave, and hybrid techniques Reviews the determination of microstructural and mechanical properties Focuses on materials used in the automotive, aerospace, power plants, and infrastructure construction industries Serves as a highly desirable resource for both long-term monitoring and short-term assessment of materials

Advances in Chemical Mechanical Planarization (CMP) provides the latest information on a mainstream process that is critical for high-volume, high-yield semiconductor manufacturing, and even more so as device dimensions continue to shrink. The technology has grown to encompass the removal and planarization of multiple metal and dielectric materials and layers both at the device and the metallization levels, using different tools and parameters, requiring improvements in the control of topography and defects. This important book offers a systematic review of fundamentals and advances in the area. Part One covers CMP of dielectric and metal films, with chapters focusing on the use of particular techniques and processes, and on CMP of particular various materials, including ultra low-k materials and high-mobility channel materials, and ending with a chapter reviewing the environmental impacts of CMP processes. Part Two addresses consumables and process control for improved CMP, and includes chapters on the preparation and characterization of slurry, diamond disc pad conditioning, the use of FTIR spectroscopy for characterization of surface processes, and approaches for defect characterization, mitigation, and reduction. Considers techniques and processes for CMP of dielectric and metal films Includes chapters devoted to CMP for particular materials Addresses consumables and process control for improved CMP
Diamond nitrogen vacancy (NV) color centers can transform quantum information science into practical quantum information technology, including fast, safe computing. Quantum Information Processing with Diamond looks at the principles of quantum information science, diamond materials, and their applications. Part one provides an introduction to quantum information processing using diamond, as well as its principles and fabrication techniques. Part two outlines experimental demonstrations of quantum information processing using diamond, and the emerging applications of diamond for quantum information science. It contains chapters on quantum key distribution, quantum microscopy, the hybridization of quantum systems, and building quantum optical devices. Part three outlines promising directions and future trends in diamond technologies for quantum information processing and sensing. Quantum Information Processing with Diamond is a key reference for R&D managers in industrial sectors such as conventional electronics, communication engineering, computer science, biotechnology, quantum optics, quantum mechanics, quantum computing, quantum cryptography, and nanotechnology, as well as academics in physics, chemistry, biology, and engineering. Brings together the topics of diamond and quantum information processing Looks at applications such as quantum computing, neural circuits, and in vivo monitoring of processes at the molecular scale. Semiconductor nanowires promise to provide the building blocks for a new generation of nanoscale electronic and optoelectronic devices. Semiconductor Nanowires: Materials, Synthesis, Characterization and Applications covers advanced materials for nanowires, the growth and synthesis of semiconductor nanowires—including methods such as solution growth, MOVPE, MBE, and self-organization. Characterizing the properties of semiconductor nanowires is covered in chapters describing studies using TEM, SPM, and Raman scattering. Applications of semiconductor nanowires are discussed in chapters focusing on solar cells, battery electrodes, sensors, optoelectronics and biology. Explores a selection of advanced materials for semiconductor nanowires Outlines key techniques for the property assessment and characterization of semiconductor nanowires Covers a broad range of applications across a number of fields. The directed self-assembly (DSA) method of patterning for microelectronics uses polymer phase-separation to generate features of less than 20nm, with the positions of self-assembling materials externally guided into the desired pattern. Directed self-assembly of Block Co-polymers for Nano-manufacturing reviews the design, production, applications and future developments needed to facilitate the widespread adoption of this promising technology. Beginning with a solid overview of the physics and chemistry of block copolymer (BCP) materials, Part 1 covers the synthesis of new materials and new processing methods for DSA. Part 2 then goes on to outline the key modelling and characterization principles of DSA, reviewing templates and patterning using topographical and chemically modified surfaces, line edge roughness and dimensional control, x-ray scattering for characterization, and nanoscale driven assembly. Finally, Part 3 discusses application areas and related issues for DSA in nano-manufacturing, including for basic logic circuit design, the inverse DSA problem, design decomposition and the modelling and analysis of large scale, template self-assembly manufacturing techniques. Authoritative outlining of theoretical principles and modeling techniques to give a thorough introduction to the topic Discusses a broad range of practical applications for directed self-assembly in nano-manufacturing Highlights