Bio Inspired Flying Robots Experimental Synthesis Of Autonomous Indoor Flyers Engineering Sciencs Microtechnology

Computational Modelling of Objects Represented in Images: Fundamentals, Methods and Applications III contains all contributions presented at the International Symposium CompIMAGE 2012 - Computational Modelling of Object Presented in Images: Fundamentals, Methods and Applications (Rome, Italy, 5-7 September 2012). The contributions cover the state-o

From simple cases such as hook and latch attachments found in Velcro to articulated-wing flying vehicles, biology often has been used to inspire many creative design ideas. The scientific challenge now is to transform the paradigm into a repeatable and scalable methodology. Biologically Inspired Design explores computational techniques and tools that can help integrate the method into design practice. With an inspiring foreword from Janine Benyus, Biologically Inspired Design contains a dozen chapters written by some of the leading scholars in the transdisciplinary field of bioinspired design, such as Frank Fish, Julian Vincent and Jeannette Yen from biology, and Amaresk Chakrabarti, Satyandra Gupta and Li Shu from engineering. Based in part on discussions at two workshops sponsored by the United States National Science Foundation, this volume introduces and develops several methods and tools for bioinspired design including: Information-processing theories, Natural language techniques, Knowledge-based tools, and Functional approaches and Pedagogical techniques. By exploring these fundamental theories, techniques and tools for supporting biologically inspired design, this volume provides a comprehensive resource for design practitioners wishing to explore the paradigm, an invaluable guide to design educators interested in teaching the method, and a preliminary reading for design researchers wanting to investigate bioinspired design.

This book introduces readers to the latest findings on disaster robotics. It is based on the ImPACT Tough Robotics Challenge, a national project spearheaded by the Japan Cabinet Office that focuses on developing robotics technologies to aid in disaster response, recovery and preparedness. It presents six subprojects that involve robot platforms and several component technologies used in conjunction with robots: cyber rescue canines, which are digitally empowered rescue dogs; serpent-like robots for searching debris; serpent-like robots for plant/infrastructure inspection; UAVs for gathering information on large areas struck by disaster; legged robots for plant/infrastructure inspection in risky places; and construction robots for recovery tasks that require both power and precision. The book offers a valuable source of information for researchers, engineers and practitioners in safety, security and rescue robotics, disaster robotics, and plant and infrastructure maintenance. It will also appeal to a wider demographic, including students and academics, as it highlights application scenarios and the total concept for each robot in various scientific and technical contexts. In addition to a wealth of figures and photos that explain these robots and systems, as well as experimental data, the book includes a comprehensive list of published papers from this project for readers to refer to. Lastly, an external website offers video footage and updated information from the International Rescue System Institute.

This book is a printed edition of the Special Issue "Bio-Inspired Robotics" that was published in Applied Sciences

Mobile robotics is a challenging field with great potential. It covers disciplines including electrical engineering, mechanical engineering, computer science, cognitive science, and social science. It is essential to the design of automated robots, in combination with artificial intelligence, vision, and sensor technologies. Mobile robots are widely used for surveillance, guidance, transportation and entertainment tasks, as well as medical applications. This Special Issue intends to concentrate on recent developments concerning mobile robots and the research surrounding them to enhance studies on the fundamental problems observed in the robots. Various multidisciplinary approaches and integrative contributions including navigation, learning and adaptation, networked system, biologically inspired robots and cognitive methods are welcome contributions to this Special Issue, both from a research and an application perspective.

These are the Proceedings of the 6th International Symposium on Multibody Systems and Mechatronics (MUSME 2017) which was held in Florianópolis, Brazil, October 24-28, 2017. Topics addressed include analysis and synthesis of mechanisms; dynamics of multibody systems; design algorithms for mechatronic systems; simulation procedures and results; prototypes and their performance; robots and micromachines; experimental validations; theory of mechatronic simulation; mechatronic systems; and control of mechatronic systems. The MUSME 2017 Symposium was one of the activities of the FEIbIM Commission for Mechatronics and IFToMM technical Committees for Multibody Dynamics, Robotics and Mechatronics.

Self-organizing approaches inspired from biological systems, such as social insects, genetic, molecular and cellular systems under morphogenesis, and human mental development, has enjoyed great success in advanced robotic systems that need to work in dynamic and changing environments. Compared with classical control methods for robotic systems, the major advantages of bio-inspired self-organizing robotic systems include robustness, self-repair and self-healing in the presence of system failures and/or malfunctions, high adaptability to environmental changes, and autonomous self-organization and self-reconfiguration without a centralized control. "Bio-inspired Self-organizing Robotic Systems" provides a valuable reference for scientists, practitioners and research students working on developing control algorithms for self-organizing engineered collective systems, such as swarm robotic systems, self-reconfigurable modular robots, smart material based robotic devices, unmanned aerial vehicles, and satellite constellations.

