
The first edition of this book was published in 2008 and it went on to become IWA Publishing’s bestseller. Clearly there was a need for it because over the twenty years prior to 2008, the knowledge and understanding of wastewater treatment had advanced extensively and moved away from empirically-based approaches to a fundamental first-
principles approach based on chemistry, microbiology, physical and bioprocess engineering, mathematics and modelling. However the quantity, complexity and diversity of these new developments was overwhelming for young water professionals, particularly in developing countries without readily available access to advanced-level tertiary education courses in wastewater treatment. For a whole new generation of young scientists and engineers entering the wastewater treatment profession, this book assembled and integrated the postgraduate course material of a dozen or so professors from research groups around the world who have made significant contributions to the advances in wastewater treatment. This material had matured to the degree that it had been codified into mathematical models for simulation with computers. The first edition of the book offered, that upon completion of an in-depth study of its contents, the modern approach of modelling and simulation in wastewater treatment plant design and operation could be embraced with deeper insight, advanced knowledge and greater confidence, be it activated sludge, biological nitrogen and phosphorus removal, secondary settling tanks, or biofilm systems.

However, the advances and developments in wastewater treatment have accelerated over the past 12 years since publication of the first edition. While all the chapters of the first edition have been updated to accommodate these advances and developments, some, such as granular sludge, membrane bioreactors, sulphur conversion-based bioprocesses and biofilm reactors which were new in 2008, have matured into new industry approaches and are also now included in this second edition. The target readership of this second edition remains the young water professionals, who will still be active in the field of protecting our precious water resources long after the aging professors who are leading some of these advances have retired. The authors, all still active in the field, are aware that cleaning dirty water has become more complex but that it is even more urgent now than 12 years ago, and offer this second edition to help the young water professionals engage with the scientific and bioprocess engineering principles of wastewater treatment science and technology with deeper insight, advanced knowledge and greater confidence built on stronger competence.

This book bridges the current gap between the theory of symmetry-based dynamics and its application to model and
analyze complex systems. As an alternative approach, the authors use the symmetry of the system directly to formulate the appropriate models, and also to analyze the dynamics. Complex systems with symmetry arise in a wide variety of fields, including communication networks, molecular dynamics, manufacturing businesses, ecosystems, underwater vehicle dynamics, celestial and spacecraft dynamics and continuum mechanics. A general approach for their analysis has been to derive a detailed model of their individual parts, connect the parts and note that the system contains some sort of symmetry, then attempt to exploit this symmetry in order to simplify numerical computations. This approach can result in highly complicated models that are difficult to analyze even numerically. The alternative approach, while nonstandard, is not entirely new among the mathematics community. However, there is much less familiarity with the techniques of symmetry-breaking bifurcation, as they apply to the engineering, design and fabrication, of complex systems, in particular, nonlinear sensor devices with special emphasis on the conceptualization and development of new technologies of magnetic sensors such as fluxgate magnetometers and SQUID (Superconducting Quantum Interference Devices), E-- (electric-field) sensors, and communication and navigation systems that require multiple frequencies of operation, such as radar and antenna devices as well as gyroscopic systems.

This book comprises select peer-reviewed proceedings of the Control Instrumentation System Conference (CISCON 2019) in the specialized area of cyber-physical systems. The topics include current trends in the areas of instrumentation, sensors and systems, industrial automation and control, image and signal processing, robotics, renewable energy, power systems and power drives, and artificial intelligence technologies. Wide-ranging applications in various fields such as aerospace, biomedical, optical imaging and biomechanics are covered in the book. The contents of this book are useful for students, researchers as well as industry professionals working in the field of instrumentation and control engineering.

INTERNATIONAL WORKSHOPS (at IAREC'17) (This book includes English (main) and Turkish languages) International Workshop on Mechanical Engineering International Workshop on Mechatronics Engineering International Workshop on Energy
Ferroelectric materials exhibit a wide spectrum of functional properties, including switchable polarization, piezoelectricity, high non-linear optical activity, pyroelectricity, and non-linear dielectric behaviour. These properties are crucial for application in electronic devices such as sensors, microactuators, infrared detectors, microwave phase filters and, non-volatile memories. This unique combination of properties of ferroelectric materials has attracted researchers and engineers for a long time. This book reviews a wide range of diverse topics related to the phenomenon of ferroelectricity (in the bulk as well as thin film form) and provides a forum for scientists, engineers, and students working in this field. The present book containing 24 chapters is a result of contributions of experts from international scientific community working in different aspects of ferroelectricity related to experimental and theoretical work aimed at the understanding of ferroelectricity and their utilization in devices. It provides an up-to-date insightful coverage to the recent advances in the synthesis, characterization, functional properties and potential device applications in specialized areas.