the importance of this technology to both the present and future of nano-manufacturing by exploring its potential use in a range of fields. The optical world is continuously and rapidly evolving, and new challenges arise every day. As a result of these rapid changes, the need for up-to-date texts that address this growing field from an interdisciplinary perspective persists. This book presents an overview of new optical communication technologies and a bird's-eye view of some of the more promising technologies among them. The book covers the theoretical but also the practical aspects of technology implementation in a way that is suitable for undergraduate- and graduate-level students, as well as researchers and professional engineers. Current data centre networks, based on electronic packet switches, are experiencing an exponential increase in network traffic due to developments such as cloud computing. Optical interconnects have emerged as a promising alternative offering high throughput and reduced power consumption. Optical Interconnects for Data Centers reviews key developments in the use of optical interconnects in data centres and the current state of the art in transforming this technology into a reality. The book discusses developments in optical materials and components (such as single and multi-mode waveguides), circuit boards and ways the technology can be deployed in data centres. Optical Interconnects for Data Centers is a key reference text for electronics designers, optical engineers, communications engineers and R&D managers working in the communications and electronics industries as well as postgraduate researchers. Summarizes the state-of-the-art in this emerging field Presents a comprehensive review of all the key aspects of deploying optical interconnects in data centers, from materials and components, to circuit boards and methods for integration Contains contributions that are drawn from leading international experts on the topic High Performance Silicon ImagingFundamentals and Applications of CMOS and CCD sensors Elsevier High Mobility Materials for CMOS Applications provides a comprehensive overview of recent developments in the field of (Si)Ge and III-V materials and their integration on Si. The book covers material growth and integration on Si, going all the way from device to circuit design. While the book's focus is on digital applications, a number of chapters also address the use of III-V for RF and analog applications, and in optoelectronics. With CMOS technology moving to the 10nm node and beyond, however, severe concerns with power dissipation and performance are arising, hence the need for this timely work on the advantages and challenges of the technology. Addresses each of the challenges of utilizing high mobility materials for CMOS applications, presenting possible solutions and the latest innovations Covers the latest advances in research on heterogeneous integration, gate stack, device design and scalability Provides a broad overview of the topic, from materials integration to circuits The new edition of the most detailed and comprehensive single-volume reference on major semiconductor devices The Fourth Edition of Physics of Semiconductor Devices remains the standard reference work on the fundamental physics and operational characteristics of all major bipolar, unipolar, special microwave, and optoelectronic devices. This fully updated and expanded edition includes approximately 1,000 references to original research papers and review articles, more than 650 high-quality technical illustrations, and over two dozen tables of material parameters. Divided into five parts, the text first provides a summary of semiconductor properties, covering energy band, carrier concentration, and transport properties. The second part surveys the basic building blocks of semiconductor devices, including p-n junctions, metal-semiconductor contacts, and metal-insulator-semiconductor (MIS) capacitors. Part III examines
bipolar transistors, MOSFETs (MOS field-effect transistors), and other field-effect transistors such as JFETs (junction field-effect transistors) and MESFETs (metal-semiconductor field-effect transistors). Part IV focuses on negative-resistance and power devices. The book concludes with coverage of photonic devices and sensors, including light-emitting diodes (LEDs), solar cells, and various photodetectors and semiconductor sensors. This classic volume, the standard textbook and reference in the field of semiconductor devices: Provides the practical foundation necessary for understanding the devices currently in use and evaluating the performance and limitations of future devices Offers completely updated and revised information that reflects advances in device concepts, performance, and application Features discussions of topics of contemporary interest, such as applications of photonic devices that convert optical energy to electric energy Includes numerous problem sets, real-world examples, tables, figures, and illustrations; several useful appendices; and a detailed solutions manual Explores new work on leading-edge technologies such as MODFETs, resonant-tunneling diodes, quantum-cascade lasers, single-electron transistors, real-space-transfer devices, and MOS-controlled thyristors Physics of Semiconductor Devices, Fourth Edition is an indispensable resource for design engineers, research scientists, industrial and electronics engineering managers, and graduate students in the field.

