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Description. Microbiorobotics is a new engineering discipline that inherently involves a multidisciplinary approach (mechanical engineering, cellular biology, mathematical modeling, control systems, synthetic biology, etc). Building robotics system in the micro scale is an engineering task that has resulted in many important applications, ranging from micromanufacturing techniques to cellular manipulation.

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Microbiorobotics is a new engineering discipline that takes a multidisciplinary approach to accomplish precise manipulation in microscale spaces. Microorganisms have evolved various mechanisms to thrive in microscale environments and therefore are a useful tool to utilize in many applications, ranging from micromanufacturing techniques to cellular manipulation.

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Microbiorobotics: Biologically Inspired Microscale Robotic Systems. Microrobotics is an area that is acknowledged to have massive potential in applications from medicine to manufacturing. This book introduces an inter-disciplinary readership to the toolkit that micro-organisms offer to micro-engineering.

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A bacteria-powered microrobot (BPM) is a hybrid robotic system consisting of an inorganic SU-8 microstructure with bacterial carpets, in which massive arrays of biomolecular flagellar motors work cooperatively.

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Biologically Inspired Microscale Robotic Systems. A volume in Micro and Nano Technologies. Minjun Kim, Agung Julius and U Kei Cheang (Eds.) Microbiorobotics: Biologically Inspired Microscale Robotic Systems, Second Edition presents information on a new engineering discipline that takes a multidisciplinary approach to accomplish precise manipulation of microscale spaces.

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In the context of microrobotics, biological microrobots can directly harness the microorganisms for propulsive and sensing power and synthetic microrobots can mimic the microorganisms’ motions for effective locomotion. This second edition covers new advances and insights that have emerged in recent years.

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Microbiorobotics: Biologically Inspired Microscale Robotic Systems, Second Edition presents information on a new engineering discipline that takes a multidisciplinary approach to accomplish precise manipulation of microscale spaces. Microorganisms have evolved various mechanisms to thrive in microscale environments and are therefore a useful tool for use in many applications, ranging from micromanufacturing techniques, to cellular manipulation.

Microbiorobotics: Biologically Inspired Microscale Robotic Systems, Second Edition presents information on a new engineering discipline that takes a multidisciplinary approach to accomplish precise manipulation of microscale spaces. Microorganisms have evolved various mechanisms to thrive in microscale environments and are therefore a useful tool for use in many applications, ranging from micromanufacturing techniques, to cellular manipulation. In the context of microrobotics, biological microrobots can directly harness the microorganisms for propulsive and sensing power and synthetic microrobots can mimic the microorganisms’ motions for effective locomotion. This second edition covers new advances and insights that have emerged in recent years. Several new chapters have been added on important new research areas, with existing chapters thoroughly revised. In particular, increased coverage is given to fluid dynamics of microswimmers in nature. Gives the reader an understanding of the fundamental changes in dynamics and fabrication techniques in the microenvironment Offers a unique two-pronged approach to microrobotics from a biological perspective, i.e. bioinspired engineering design of biological systems to accomplish engineering tasks Introduces an interdisciplinary readership to the toolkit that micro-organisms offer to micro-engineering

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Microbiorobotics is a new engineering discipline that inherently involves a multidisciplinary approach (mechanical engineering, cellular biology, mathematical modeling, control systems, synthetic biology, etc). Building robotics system in the micro scale is an engineering task that has resulted in many important applications, ranging from micromanufacturing techniques to cellular manipulation. However, it is also a very challenging engineering task. One of the reasons is because many engineering ideas and principles that are used in larger scales do not scale well to the micro-scale. For example, locomotion principles in a fluid do not function in the same way, and the use of rotational motors is impractical because of the difficulty of building of the required components. Microrobotics is an area that is acknowledged to have massive potential in applications from medicine to manufacturing. This book introduces an inter-disciplinary readership to the toolkit that micro-organisms offer to micro-engineering. The design of robots, sensors and actuators faces a range of techology challenges at the micro-scale. This book shows how biological techniques and materials can be used to meet these challenges. World-class multi-disciplanry editors and contributors leverage insights from engineering, mathematical modeling and the life sciences - creating a novel toolkit for microrobotics.

Bioinspired Legged Locomotion: Models, Concepts, Control and Applications explores the universe of legged robots, bringing in perspectives from engineering, biology, motion science, and medicine to provide a comprehensive overview of the field. With comprehensive coverage, each chapter brings outlines, and an abstract, introduction, new developments, and a summary. Beginning with bio-inspired locomotion concepts, the book's editors present a thorough review of current literature that is followed by a more detailed view of bouncing, swinging, and balancing, the three fundamental sub functions of locomotion. This part is closed with a presentation of conceptual models for locomotion. Next, the book explores bio-inspired body design, discussing the concepts of motion control, stability, efficiency, and robustness. The morphology of legged robots follows this discussion, including biped and quadruped designs. Finally, a section on high-level control and applications discusses neuromuscular models, closing the book with examples of applications and discussions of performance, efficiency, and robustness. At the end, the editors share their perspective on the future directions of each area, presenting state-of-the-art knowledge on the subject using a structured and consistent approach that will help researchers in both academia and industry formulate a better understanding of bioinspired legged robotic locomotion and quickly apply the concepts in research or products. Presents state-of-the-art control approaches with biological relevance Provides a thorough understanding of the principles of organization of biological locomotion Teaches the organization of complex systems based on low-dimensional motion concepts/control Acts as a guideline reference for future robots/assistive devices with legged architecture Includes a selective bibliography on the most relevant published articles