The volume LNAI 13054 constitutes the refereed proceedings of the 22th Annual Conference Towards Autonomous Robotic Systems, TAROS 2021, held in Lincoln, UK, in September 2021.*The 45 full papers were carefully reviewed and selected from 66 submissions. Organized in the topical sections "Algorithms" and "Systems", they discuss significant findings and advances in the following areas: artificial intelligence; mechatronics; image processing and computer vision; special purpose and application-based systems; user interfaces and human computer interaction. * The conference was held virtually due to the COVID-19 pandemic.

This book is devoted to mechatronic, chemical, bacteriological, biological, and hybrid systems, utilizing cooperative, networked, swarm, self-organizing, evolutionary and bio-inspired design principles and targeting underwater, ground, air, and space applications. It addresses issues such as open-ended evolution, self-replication, self-development, reliability, scalability, energy foraging, adaptivity, and artificial sociality. The book has been prepared by 52 authors from world-leading research groups in 14 countries. This book covers not only current but also future key technologies and is aimed at anyone who is interested in learning more about collective robotics and how it might affect our society.

This book introduces the topics most relevant to autonomously flying flapping wing robots: flapping-wing design, aerodynamics, and artificial intelligence. Readers can explore these topics in the context of the "Delfly", a flapping wing robot designed at Delft University in The Netherlands. How are tiny fruit flies able to lift their weight, avoid obstacles and predators, and find food or shelter? The first step in emulating this is the creation of a micro flapping wing robot that flies by itself. The challenges are considerable: the design and aerodynamics of flapping wings are still active areas of scientific research, whilst artificial intelligence is subject to extreme limitations deriving from the few sensors and minimal processing onboard. This book conveys the essential insights that lie behind success such as the DelFly Micro and the

DelFly Explorer. The DelFly Micro, with its 3.07 grams and 10 cm wing span, is still the smallest flapping wing MAV in the world carrying a camera, whilst the DelFly Explorer is the world's first flapping wing MAV that is able to fly completely autonomously in unknown environments. The DelFly project started in 2005 and ever since has served as inspiration, not only to many scientific flapping wing studies, but also the design of flapping wing toys. The combination of introductions to relevant fields, practical insights and scientific experiments from the DelFly project make this book a must-read for all flapping wing enthusiasts, be they students, researchers, or engineers.

The Earth has limited material and energy resources while these resources in space are virtually unlimited. Further development of humanity will require going beyond our planet and exploring of extraterrestrial resources and sources of unlimited power. Thus far, all missions to asteroids have been motivated by scientific exploration. However, given recent advancements in various space technologies, mining asteroids for resources is becoming ever more feasible. A significant portion of asteroids value is derived from their location; the required resources do not need to be lifted at a great expense from the surface of the Earth. Resources derived from Asteroid not only can be brought back to Earth but could also be used to sustain human exploration of space and permanent settlements in space. This book investigates asteroids' prospective energy and material resources. It is a collection of topics related to asteroid exploration, and utilization. It presents past and future technologies and solutions to old problems that could become reality in our life time. The book therefore is a great source of condensed information for specialists involved in current and impending asteroid-related activities and a good starting point for space researchers, inventors, technologists and potential investors. Written for researchers, engineers, and businessmen interested in asteroids' exploration and exploitation. Keywords: Asteroids, Asteroid exploration, Asteroid exploitation, Energy sources, Space Resources, Material Resources, In-Situ Resource Utilization, Mining

This book constitutes the refereed proceedings of six workshops collocated with the 13th International Conference on Ad-Hoc Networks and Wireless, ADHOC-NOW Workshops 2014, held in Benidorm, Spain, in June 2014. The 25 revised full papers presented were carefully reviewed and selected from 59 submissions. The papers address the following topics: emerging technologies for smart devices; marine sensors and systems; multimedia wireless ad hoc networks; security in ad hoc networks; smart sensor protocols and algorithms; wireless sensor, actuator and robot networks.

Motor control has established itself as an area of scientific research characterized by a multi-disciplinary approach. The book offers a collection of chapters written by the most prominent researchers in the field.