This book presents a variety of perspectives on vision-based applications. These contributions are focused on optoelectronic sensors, 3D & 2D machine vision technologies, robot navigation, control schemes, motion controllers, intelligent algorithms and vision systems. The authors focus on applications of unmanned aerial vehicles, autonomous and mobile robots, industrial inspection applications and structural health monitoring. Recent advanced research in measurement and others areas where 3D & 2D machine vision and machine control play an important role, as well as surveys and reviews about vision-based applications. These topics are of interest to readers from diverse areas, including electrical, electronics and computer engineering, technologists, students and non-specialist readers. • Presents current research in image and signal sensors, methods, and 3D & 2D technologies in vision-based theories and applications; • Discusses applications such as daily use devices including robotics, detection, tracking and stereoscopic vision systems, pose estimation, avoidance of objects, control and data exchange for navigation, and aerial imagery processing; • Includes research contributions in scientific, industrial, and civil applications.

Wireless MEMS Networks and Applications reviews key emerging applications of MEMS in wireless and mobile networks. This book covers the different types of wireless MEMS devices, also exploring MEMS in smartphones, tablets, and the MEMS used for energy harvesting. The book reviews the range of applications of wireless MEMS networks in manufacturing, infrastructure monitoring, environmental monitoring, space applications, agricultural monitoring for food safety, health applications, and systems for smart cities. Focuses on the use of MEMS in the emerging area of wireless applications Contains comprehensive coverage of the range of applications of MEMS for wireless networks Presents an international range of expert contributors who identify key research in the field

High Performance Silicon Imaging covers the fundamentals of silicon image sensors, with a focus on existing performance issues and potential solutions. The book considers several applications for the technology as well. Silicon imaging is a fast growing area of the semiconductor industry. Its use in cell phone cameras is already well established, and emerging applications include web, security, automotive, and digital cinema cameras. Part one begins with a review of the fundamental principles of photosensing and the operational principles of silicon image sensors. It then focuses on on-charged coupled device (CCD) image sensors and complementary metal oxide semiconductor (CMOS) image sensors. The performance issues considered include image quality, sensitivity, data transfer rate, system level integration, rate of power consumption, and the potential for 3D imaging. Part two then discusses how CMOS technology can be used in a range of areas, including in mobile devices, image sensors for automotive applications, sensors for several forms of scientific imaging, and sensors for medical applications. High Performance Silicon Imaging is an excellent resource for both academics and engineers working in the optics, photonics, semiconductor, and electronics industries. Covers the fundamentals of silicon-based image sensors and technical advances, focusing on performance issues Looks at image sensors in applications such as mobile phones, scientific imaging, TV broadcasting, automotive, and biomedical applications

Part one of Machine-to-Machine (M2M) Communications covers machine-to-machine systems, architecture and components. Part two assesses performance management techniques for M2M communications. Part three looks at M2M applications, services, and standardization. Machine-to-machine communications refers to autonomous communication between devices or machines. This book serves as a key resource in M2M, which is set to grow significantly and is expected to generate a huge amount of additional data traffic and new revenue streams, underpinning key areas of the economy such as the smart grid, networked homes, healthcare and transportation. Examines the opportunities in M2M for businesses Analyses the optimisation and development of M2M communications Chapters cover aspects of access, scheduling, mobility and security protocols within M2M communications

The unique properties and functionalities of chalcogenide glasses make them promising materials for photonic applications. Chalcogenide glasses are transparent from the visible to the near infrared region and can be moulded into lenses or drawn into fibres. They have useful commercial applications as components for lenses for infrared cameras, and chalcogenide glass fibres and optical components are used in waveguides for use with lasers, for optical switching, chemical and temperature sensing and phase change memories. Chalcogenide glasses comprehensively reviews the latest technological advances in this field and the industrial applications of the technology. Part one outlines the preparation methods and properties of chalcogenide glasses, including the thermal properties, structure, and optical properties, before going on to discuss mean coordination and topological constraints in chalcogenide network glasses, and the photo-induced phenomena in chalcogenide glasses. This section also covers the ionic conductivity and physical aging of chalcogenide glasses, deposition techniques for chalcogenide thin films, and transparent chalcogenide glass-ceramics. Part two explores the applications of chalcogenide glasses. Topics discussed include rare-earth-doped chalcogenide glass for lasers and amplifiers, the applications of chalcogenide glasses for infrared sensing, microstructured optical fibres for infrared applications, and chalcogenide glass waveguide devices for all-optical signal processing. This section also discusses the control of light on the nanoscale with chalcogenide thin films, chalcogenide glass resists for lithography, and chalcogenide for phase change optical and electrical memories. The book concludes with an overview of chalcogenide glasses as electrolytes for batteries. Chalcogenide glasses comprehensively reviews the latest technological advances and applications of chalcogenide glasses, and is an essential text for academics, materials scientists and electrical engineers working in the photonics and
optoelectronics industry. Outlines preparation methods and properties, and explores applications of chalcogenide glasses. Covers the ionic conductivity and physical aging of chalcogenide glasses, deposition techniques for chalcogenide thin films, and transparent chalcogenide glass-ceramics Discusses the control of light on the nanoscale with chalcogenide thin films, chalcogenide glass resists for lithography, and chalcogenide for phase change optical and electrical memories