The first textbook on micron-scale mobile robotics, introducing the fundamentals of design, analysis, fabrication, and control, and drawing on case studies of existing approaches. Progress in micro- and nano-scale science and technology has created a demand for new microsystems for high-impact applications in healthcare, biotechnology, manufacturing, and mobile sensor networks. The new robotics field of microrobotics has emerged to extend our interactions and explorations to sub-millimeter scales. This is the first textbook on micron-scale mobile robotics, introducing the fundamentals of design, analysis, fabrication, and control, and drawing on case studies of existing approaches. The book covers the scaling laws that can be used to determine the dominant forces and effects at the micron scale; models forces acting on microrobots, including surface forces, friction, and viscous drag; and describes such possible microfabrication techniques as photo-lithography, bulk micromachining, and deep reactive ion etching. It presents on-board and remote sensing methods, noting that remote sensors are currently more feasible; studies possible on-board microactuators; discusses self-propulsion methods that use self-generated local gradients and fields or biological cells in liquid environments; and describes remote microrobot actuation methods for use in limited spaces such as inside the human body. It covers possible on-board powering methods, indispensable in future medical and other applications; locomotion methods for robots on surfaces, in liquids, in air, and on fluid-air interfaces; and the challenges of microrobot localization and control, in particular multi-robot control methods for magnetic microrobots. Finally, the book addresses current and future applications, including noninvasive medical diagnosis and treatment, environmental remediation, and scientific tools.

Polymeric Nanomaterials in Nanotherapeutics describes how polymeric nanosensors and nanorobotics are used for biomedical instrumentation, surgery, diagnosis and targeted drug delivery for cancer, pharmacokinetics, monitoring of diabetes and healthcare. Key areas of coverage include drug administration and formulations for targeted delivery and release of active agents (drug molecules) to non-healthy tissues and cells. The book demonstrates how these are applied to dental work, wound healing, cancer, cardiovascular diseases, neurodegenerative disorders, infectious diseases, chronic inflammatory diseases, metabolic diseases, and more. Methods of administration discussed include oral, dental, topical and transdermal, pulmonary and nasal, ocular, vaginal, and brain drug delivery and targeting. Drug delivery topics treated in several subchapters includes materials for active targeting and cases study of polymeric nanomaterials in clinical trials. The toxicity and regulatory status of therapeutic polymeric nanomaterials are also examined. The book gives a broad perspective on the topic for researchers, postgraduate students and professionals in the biomaterials, biotechnology, and biomedical fields. Shows how the properties of polymeric nanomaterials can be used to create more efficient medical treatments/therapies Demonstrates the potential and range of applications of polymeric nanomaterials in disease prevention, diagnosis, drug development, and for improving treatment outcomes Accurately explains how nanotherapeutics can help in solving problems in the field through the latest technologies and formulations

This book discusses the most significant ways in which design has been applied to sustainability challenges using an evolutionary perspective. It puts forward an innovation framework that is capable of coherently integrating multiple design for sustainability (DfS) approaches developed so far. It is now widely understood that design can and must play a crucial role in the societal transformations towards sustainability. Design can in fact act as a catalyst to trigger and support innovation, and can help to shape the world at different levels: from materials to products, product–service systems, social organisations and socio-technical systems. This book offers a unique perspective on how DfS has evolved in the past decades across these innovation levels, and provides insights on its promising and necessary future development directions. For design scholars, this book will trigger and feed the academic debate on the evolution of DfS and its next research frontiers. For design educators, the book can be used as a supporting tool to design courses and programmes on DfS. For bachelor’s and master’s level design, engineering and management students, the book can be a general resource to provide an understanding of the historical evolution of DfS. For design practitioners and businesses, the book offers a rich set of practical examples, design methods and tools to apply the various DfS approaches in practice, and an innovation framework which can be used as a tool to support change in organisations that aim to integrate DfS in their strategy and processes.

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Investigation on biobased nanomaterials has provided new insights into the rapidly advancing fields of the biomedical and environmental sciences by showing how these nanomaterials are effective in biomedicine and environmental remediation. These particles hold tremendous prospective applications, and are likely to become the next generation of particles in these areas. As such, research is ongoing and the data generated should have the potential for a sustainable future in both the environmental and biomedical fields. This book presents important findings on the role of and identification of novel applications of biobased nanomaterials. Unlike other books in this field, this book focuses entirely on sustainable application and remediation in biomedicine and environmental science. The chapters are written in such a way as to make them accessible to the reader, and furthermore, the volume can be readily adopted as a reference, or used as a guide for further research. This project was based on recent research (the last 5 years) and developed through an extensive literature search. The editors have also compiled some advanced, outstanding texts that should be of benefit to graduate students in their

research.

The Handbook of Silicon Based MEMS Materials and Technologies, Second Edition, is a comprehensive guide to MEMS materials, technologies, and manufacturing that examines the state-of-the-art with a particular emphasis on silicon as the most important starting material used in MEMS. The book explains the fundamentals, properties (mechanical, electrostatic, optical, etc.), materials selection, preparation, manufacturing, processing, system integration, measurement, and materials characterization techniques, sensors, and multi-scale modeling methods of MEMS structures, silicon crystals, and wafers, also covering micromachining technologies in MEMS and encapsulation of MEMS components. Furthermore, it provides vital packaging technologies and process knowledge for silicon direct bonding, anodic bonding, glass frit bonding, and related techniques, shows how to protect devices from the environment, and provides tactics to decrease package size for a dramatic reduction in costs. Provides vital packaging technologies and process knowledge for silicon direct bonding, anodic bonding, glass frit bonding, and related techniques Shows how to protect devices from the environment and decrease package size for a dramatic reduction in packaging costs Discusses properties, preparation, and growth of silicon crystals and wafers Explains the many properties (mechanical, electrostatic, optical, etc.), manufacturing, processing, measuring (including focused beam techniques), and multiscale modeling methods of MEMS structures Geared towards practical applications rather than theory