State-of-the-art overview on bioepoxy polymers as well as their blends and composites -- covering all aspects from fundamentals to applications! Bioepoxy polymers is an emerging area and have attracted more and more attention due to their biodegradability and good thermo-mechanical performance. In recent years, research progress has been made in synthesis, processing, characterization, and applications of bioepoxy blends and composites. Bioepoxy polymers are very promising candidates to replace the traditional thermosetting nonbiodegradable polymers. Bio-Based Epoxy Polymers, Blends and Composites summaries recent research progress on bioepoxy polymers as well as their blends and composites. It covers aspects from synthesis, processing, various characterization techniques to broad spectrum of applications. It provides a correlation of physical properties with macro, micro and nanostructures of the materials. Moreover, research trends, future directions, and opportunities are also discussed. Attracts attention: Bioepoxy polymers are environmentally friendly and considered as a promising candidate to replace the traditional thermosetting nonbiodegradable polymers Highly application-oriented: Bioepoxy polymers can be used in a broad range of applications such as polymer foams, construction, aerospace, automobiles, self-healing systems One-stop reference: Covers all aspects of bioepoxy polymer, their blends and composites, such as synthesis, properties, processing, characterization and applications Broad audience: Attracts attention from both academia and industry

This volume presents a collection of papers presented at the 15th International Symposium of Robotic Research (ISRR). ISRR is the biennial meeting of the International Foundation of Robotic Research (IFRR) and its 15th edition took place in Flagstaff, Arizona on December 9 to December 12, 2011. As for the previous symposia, ISRR 2011 followed up on the successful concept of a mixture of invited contributions and open submissions. Therefore approximately half of the 37 contributions were invited contributions from outstanding researchers selected by the IFRR officers and the program committee, and the other half were chosen among the open submissions after peer review. This selection process resulted in a truly excellent technical program which featured some of the very best of robotic research. The program was organized around oral presentation in a single-track format and included for the first time a small number of interactive presentations. The symposium contributions contained in this volume report on a variety of new robotics research results covering a broad spectrum including perception, manipulation, grasping, vehicles and design, navigation, control and integration, estimation and SLAM.

The International Symposium on Experimental Robotics (ISER) is a series of bi-annual meetings which are organized in a rotating fashion around North America, Europe and Asia/Oceania. The goal of ISER is to provide a forum for research in robotics that focuses on the novelty of theoretical contributions validated by experimental results. This unique reference presents the latest advances in robotics, with ideas that are conceived conceptually and have been explored experimentally.

The Science of Forensic Entomology builds a foundation of biological and entomological knowledge that equips the student to be able to understand and resolve questions concerning the presence of specific insects at a crime scene, in which the answers require deductive reasoning, seasoned observation, reconstruction and experimentation—features required of all disciplines that have hypothesis testing at its core. Each chapter addresses topics that delve into the underlying biological principles and concepts relevant to the insect biology that forms the bases for using insects in matters of legal importance. The book is more than an introduction to forensic entomology as it offers in depth coverage of non-traditional topics, including the biology of maggot masses, temperature tolerances of necrophagous insects; chemical attraction and communication; reproductive strategies of necrophagous flies; archaeoentomology, and use of insects in modern warfare (terrorism). As such it will enable advanced undergraduate and postgraduate students the opportunity to gain a sound knowledge of the principles, concepts and methodologies necessary to use insects and other arthropods in a wide range of legal matters.

This book constitutes the proceedings of the 5th International Conference on Biomimetic and Biohybrid Systems, Living Machines 2016, held in Edinburgh, UK, in July 2016. The 34 full and 27 short papers presented in this volume were carefully reviewed and selected from 63 submissions.The theme of the conference encompasses biomimetic methods for manufacture, repair and recycling inspired by natural processes such as reproduction, digestion, morphogenesis and metamorphosis.

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self-assembly and responsiveness of cellular systems; the biomineral formation in bacteria, plants, invertebrates, and vertebrates; the multi-layer structure of skin; the organization of tissue fibers; DNA structures with metal-mediated artificial base pairs; and the anisotropic microstructure of jellyfish mesogloea. In this volume, sensor and microfluidic technologies combined with surface patterning are explored for the diagnosis and monitoring of diseases. The high throughput combinatorial testing of biomaterials in regenerative medicine is also covered. The second volume presents nature-oriented studies and developments in the field of electromechanical devices and systems.