The book focuses on photonic devices and systems for space applications and critically reviews the most promising research advances in the field of photonic technologies, which may have a significant impact on the performance of space systems. Photonics is emerging as a crucial enabling technology having the potential of enhancing many space systems, including the links for on-board data handling, the high-resolution measurement systems, and the processing units. The book discusses this subject with a special emphasis on the new guided-wave devices with high performance, low cost and size. Most of the scientific content of the book is novel and it is devoted to academic and industrial researchers working on the field. Contents:IntroductionFundamentals of Photonic DevicesOptical Links for Inter- and Intra-Spacecraft Communications Optical Signal Processors and Optical RF OscillatorsImage DetectorsPhotonic Sensors and InstrumentsSolar Cells for SpaceEmerging Space Applications of Photonics Readership: Graduate students, researchers and professionals in the field of aerospace engineering, electrical & electronic engineering, nanophotonics and optics.

The use of optical methodology, instrumentation and photonics devices for imaging, vision and optical sensing is of increasing importance in understanding our marine environment. Subsea optics can make an important contribution to the protection and sustainable management of ocean resources and contribute to monitoring the response of marine systems to climate change. This important book provides an authoritative review of key principles, technologies and their applications. The book is divided into three parts. The first part provides a general introduction to the key concepts in subsea optics and imaging, imaging technologies and the development of ocean optics and colour analysis. Part two reviews the use of subsea optics in environmental analysis. An introduction to the concepts of underwater light fields is followed by an overview of coloured dissolved organic matter (CDOM) and an assessment of nutrients in the water column. This section concludes with discussions of the properties of subsea bioluminescence, harmful algal blooms and their impact and finally an outline of optical techniques for studying suspended sediments, turbulence and mixing in the marine environment. Part three reviews subsea optical systems technologies. A general overview of imaging and visualisation using conventional photography and video leads onto advanced techniques like digital holography, laser line-scanning and range-gated imaging as well as their use in controlled observation platforms or global observation networks. This section also outlines techniques like Raman spectroscopy, hyperspectral sensing and imaging, laser Doppler anemometry (LDA) and particle image velocimetry (PIV), optical fibre sensing and LIDAR systems. Finally, a chapter on fluorescence methodologies brings the volume to a close. With its distinguished editor and international team of contributors, Subsea optics and imaging is a standard reference for those researching, developing and using subsea optical technologies as well as environmental scientists and agencies concerned with monitoring the marine environment. Provides an authoritative review of key principles, technologies and their applications Outlines the key concepts in subsea optics and imaging, imaging technologies and the development of ocean optics and colour analysis Reviews the properties of subsea bioluminescence, harmful algal blooms and their impact

This book provides an authoritative guide for postgraduate students and academic researchers in electronics, computer and network engineering, telecommunications, energy technology and home automation, as well as R&D managers in industrial sectors such as wireless technology, consumer electronics, telecommunications and networking, information technology, energy technology and home automation. Part One outlines the key principles and technologies needed for ecological smart home networks. Beginning with a thorough overview of the concept behind ecological smart home network design, the book reviews such important areas as power line communications, hybrid systems and middleware platforms. Part Two then goes on to discuss some important applications of this technology, with wireless smart sensor networks for home and telecare, and smart home networking for content and energy management (including the Intelligent Zero Emission Urban System), all explored in detail. More systematic and comprehensive coverage: the book covers ecological design and technology requirements, performance and applications for smart home networks Better focus on industry needs: the book