The purpose of this book is to provide an up-to-date view of
latest research advances in the design of efficient small-scale energy harvesters through contributions of internationally recognized researchers. The book covers the physics of the energy conversion, the elaboration of electroactive materials and their application to the conception of a complete microgenerator, and is organized according to the input energy source. I sincerely hope you will find this book as enjoyable to read as it was to edit, and that it will help your research and/or give new ideas in the wide field of energy harvesting.

Provides a systematic overview of a hot research area, examining the principles and theories of energy harvesting communications. This book provides a detailed and advanced level introduction to the fundamentals of energy harvesting techniques and their use in state-of-the-art communications systems. It fills the gap in the market by covering both basic techniques in energy harvesting and advanced topics in wireless communications. More importantly, it discusses the application of energy harvesting in communications systems to give readers at different levels a full understanding of these most recent advances in communications technologies. The first half of Energy Harvesting Communications: Principles and Theories focuses on the challenges brought by energy harvesting in communications. The second part of the book looks at different communications applications enhanced by energy harvesting. It offers in-depth chapters that: discuss different energy sources harvested for communications; examine the energy harvesters used for widely used sources; study the physical layer and upper layer of the energy harvesting communications device; and investigate wireless powered communications, energy harvesting cognitive radios, and energy harvesting relaying as applications. Methodically examines the state-of-the-art of energy harvesting techniques. Provides comprehensive coverage from basic energy harvesting sources and devices to the end users of these sources and devices. Looks at the fundamental principles of energy harvesting communications, and biomedical application and intra-body communications. Written in a linear order so that beginners can learn the subject and experienced users can attain a broader view. Written by a renowned expert in the field, Energy Harvesting Communications: Principles and Theories is an excellent resource for students, researchers, and others interested in the subject.
This volume presents a collection of rail orientated research articles, covering a variety of topics on rail operations research and management of rail systems as well as innovation, particularly focusing on sustainability aspects. The material consists of the most recent research work of the authors. The authorship is international, which makes it an interesting read for rail academics and professionals around the world. Although the material has a rail research focus the material is also excellent for preparation and delivery of rail, transport and logistics orientated courses and programmes. The target audience primarily comprises research experts in transport research, but the book may also be beneficial for graduate students alike.

Wind Turbines and Aerodynamics Energy Harvesters not only presents the most research-focused resource on aerodynamic energy harvesters, but also provides a detailed review on aeroacoustics characteristics. The book considers all developing aspects of 3D printed miniature and large-size Savonious wind harvesters, while also introducing and discussing bladeless and aeroelastic harvesters. Following with a review of Off-shore wind turbine aerodynamics modeling and measurements, the book continues the discussion by comparing the numerical codes for floating offshore wind turbines. Each chapter contains a detailed analysis and numerical and experimental case studies that consider recent research design, developments, and their application in practice. Written by an experienced, international team in this cross-disciplinary field, the book is an invaluable reference for wind power engineers, technicians and manufacturers, as well as researchers examining one of the most promising and efficient sources of renewable energy. Offers numerical models and case studies by experienced authors in this field Contains an overview and analysis of the latest research Explores 3D printing technology and the production of wind harvesters for real applications Includes, and uses, ANSYS FLUENT case files

Wireless sensors and sensor networks (WSNs) are nowadays becoming increasingly important due to their decisive advantages. Different trends towards the Internet of Things (IoT), Industry 4.0 and 5G Networks address massive sensing and admit to have wireless sensors delivering measurement data directly to the Web in a reliable and easy manner.
These sensors can only be supported, if sufficient energy efficiency and flexible solutions are developed for energy-aware wireless sensor nodes. In the last years, different possibilities for energy harvesting have been investigated showing a high level of maturity. This book gives therefore an overview on fundamentals and techniques for energy harvesting and energy transfer from different points of view. Different techniques and methods for energy transfer, management and energy saving on network level are reported together with selected interesting applications. The book is interesting for researchers, developers and students in the field of sensors, wireless sensors, WSNs, IoT and manifold application fields using related technologies. The book is organized in four major parts. The first part of the book introduces essential fundamentals and methods, while the second part focusses on vibration converters and hybridization. The third part is dedicated to wireless energy transfer, including both RF and inductive energy transfer. Finally, the fourth part of the book treats energy saving and management strategies. The main contents are:

- Essential fundamentals and methods of wireless sensors
- Energy harvesting from vibration
- Hybrid vibration energy converters
- Electromagnetic transducers
- Piezoelectric transducers
- Magneto-electric transducers
- Non-linear broadband converters
- Energy transfer via magnetic fields
- RF energy transfer
- Energy saving techniques
- Energy management strategies
- Energy management on network level
- Applications in agriculture
- Applications in structural health monitoring
- Application in power grids

Prof. Dr. Olfa Kanoun is professor for measurement and sensor technology at Chemnitz university of technology. She is specialist in the field of sensors and sensor systems design.