Part two reviews the use of subsea optics in environmental analysis. An introduction to the concepts of underwater light fields is followed by an overview of coloured dissolved organic matter (CDOM) and an assessment of nutrients in the water column. This section concludes with discussions of the properties of subsea bioluminescence, harmful algal blooms and their impact and finally an outline of optical techniques for studying suspended sediments, turbulence and mixing in the marine environment. Part three reviews subsea optical systems technologies. A general overview of imaging and visualisation using conventional photography and video leads onto advanced techniques like digital holography, laser line-scanning and range-gated imaging as well as their use in controlled observation platforms or global observation networks. This section also outlines techniques like Raman spectroscopy, hyperspectral sensing and imaging, laser Doppler anemometry (LDA) and particle image velocimetry (PIV), optical fibre sensing and LIDAR systems. Finally, a chapter on fluorescence methodologies brings the volume to a close. With its distinguished editor and international team of contributors, Subsea optics and imaging is a standard reference for those researching, developing and using subsea optical technologies as well as environmental scientists and agencies concerned with monitoring the marine environment. Provides an authoritative review of key principles, technologies and their applications Outlines the key concepts in subsea optics and imaging, imaging technologies and the development of ocean optics and colour analysis Reviews the properties of subsea bioluminescence, harmful algal blooms and their impact

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types of sensor including piezoelectric transducers, fiber optic sensors, acoustic emission sensors, and electromagnetic sensors, and the use of these sensors for assessing and monitoring civil infrastructures. Developments in technologies applied to civil infrastructure performance assessment are also discussed, including radar technology, micro-electromechanical systems (MEMS) and nanotechnology. Sensor Technologies for Civil Infrastructure provides a standard reference for structural and civil engineers, electronics engineers, and academics with an interest in the field. Describes sensing hardware and data collection, covering a variety of sensors Examines fiber optic systems, acoustic emission, piezoelectric sensors, electromagnetic sensors, ultrasonic methods, and radar and millimeter wave technology Covers strain gauges, micro-electro-mechanical systems (MEMS), multifunctional materials and nanotechnology for sensing, and vision-based sensing and lasers

Lasers can alter the surface composition and properties of materials in a highly controllable way, which makes them efficient and cost-effective tools for surface engineering. This book provides an overview of the different techniques, the laser-material interactions and the advantages and disadvantages for different applications. Part one looks at laser heat treatment, part two covers laser additive manufacturing such as laser-enhanced electroplating, and part three discusses laser micromachining, structuring and surface modification. Chemical and biological applications of laser surface engineering are explored in part four, including ways to improve the surface corrosion properties of metals.

Provides an overview of thermal surface treatments using lasers, including the treatment of steels, light metal alloys, polycrystalline silicon and technical ceramics Addresses the development of new metallic materials, innovations in laser cladding and direct metal deposition, and the fabrication of tuneable micro- and nano-scale surface structures Chapters also cover laser structuring, surface modification, and the chemical and biological applications of laser surface engineering

The third edition of Fundamentals of Photonics presents a logical blend of theory and applications, coverage includes detailed accounts of the primary theories of light, including ray optics, wave optics, electromagnetic optics, and photon optics, as well as the interaction of light with matter, and the theory of semiconductor materials and their optical properties. Photonics technology has been continuing to develop at a rapid pace since the publication of the second edition. In the new, full color Third Edition of this landmark book, two new chapters have been written to cover the advances in the field of photonics. All the chapters have been updated and many new sections have been added. References to book and articles have been thoroughly updated, and much of the material has been rewritten to improve readability. New problems and exercises are provided and, once again, a solutions manual for the exercises is available to instructors. New to this edition is an electronic version with animated illustrations for better comprehension.

Industrial Tomography: Systems and Applications thoroughly explores the important tomographic techniques of industrial tomography, also discussing image reconstruction, systems, and applications. The text presents complex processes, including the way three-dimensional imaging is used to create multiple cross-sections, and how computer software helps monitor flows, filtering, mixing, drying processes, and chemical reactions inside vessels and pipelines. Readers will find a comprehensive discussion on the ways tomography systems can be used to optimize the performance of a wide variety of industrial processes. Provides a comprehensive discussion on the different formats of tomography Includes an excellent overview of image reconstruction using a wide range of applications Presents a comprehensive discussion of tomography systems and their application in a wide variety of industrial processes

Laser spectroscopy is a valuable tool for sensing and chemical analysis. Developments in lasers, detectors and mathematical analytical tools have led to improvements in the sensitivity and selectivity of spectroscopic techniques and extended their fields of application. Laser Spectroscopy for Sensing examines these advances and how laser spectroscopy can be used in a diverse range of industrial, medical, and environmental applications. Part one reviews basic concepts of atomic and molecular processes and presents the fundamentals of laser technology for controlling the spectral and temporal aspects of laser excitation. In addition, it explains the selectivity, sensitivity, and stability of the measurements, the construction of databases, and the automation of data analysis by machine learning. Part two explores laser spectroscopy techniques, including cavity-based absorption spectroscopy and the use of photo-acoustic spectroscopy to acquire absorption spectra of gases and condensed media. These chapters discuss imaging methods using laser-induced fluorescence and phosphorescence spectroscopies before focusing on light detection and ranging, photothermal spectroscopy and terahertz spectroscopy. Part three covers a variety of applications of these techniques, particularly the detection of chemical, biological, and explosive threats, as well as their use in medicine and forensic science. Finally, the book examines spectroscopic analysis of industrial materials and their applications in nuclear research and industry. The text provides readers with a broad overview of the techniques and applications of laser spectroscopy for sensing. It is of great interest to laser scientists and engineers, as well as professionals using lasers for medical applications, environmental applications, military applications, and material processing. Presents the fundamentals of laser technology for controlling the spectral and temporal aspects of laser excitation Explores laser spectroscopy techniques, including cavity-based absorption spectroscopy and the use of photo-acoustic spectroscopy to acquire absorption spectra of gases and condensed media Considers spectroscopic analysis of industrial materials and their applications in nuclear research and industry

Nano-scale materials have unique electronic, optical, and chemical properties which make them attractive for a new generation of devices. Part one of Modeling, Characterization, and Production of Nanomaterials: Electronics, Photonics and Energy Applications covers modeling techniques incorporating quantum mechanical effects to simulate nanomaterials and devices, such as multiscale modeling and density functional theory. Part two describes the characterization of nanomaterials using diffraction techniques and Raman spectroscopy. Part three looks at the structure and properties of nanomaterials, including their optical properties and atomic behaviour. Part four explores nanofabrication and nanodevices, including the growth of graphene, GaN-based nanorod heterostructures and colloidal quantum
dots for applications in nanophotonics and metallic nanoparticles for catalysis applications. Comprehensive coverage of the close connection between modeling and experimental methods for studying a wide range of nanomaterials and nanostructures Focus on practical applications and industry needs, supported by a solid outlining of theoretical background Draws on the expertise of leading researchers in the field of nanomaterials from around the world

The field of application-specific integrated circuits (ASICs) is fast-paced being at the very forefront of modern nanoscale fabrication and presents a deeply engaging career path. ASICs can provide us with high-speed computation in the case of digital circuits. For example, central processing units, graphics processing units, field-programmable gate arrays, and custom-made digital signal processors are examples of ASICs and the transistors they are fabricated from. We can use that same technology complementary metal-oxide semiconductor processes to implement high-precision sensing of or interfacing to the world through analog-to-digital converters, digital-to-analog converters, custom image sensors, and highly integrated micron-scale sensors such as magnetometers, accelerometers, and microelectromechanical systems. ASIC technologies now transitioning toward magneto-resistive and phase-changing materials also offer digital memory capacities that have aided our technological progress. Combining these domains, we have moved toward big data analytics and the new era of artificial intelligence and machine learning. This book provides a small selection of chapters covering aspects of ASIC development and the surrounding business model.

Optical Payloads for Space Missions is a comprehensive collection of optical spacecraft payloads with contributions by leading international rocket-scientists and instrument builders. Covers various applications, including earth observation, communications, navigation, weather, and science satellites and deep space exploration. Each chapter covers one or more specific optical payload. Contains a review chapter which provides readers with an overview on the background, current status, trends, and future prospects of the optical payloads. Provides information on the principles of the optical spacecraft payloads, missions’ background, motivation and challenges, as well as the scientific returns, benefits and applications.

Industrial Wireless Sensor Networks: Monitoring, Control and Automation explores the explosive growth that has occurred in the use of wireless sensor networks in a variety of applications during the last few years. As wireless technology can reduce costs, increase productivity, and ease maintenance, the book looks at the progress in standardization efforts regarding reliability, security, performance, power consumption, and integration. Early sections of the book discuss issues in communication access control (MAC), antenna design and site survey, energy harvesting, and explosion-proof design. Subsequent sections present WSN standards, including ISA100, ZigBeeTM, WiFiTM, WirelessHARTTM and 6loWPAN, and the applications of WSNs in the oil and gas, chemical, food, and nuclear power industries. Reviews technologies and standards for industrial wireless sensor networks. Considers particular applications for the technology and their ability to reduce costs, increase productivity, and ease maintenance. Focuses on industry needs and standardization efforts regarding reliability, security, performance, power consumption, and integration.