This book investigates in detail piezoelectric energy harvesting (PEH) technology, assessing its potential us to replace conventional electrochemical batteries with kinetic energy harvesters as sustainable power supplies in wireless sensor network (WSN) devices and mobile electronics, which are originally exposed to ambient vibration. Studies on PEH have attracted engineers and scientists from various disciplines, such as electrical, mechanical, materials, civil and biomedical engineering. Pursuing a holistic approach, the book establishes a fundamental framework for this topic, while emphasizing the importance of integrated analysis and the significant influence of circuit issues in
the design and optimization of PEH systems. This approach will help readers from different disciplines recognize the essential aspects of and milestones towards the optimization of PEH systems in practice. The book is intended for undergraduate and graduate students who are interested in energy harvesting technology, researchers investigating kinetic energy harvesting systems, and structure/circuit design engineers working on self-powered WSNs or other energy harvesting applications.

System-level modeling of MEMS - microelectromechanical systems - comprises integrated approaches to simulate, understand, and optimize the performance of sensors, actuators, and microsystems, taking into account the intricacies of the interplay between mechanical and electrical properties, circuitry, packaging, and design considerations. Thereby, system-level modeling overcomes the limitations inherent to methods that focus only on one of these aspects and do not incorporate their mutual dependencies. The book addresses the two most important approaches of system-level modeling, namely physics-based modeling with lumped elements and mathematical modeling employing model order reduction methods, with an emphasis on combining single device models to entire systems. At a clearly understandable and sufficiently detailed level the readers are made familiar with the physical and mathematical underpinnings of MEMS modeling. This enables them to choose the adequate methods for the respective application needs. This work is an invaluable resource for all materials scientists, electrical engineers, scientists working in the semiconductor and/or sensor industry, physicists, and physical chemists.

In the early 21st century, research and development of sustainable energy harvesting (EH) technologies have started. Since then, many EH technologies have evolved, advanced and even been successfully developed into hardware prototypes for sustaining the operational lifetime of low-power electronic devices like mobile gadgets, smart wireless sensor networks, etc. Energy harvesting is a technology that harvests freely available renewable energy from the ambient environment to recharge or put used energy back into the energy storage devices without the hassle of disrupting or even discontinuing the normal operation of the specific application. With the prior knowledge and
experience developed over a decade ago, progress of sustainable EH technologies research is still intact and ongoing. EH technologies are starting to mature and strong synergies are formulating with dedicate application areas. To move forward, now would be a good time to setup a review and brainstorm session to evaluate the past, investigate and think through the present and understand and plan for the future sustainable energy harvesting technologies.

This book begins with the premise that energy demands are directing scientists towards ever-greener methods of power management, so highly integrated power control ICs (integrated chip/circuit) are increasingly in demand for further reducing power consumption. A timely and comprehensive reference guide for IC designers dealing with the increasingly widespread demand for integrated low power management includes new topics such as LED lighting, fast transient response, DVS-tracking and design with advanced technology nodes. Leading author (Chen) is an active and renowned contributor to the power management IC design field, and has extensive industry experience. Accompanying website includes presentation files with book illustrations, lecture notes, simulation circuits, solution manuals, instructors’ manuals, and program downloads.

This book deals with the challenge of exploiting ambient vibrational energy which can be used to power small and low-power electronic devices, e.g. wireless sensor nodes. Generally, particularly for low voltage amplitudes, low-loss rectification is required to achieve high conversion efficiency. In the special case of piezoelectric energy harvesting, pulsed charge extraction has the potential to extract more power compared to a single rectifier. For this purpose, a fully autonomous CMOS integrated interface circuit for piezoelectric generators which fulfills these requirements is presented. Due to these key properties enabling universal usage, other CMOS designers working in the field of energy harvesting will be encouraged to use some of the shown structures for their own implementations. The book is unique in the sense that it highlights the design process from scratch to the final chip. Hence, it gives the designer a comprehensive guide of how to (i) setup an appropriate harvester model to get realistic simulation results, (ii) design the integrated circuits for low power operation, (iii) setup a laboratory measurement environment.
in order to extensively characterize the chip in combination with the real harvester and finally, (iv) interpret the simulation/measurement results in order to improve the chip performance. Since the dimensions of all devices (transistors, resistors etc.) are given, readers and other designers can easily re-use the presented circuit concepts.