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, looking at advances and their impacts on the semiconductor industry and applications. It looks into the future of alternative technologies and their potential impacts on the industry.

High Performance Silicon Imaging: Fundamentals and Applications of CMOS and CCD Sensors, Second Edition, covers the fundamentals of silicon image sensors, addressing existing performance issues and current and emerging solutions. Silicon imaging is a fast growing area of the semiconductor industry. Its use in cell phone cameras is already well established, with emerging applications including web, security, automotive and digital cinema cameras. The book has been revised to reflect the latest state-of-the art developments in the field, including 3D imaging, advances in achieving lower signal noise, and new applications for consumer markets. The fundamentals section has also been expanded to include a chapter on the characterization and testing of CMOS and CCD sensors that is crucial to the success of new applications. This book is an excellent resource for both academics and engineers working in the optics, photonics, semiconductor and electronics industries. Covers the fundamentals of silicon-based image sensors and technical advances, focusing on performance issues. Looks at image sensors in applications, such as mobile phones, scientific imaging, and TV broadcasting, and in automotive, consumer, and biomedical applications. Addresses the theory behind 3D imaging and 3D sensor development, including challenges and opportunities.

Robust Design of Microelectronics Assemblies Against Mechanical Shock, Temperature and Moisture discusses how the reliability of packaging components is a prime concern to electronics manufacturers. The text presents a thorough review of this important field of research, providing users with a practical guide that discusses theoretical aspects, experimental results, and modeling techniques. The authors use their extensive experience to produce detailed chapters covering temperature, moisture, and mechanical shock induced failure, adhesive interconnects, and viscoelasticity. Useful program files and macros are also included. Discusses how the reliability of packaging components is a prime concern to electronics manufacturers. Presents a thorough review of this important field of research, providing users with a practical guide that discusses theoretical aspects, experimental results, and modeling techniques. Includes program files and macros for additional study.

Sensors are used for civil infrastructure performance assessment and health monitoring, and have evolved significantly through developments in materials and methodologies. Sensor Technologies for Civil Infrastructure Volume II provides an overview of sensor data analysis and case studies in assessing and monitoring civil infrastructures. Part one focuses on sensor data interrogation and decision making,
with chapters on data management technologies, data analysis, techniques for damage detection and structural damage detection. Part two is made up of case studies in assessing and monitoring specific structures such as bridges, towers, buildings, dams, tunnels, pipelines, and roads. Sensor Technologies for Civil Infrastructure provides a standard reference for structural and civil engineers, electronics engineers, and academics with an interest in the field. Provides an in-depth examination of sensor data management and analytical techniques for fault detection and localization, looking at prognosis and life-cycle assessment Includes case studies in assessing structures such as bridges, buildings, super-tall towers, dams, tunnels, wind turbines, railroad tracks, nuclear power plants, offshore structures, levees, and pipelines

Photodetectors: Materials, Devices and Applications discusses the devices that convert light to electrical signals, key components in communication, computation, and imaging systems. In recent years, there has been significant improvement in photodetector performance, and this important book reviews some of the key advances in the field. Part one covers materials, detector types, and devices, and includes discussion of silicon photonics, detectors based on reduced dimensional charge systems, carbon nanotubes, graphene, nanowires, low-temperature grown gallium arsenide, plasmonic, Si photomultiplier tubes, and organic photodetectors, while part two focuses on important applications of photodetectors, including microwave photonics, communications, high-speed single photon detection, THz detection, resonant cavity enhanced photodetection, photodetectors, and imaging. Reviews materials, detector types and devices Addresses fabrication techniques, and the advantages and limitations and different types of photodetector Considers a range of application for this important technology Includes discussions of silicon photonics, detectors based on reduced dimensional charge systems, carbon nanotubes, graphene, nanowires, and more

Smart sensors and MEMS can include a variety of devices and systems that have a high level of functionality. They do this either by integrating multiple sensing and actuating modes into one device, or else by integrating sensing and actuating with information processing, analog-to-digital conversion and memory functions. Part one outlines the industrial applications for smart sensors, covering direct interface circuits for sensors, capacitive sensors for displacement measurement in the sub-nanometer range, integrated inductive displacement sensors for harsh industrial environments, advanced silicon radiation detectors in the vacuum ultraviolet (VUV) and extreme ultraviolet (EUV) spectral range, and advanced optical incremental sensors (encoders and interferometers), among other topics. The second part of the book describes the industrial applications of smart micro-electro-mechanical systems (MEMS). Some of the topics covered in this section include microfabrication technologies used for creating smart devices for industrial applications, microactuators, dynamic behaviour of smart MEMS in industrial applications, MEMS integrating motion and displacement sensors, MEMS print heads for industrial printing, Photovoltaic and fuel cells in power MEMS for smart energy management, and radio frequency (RF)-MEMS for smart communication microsystems. Smart sensors and MEMS is invaluable reference for academics, materials scientists and electrical engineers working in the microelectronics, sensors and micromechanics industry, and engineers looking for industrial sensing, monitoring and automation solutions. Outlines industrial applications for smart sensors and smart MEMS Covers smart sensors including capacitive, inductive, resistive and magnetic sensors and sensors to detect radiation and measure temperature Covers smart MEMS including power MEMS, radio frequency MEMS, optical MEMS, inertial MEMS, and microreaction chambers

Composite Magnetoelectrics: Materials, Structures, and Applications gives the reader a summary of the theory behind magnetoelectric phenomena, later introducing magnetoelectric materials and structures and the techniques used to fabricate and characterize them. Part two of the book looks at magnetoelectric devices. Applications include magnetic and current sensors, transducers for energy harvesting, microwave and millimeter wave devices, miniature antennas and medical imaging. The final chapter discusses progress towards magnetoelectric memory. Summarises clearly the theory behind magnetoelectric phenomena Strong coverage of fabrication and characterisation techniques Reviews a broad range of current and potential magnetoelectric devices

Biological Identification provides a detailed review of, and potential future developments in, the technologies available to counter the threats to life and health posed by natural pathogens, toxins, and bioterrorism agents. Biological identification systems must be fast, accurate, reliable, and easy to use. It is also important to employ the most suitable technology in dealing with any particular threat. This book covers the fundamentals of these vital systems and lays out possible advances in the technology. Part one covers the essentials of DNA and RNA sequencing for the identification of pathogens, including next generation sequencing (NGS), polymerase chain reaction (PCR) methods, isothermal amplification, and bead array technologies. Part two addresses a variety of approaches to making identification systems portable, tackling the special requirements of smaller, mobile systems in fluid movement, power usage, and sample preparation. Part three focuses on a range of optical methods and their advantages. Finally, part four describes a unique approach to sample preparation and a promising approach to identification using mass spectrometry. Biological Identification is a useful resource for academics and engineers involved in the microelectronics and sensors industry, and for companies, medical organizations and military bodies looking for biodetection solutions. Covers DNA sequencing of pathogens, lab-on-chip, and portable systems for biodetection and analysis Provides an in-depth description of optical systems and explores sample preparation and mass spectrometry-based biological analysis

Silicon-On-Insulator (SOI) Technology: Manufacture and Applications covers SOI transistors and circuits, manufacture, and reliability. The book also looks at applications such as memory, power devices, and photonics. The book is divided into two parts; part one covers SOI materials and manufacture, while part two covers SOI devices and applications. The book begins with chapters that introduce techniques for manufacturing SOI wafer technology, the electrical properties of advanced SOI materials, and modeling short-
channel SOI semiconductor transistors. Both partially depleted and fully depleted SOI technologies are considered. Chapters 6 and 7 concern junctionless and fin-on-oxide field effect transistors. The challenges of variability and electrostatic discharge in CMOS devices are also addressed. Part two covers recent and established technologies. These include SOI transistors for radio frequency applications, SOI CMOS circuits for ultralow-power applications, and improving device performance by using 3D integration of SOI integrated circuits. Finally, chapters 13 and 14 consider SOI technology for photonic integrated circuits and for micro-electromechanical systems and nano-electromechanical sensors. The extensive coverage provided by Silicon-On-Insulator (SOI) Technology makes the book a central resource for those working in the semiconductor industry, for circuit design engineers, and for academics. It is also important for electrical engineers in the automotive and consumer electronics sectors. Covers SOI transistors and circuits, as well as manufacturing processes and reliability. Looks at applications such as memory, power devices, and photonics.