This book introduces an innovative and high-efficiency technology for mechanical energy harvesting. The book covers the history and development of triboelectric nanogenerators, basic structures, working principles, performance characterization, and potential applications. It is divided into three parts: Part A illustrates the fundamental working modes of triboelectric nanogenerators with their prototype structures and theoretical analysis; Part B and Part C introduce two categories of applications, namely self-powered systems and self-powered active sensors. The book will be an ideal guide to scientists and engineers beginning to study triboelectric nanogenerators or wishing to deepen their knowledge of the field. Readers will be able to place the technical details about this technology in context, and acquire the necessary skills to reproduce the experimental setups for fabrication and measurement.

Incentives provided by European governments have resulted in the rapid growth of the photovoltaic (PV) market. Many PV modules are now commercially available, and there are a number of power electronic systems for processing the electrical power produced by PV systems, especially for grid-connected applications. Filling a gap in the literature, Power Electronics and Control Techniques for Maximum Energy Harvesting in Photovoltaic Systems brings together research on control circuits, systems, and techniques dedicated to the maximization of the electrical power produced by a photovoltaic (PV) source. Tools to Help You Improve the Efficiency of Photovoltaic Systems The book supplies an overview of recent improvements in connecting PV systems to the grid and highlights various solutions that can be used as a starting point for further research and development. It begins with a review of methods for modeling a PV array working in uniform and mismatched conditions. The book then discusses several ways to achieve the best maximum power point tracking (MPPT) performance. A chapter focuses on MPPT efficiency, examining the design of the parameters that affect algorithm performance. The authors also address the
maximization of the energy harvested in mismatched conditions, in terms of both power architecture and control algorithms, and discuss the distributed MPPT approach. The final chapter details the design of DC/DC converters, which usually perform the MPPT function, with special emphasis on their energy efficiency. Get Insights from the Experts on How to Effectively Implement MPPT Written by well-known researchers in the field of photovoltaic systems, this book tackles state-of-the-art issues related to how to extract the maximum electrical power from photovoltaic arrays under any weather condition. Featuring a wealth of examples and illustrations, it offers practical guidance for researchers and industry professionals who want to implement MPPT in photovoltaic systems.

Piezoelectric Aeroelastic Energy Harvesting explains the design and implementation of piezoelectric energy harvesting devices based on fluid-structure interaction. There is currently an increase in demand for low power electronic instruments in a range of settings, and recent advances have driven their energy consumption downwards. As a result, the possibility to extract energy from an operational environment is of growing significance to industry and academic research globally. This book solves problems related to the integration of smart structures with the aeroelastic system, addresses the importance of the aerodynamic model on accurate prediction of the performance of the energy harvester, describes the overall effect of the piezoelectric patch on the dynamics of the system, and explains different mechanisms for harvesting energy via fluid-structure interaction. This wealth of innovative technical information is supported by introductory chapters on piezoelectric materials, energy harvesting and circuits, and fluid structure interaction, opening this interdisciplinary topic up for readers with a range of backgrounds. Provides new designs of piezoelectric energy harvesters for fluid-structure interaction Explains how to correctly model aerodynamics for effective aeroelastic energy harvesting Numerical examples allow the reader to practice the design, modeling and implementation of piezoelectric energy harvesting devices

Kinetic energy harvesting converts movement or vibrations into electrical energy, enables battery free operation of wireless sensors and autonomous devices and facilitates
their placement in locations where replacing a battery is not feasible or attractive. This book provides an introduction to operating principles and design methods of modern kinetic energy harvesting systems and explains the implications of harvested power on autonomous electronic systems design. It describes power conditioning circuits that maximize available energy and electronic systems design strategies that minimize power consumption and enable operation. The principles discussed in the book will be supported by real case studies such as battery-less monitoring sensors at water waste processing plants, embedded battery-less sensors in automotive electronics and sensor-networks built with ultra-low power wireless nodes suitable for battery-less applications.

This book offers a comprehensive review of renewable energy sources and optimization strategies in hybrid power systems (HPSs). It analyses the main issues and challenges in the renewable (REW) HPS field, particularly those using fuel cell (FC) systems as their main source of energy. It then offers innovative solutions to these issues, comparing them to solutions currently found in the literature. The book discusses optimization algorithms and energy management strategies. The focus is chiefly on FC net power maximization and fuel economy strategies based on global optimization. The last two chapters discuss energy harvesting from photovoltaic systems and how to mitigate energy variability in REW FC HPS. The main content is supplemented by numerous examples and simulations. Academics, students and practitioners in relevant industrial branches interested in REW HPS finds it of considerable interest, as a reference book or for building their own HPSs based on the examples provided.

The transformation of vibrations into electric energy through the use of piezoelectric devices is an exciting and rapidly developing area of research with a widening range of applications constantly materialising. With Piezoelectric Energy Harvesting, world-leading researchers provide a timely and comprehensive coverage of the electromechanical modelling and applications of piezoelectric energy harvesters. They present principal modelling approaches, synthesizing fundamental material related to mechanical, aerospace, civil, electrical and materials engineering disciplines for vibration-based energy harvesting using
piezoelectric transduction. Piezoelectric Energy Harvesting provides the first comprehensive treatment of distributed-parameter electromechanical modelling for piezoelectric energy harvesting with extensive case studies including experimental validations, and is the first book to address modelling of various forms of excitation in piezoelectric energy harvesting, ranging from airflow excitation to moving loads, thus ensuring its relevance to engineers in fields as disparate as aerospace engineering and civil engineering. Coverage includes: Analytical and approximate analytical distributed-parameter electromechanical models with illustrative theoretical case studies as well as extensive experimental validations Several problems of piezoelectric energy harvesting ranging from simple harmonic excitation to random vibrations Details of introducing and modelling piezoelectric coupling for various problems Modelling and exploiting nonlinear dynamics for performance enhancement, supported with experimental verifications Applications ranging from moving load excitation of slender bridges to airflow excitation of aeroelastic sections A review of standard nonlinear energy harvesting circuits with modelling aspects.

This timely new resource explores the available energy sources within commercial and residential buildings and the available technologies for energy harvesting. Energy harvesting within built environments is presented using strong research and commercial examples. This book includes clear and concise case studies on solar cell powered sensor nodes for emotion monitoring systems in ambient assistive living environments and inductive/RF power transfers. Thermoelectric energy harvesting and power management circuit design, airflow and vibration energy harvesting is also explored. The book concludes with a look at the future of energy harvesting in buildings.

Developments in the connected fields of solid state physics, bioengineering, mechatronics and nanometrology have had a profound effect on the emergence of modern technologies and their influence on our lives. In all of these fields, understanding and improving the basic underlying materials is of crucial importance for the development of systems and applications. The International Conference Inter-Academia 2016 has successfully married these fields and become a regular feature in the conference calendar. It consisted of
seven thematic areas in the field of material science, nanotechnology, biotechnology, plasma physics, metrology, robotics, sensors and devices. The book Recent Global Research and Education: Technological Challenges is intended for use in academic, government and industry R&D departments, as an indispensible reference tool for the years to come. Also, we hope that the volume can serve the world community as the definitive reference source in Advances in Intelligent Systems and Computing. This book comprises carefully selected 68 contributions presented at the 15th International Conference on Global Research and Education INTER-ACADEMIA 2016, organized by Faculty of Mechatronics, Warsaw University of Technology, on September 26-28, in Warsaw, Poland. It is the second volume in series, following the edition in 2015. It brings together the knowledge and experience of 150 leading researchers representing 13 countries. We would like to thank all contributors and reviewers for helping us to put-together this book.

This book describes the fundamentals and principles of energy harvesting and provides the necessary theory and background to develop energy harvesting power supplies. It explains the overall system design and gives quantitative assumptions on environmental energy. It explains different system blocks for an energy harvesting power supply and the trade-offs. The text covers in detail different energy transducer technologies such as piezoelectric, electrodynamic, and thermoelectric generators and solar cells from the material to the component level and explains the appropriate power management circuits required in these systems. Furthermore, it describes and compares storage elements such as secondary batteries and supercapacitors to select the most appropriate one for the application. Besides power supplies that use ambient energy, the book presents systems that use electromagnetic fields in the radio frequency range. Finally, it discusses different application fields and presents examples of self-powered electronic systems to illustrate the content of the preceding chapters.

This book constitutes the thoroughly refereed post-conference proceedings of the 5th International Joint Conference on Biomedical Engineering Systems and Technologies, BIOSTEC 2012, held in Vilamoura, Portugal, in February 2012. The 26 revised full papers presented together...
with one invited lecture were carefully reviewed and selected from a total of 522 submissions. The papers cover a wide range of topics and are organized in four general topical sections on biomedical electronics and devices; bioinformatics models, methods and algorithms; bio-inspired systems and signal processing; health informatics.

Polymers are the only material that can act as matrices for the incorporation of the widest range of ceramics, nanotubes, nanoparticles, as well as a variety of short and continuous fibres, to create new building and structural materials. Polymer science and technology is a fast growing and dynamic area of study. With this in mind, the author has followed a multidisciplinary approach covering major contemporary advancements in the subject. Largely self-contained, the book includes all essential aspects of the topic such as: polymer nanocomposites, electrospinning, and polymers in electronic applications. It offers extensive guidance on fly-ash-based polymer composites, conducting polymers, shape memory polymers, and thermoset polymer nanocomposites. There is also a review chapter on thermoplastic elastomers based on block copolymers and dynamically cured rubber-plastic blends. Ferroelectric polymer nanocomposites, polymer-based dielectrics, organic field effect transistors, super hydrophobic polymers, and biopolymers are also extensively covered. The content has been classified into six sections of polymer materials and technology: novel polymer composites, nano polymer technology, micro-macro-nano testing and characterization of polymers, speciality polymers, bio-based and biocompatible polymer materials, and new polymer applications. The book is aimed specifically at graduate students and researchers engaged in the study of polymer science and engineering and generically at those studying mechanical engineering, chemical engineering, materials science, and engineering, as well as related industry professionals.

Kinetic energy harvesting converts movement or vibrations into electrical energy, enables battery free operation of wireless sensors and autonomous devices and facilitates their placement in locations where replacing a battery is not feasible or attractive. This book provides an introduction to operating principles and design methods of modern kinetic energy harvesting systems and explains the implications of harvested power on autonomous electronic
systems design. It describes power conditioning circuits that maximize available energy and electronic systems design strategies that minimize power consumption and enable operation. The principles discussed in the book will be supported by real case studies such as battery-less monitoring sensors at water waste processing plants, embedded battery-less sensors in automotive electronics and sensor-networks built with ultra-low power wireless nodes suitable for battery-less applications.

With its inclusion of the fundamentals, systems and applications, this reference provides readers with the basics of micro energy conversion along with expert knowledge on system electronics and real-life microdevices. The authors address different aspects of energy harvesting at the micro scale with a focus on miniaturized and microfabricated devices. Along the way they provide an overview of the field by compiling knowledge on the design, materials development, device realization and aspects of system integration, covering emerging technologies, as well as applications in power management, energy storage, medicine and low-power system electronics. In addition, they survey the energy harvesting principles based on chemical, thermal, mechanical, as well as hybrid and nanotechnology approaches. In unparalleled detail this volume presents the complete picture -- and a peek into the future -- of micro-powered microsystems.

This book presents a selection of papers from the 2017 World Conference on Information Systems and Technologies (WorldCIST'17), held between the 11st and 13th of April 2017 at Porto Santo Island, Madeira, Portugal. WorldCIST is a global forum for researchers and practitioners to present and discuss recent results and innovations, current trends, professional experiences and challenges involved in modern Information Systems and Technologies research, together with technological developments and applications. The main topics covered are: Information and Knowledge Management; Organizational Models and Information Systems; Software and Systems Modeling; Software Systems, Architectures, Applications and Tools; Multimedia Systems and Applications; Computer Networks, Mobility and Pervasive Systems; Intelligent and Decision Support Systems; Big Data Analytics and Applications; Human-Computer Interaction; Ethics, Computers & Security; Health Informatics; Information
This book covers the topic of vibration energy harvesting using piezoelectric materials. Piezoelectric materials are analyzed in the context of their electromechanical coupling, heterogeneity, microgeometry and interrelations between electromechanical properties. Piezoelectric ceramics and composites based on ferroelectrics are advanced materials that are suitable for harvesting mechanical energy from vibrations using inertial energy harvesting which relies on the resistance of a mass to acceleration and kinematic energy harvesting which couples the energy harvester to the relative movement of different parts of a source. In addition to piezoelectric materials, research efforts to develop optimization methods for complex piezoelectric energy harvesters are also reviewed. The book is important for specialists in the field of modern advanced materials and will stimulate new effective piezotechnical applications.

Energy Harvesting Technologies provides a cohesive overview of the fundamentals and current developments in the field of energy harvesting. In a well-organized structure, this volume discusses basic principles for the design and fabrication of bulk and MEMS based vibration energy systems, theory and design rules required for fabrication of efficient electronics, in addition to recent findings in thermoelectric energy harvesting systems. Combining leading research from both academia and industry onto a single platform, Energy Harvesting Technologies serves as an important reference for researchers and engineers involved with power sources, sensor networks and smart materials.

Combining different perspectives from materials science, engineering, and computer science, this reference provides a unified view of the various aspects necessary for the successful realization of intelligent systems. The editors and authors are from academia and research institutions with close ties to industry, and are thus able to offer first-hand information here. They adopt a unique, three-tiered approach such that readers can gain basic, intermediate, and advanced topical knowledge. The technology section of the book is divided into chapters covering the basics of sensor integration in materials, the challenges associated with
this approach, data processing, evaluation, and validation, as well as methods for achieving an autonomous energy supply. The applications part then goes on to showcase typical scenarios where material-integrated intelligent systems are already in use, such as for structural health monitoring and smart textiles.

This book constitutes the thoroughly refereed post-conference proceedings of the Third International Conference on Industrial Networks and Intelligent Systems, INISCOM 2017, held in Ho chi Minh City, Vietnam, in September 2017. The 31 revised full papers carefully reviewed and selected from 45 submissions. The papers cover topics on telecommunications systems and networks, intelligent systems, industrial networks, and applications, computer science, security and privacy, hardware and software design.

Fluid-Solid Interaction Dynamics: Theory, Variational Principles, Numerical Methods and Applications gives a comprehensive accounting of fluid-solid interaction dynamics, including theory, numerical methods and their solutions for various FSI problems in engineering. The title provides the fundamental theories, methodologies and results developed in the application of FSI dynamics. Four numerical approaches that can be used with almost all integrated FSI systems in engineering are presented. Methods are linked with examples to illustrate results. In addition, numerical results are compared with available experiments or numerical data in order to demonstrate the accuracy of the approaches and their value to engineering applications. The title gives readers the state-of-the-art in theory, variational principles, numerical modeling and applications for fluid-solid interaction dynamics. Readers will be able to independently formulate models to solve their engineering FSI problems using information from this book. Presents the state-of-the-art in fluid-solid interaction dynamics, providing theory, method and results Takes an integrated approach to formulate, model and simulate FSI problems in engineering Illustrates results with concrete examples Gives four numerical approaches and related theories that are suitable for almost all integrated FSI systems Provides the necessary information for bench scientists to independently formulate, model, and solve physical FSI problems in engineering
Also called energy scavenging, energy harvesting captures, stores, and uses "clean" energy sources by employing interfaces, storage devices, and other units. Unlike conventional electric power generation systems, renewable energy harvesting does not use fossil fuels and the generation units can be decentralized, thereby significantly reducing transmission and distribution losses. But advanced technical methods must be developed to increase the efficiency of devices in harvesting energy from environmentally friendly, "green" resources and converting them into electrical energy. Recognizing this need, Energy Harvesting: Solar, Wind, and Ocean Energy Conversion Systems describes various energy harvesting technologies, different topologies, and many types of power electronic interfaces for stand-alone utilization or grid connection of energy harvesting applications. Along with providing all the necessary concepts and theoretical background, the authors develop simulation models throughout the text to build a practical understanding of system analysis and modeling. With a focus on solar energy, the first chapter discusses the I?V characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, sun tracking systems, maximum power point tracking systems, shading effects, and power electronic interfaces for grid-connected and stand-alone PV systems. It also presents sizing criteria for applications and modern solar energy applications, including residential, vehicular, naval, and space applications. The next chapter reviews different types of wind turbines and electrical machines as well as various power electronic interfaces. After explaining the energy generation technologies, optimal operation principles, and possible utilization techniques of ocean tidal energy harvesting, the book explores near- and offshore approaches for harvesting the kinetic and potential energy of ocean waves. It also describes the required absorber, turbine, and generator types, along with the power electronic interfaces for grid connection and commercialized ocean wave energy conversion applications. The final chapter deals with closed, open, and hybrid-cycle ocean thermal energy conversion systems.

The science of energy harvesting materials is experiencing phenomenal growth and attracting huge interest. Exploiting recently acquired insights into the fundamental mechanisms and principles of photosynthesis, it is now possible to forge entirely new and distinctive molecular materials and
devise artificial photosystems and applications far remote from conventional solar cell technology. In this comprehensive treatment of energy harvesting, a team of internationally acclaimed scientists at the forefront of the subject paint a state-of-the-art picture of modern energy harvesting materials science. Covering all aspects of the subject, ranging from natural plant and bacterial photosystems, through their biologically inspired synthetic analogs, to other photoactive molecular materials such as dendrimers, the book also establishes the theory and underlying principles across the full range of light harvesting systems. With an authoritative, comprehensive and well-referenced content, it will appeal to all students, researchers and technologists interested or involved in solar energy, photobiology and photoactive materials science. Contents: Physical Principles of Efficient Excitation Transfer in Light Harvesting (M K Sener & K Schulten)Design and Synthesis of Light Energy Harvesting Proteins (D Noy et al.)How Purple Bacteria Harvest Light Energy (C J Law et al.)Regulation of Light Harvesting in Photosystem II of Plants, Green Algae and Cyanobacteria (N P A Huner et al.)From Biological to Synthetic Light-Harvesting Materials — The Elementary Steps (T Pullerits & V Sundström)Controlling Excitation Energy and Electron Transfer by Tuning the Electronic Coupling (B Albinsson & J Mårtensson)Energy Transfer and Trapping in Engineered Macromolecules (K P Ghiggino & T A Smith)Dendrimer-Based Devices: Antennae and Amplifiers (O Flomenbom et al.)Energy Harvesting in Synthetic Dendritic Materials (G D D'Ambruoso & D V McGrath)Fullerenes in Biomimetic Donor–Acceptor Networks (N Martín & D M Guldi) Readership: Academic researchers working in universities and photonics institutes; also useful as a graduate level textbook. Keywords:Energy Harvesting;Light Harvesting;Solar Energy;Photosynthesis;Energy Transfer;Dendrimers;Macromolecules;Photosystems;Biomimetic Materials;PhotonicsKey Features:Energy harvesting is a major focus of molecular engineering in modern materials scienceFirst comprehensive account covering both natural and synthetic systems, also extending from synthetic methods and structures to detailed theoryWritten by an outstanding team of internationally recognized authorities

This book constitutes the refereed proceedings of the 16th International Conference on Computer-Aided Architectural
Read Book Energy Harvesting Systems Principles Modeling And Applications

Design Futures, CAAD Futures 2015, held in São Paulo, Brazil, in July 2015. The 33 revised full papers presented were carefully reviewed and selected from 200 submissions. The papers are organized in topical sections on modeling, analyzing and simulating the city; sustainability and performance of the built space; automated and parametric design; building information modelling (BIM); fabrication and materiality; shape studies.

Frequency Analysis of Vibration Energy Harvesting Systems aims to present unique frequency response methods for analyzing and improving vibration energy harvesting systems. Vibration energy is usually converted into heat energy, which is transferred to and wasted in the environment. If this vibration energy can be converted into useful electric energy, both the performance and energy efficiency of machines, vehicles, and structures will be improved, and new opportunities will open up for powering electronic devices. To make use of ambient vibration energy, an effective analysis and design method is established and developed in this book. The book covers a wide range of frequency response analysis methods and includes details of a variety of real-life applications. MATLAB programming is introduced in the first two chapters and used in selected methods throughout the book. Using the methods studied, readers will learn how to analyze and optimize the efficiency of vibration energy systems. This book will be ideal for postgraduate students and researchers in mechanical and energy engineering. Covers a variety of frequency response analysis methods, including Fourier and Laplace transform, transfer function, integration and state space for piezoelectric and electromagnetic vibration energy harvesting analysis Provides coverage of new and traditional methods of analyzing and optimizing the power and efficiency of vibration energy harvesting systems, with MATLAB exercises provided throughout Demonstrates a wide range of real-life applications, such as ocean wave energy conversion, vehicle suspension vibration energy harvesting, and more

This book gathers the best papers presented at the Fourth Italian National Conference on Sensors, held in Catania, Italy, from 21 to 23 February 2018. The book represents an invaluable and up-to-the-minute tool, providing an essential overview of recent findings, strategies and new directions
in the area of sensor research. Further, it addresses various aspects based on the development of new chemical, physical or biological sensors, assembling and characterization, signal treatment and data handling. Lastly, the book applies electrochemical, optical and other detection strategies to relevant issues in the food and clinical environmental areas, as well as industry-oriented applications.

This book contains a selection of papers presented at the 17th AISEM (“Associazione Italiana Sensori e Microsistemi”) National Conference on Sensors and Microsystems, held in Brescia, 5-7 February, 2013. The conference highlighted state-of-the-art results from both theoretical and applied research in the field of sensors and related technologies. This book presents material in an interdisciplinary approach, covering many aspects of the disciplines related to sensors, including physics, chemistry, materials science, biology and applications.

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