ISRR, the "International Symposium on Robotics Research", is one of robotics pioneering Symposia, which has established over the past two decades some of the field's most fundamental and lasting contributions. This book presents the results of the seventeenth edition of "Robotics Research" ISRR15, offering a collection of a broad range of topics in robotics. The content of the contributions provides a wide coverage of the current state of robotics research.: the advances and challenges in its theoretical foundation and technology basis, and the developments in its traditional and new emerging areas of applications. The diversity, novelty, and span of the work unfolding in these areas reveal the field's increased maturity and expanded scope and define the state of the art of robotics and its future direction.

The second edition of a comprehensive introduction to all aspects of mobile robotics, from algorithms to mechanisms. Mobile robots range from the Mars Pathfinder mission's teleoperated Sojourner to the cleaning robots in the Paris Metro. This text offers students and other interested readers an introduction to the fundamentals of mobile robotics, spanning the mechanical, motor, sensory, perceptual, and cognitive layers the field comprises. The text focuses on mobility itself, offering an overview of the mechanisms that allow a mobile robot to move through a real world environment to perform its tasks, including locomotion, sensing, localization, and motion planning. It synthesizes material from such fields as kinematics, control theory, signal analysis, computer vision, information theory, artificial intelligence, and probability theory. The book presents the techniques and technology that enable mobility in a series of interacting modules. Each chapter treats a different aspect of mobility, as the book moves from low-level to high-level details. It covers all aspects of mobile robotics, including software and hardware design considerations, related technologies, and algorithmic techniques. This second edition has been revised and updated throughout, with 130 pages of new material on such topics as locomotion, perception, localization, and planning and navigation. Problem sets have been added at the end of each chapter. Bringing together all aspects of mobile robotics into one volume, Introduction to Autonomous Mobile Robots can serve as a textbook or a working tool for beginning practitioners. Curriculum developed by Dr. Robert King, Colorado School of Mines, and Dr. James Conrad, University of North Carolina-Charlotte, to accompany the National Instruments LabVIEW Robotics Starter Kit, are available. Included are 13 (6 by Dr. King and 7 by Dr. Conrad) laboratory exercises for using the LabVIEW Robotics Starter Kit to teach mobile robotics concepts.

Keywords: Biomimetics Robotics Biomimetic intelligence Biomimetic robotics Biomimetics is the development of novel theories and technologies by emulating the models and systems of nature. The transfer of function from biological science into engineering promotes emerging research areas across many disparate disciplines. Recently, advances in biomimetic intelligence and robotics have gained great popularity. Biomimetic robotics are designed with biological characteristics and functions to be applied in different scenarios, such as humanoid robots in the home environment, quadruped robots in the field, and bird-like flying robots in the sky. Biomimetic intelligence aims to solve many complex problems by studying the principles of biological systems, resulting in a series of efficient algorithms, such as the genetic algorithm and neural network. Biomimetic intelligence further facilitates the performance of biomimetic robotics, making it possible to be deployed in more and more practical applications.

A comprehensive introduction to new approaches in artificial intelligence and robotics that are inspired by self-organizing biological processes and structures. New approaches to artificial intelligence spring from the idea that intelligence emerges as much from cells, bodies, and societies as it does from evolution, development, and learning. Traditionally, artificial intelligence has been concerned with reproducing the abilities of human brains; newer approaches take inspiration from a wider range of biological structures that that are capable of autonomous self-organization. Examples of these new approaches include evolutionary computation and evolutionary electronics, artificial neural networks, immune systems, biorobotics, and swarm intelligence—to mention only a few. This book offers a comprehensive introduction to the emerging field of biologically inspired artificial intelligence that can be used as an upper-level text or as a reference for researchers. Each chapter presents computational approaches inspired by a different biological system; each begins with background information about the biological system and then proceeds to develop computational models that make use of biological concepts. The chapters cover evolutionary computation and electronics; cellular systems; neural systems, including neuromorphic engineering; developmental systems; immune systems; behavioral systems—including several approaches to robotics, including behavior-based, bio-mimetic, epigenetic, and evolutionary robots; and collective systems, including swarm robotics as well as cooperative and competitive co-evolving systems. Chapters end with a concluding overview and suggested reading.

Flying insects are intelligent micromachines capable of exquisite maneuvers in unpredictable environments. Understanding these systems advances our knowledge of flight control, sensor suites, and unsteady aerodynamics, which is of crucial interest to engineers developing intelligent flying robots or micro air vehicles (MAVs). The insights we gain when synthesizing bioinspired systems can in turn benefit the fields of neurophysiology, ethology and zoology by providing real-life tests of the proposed models. This book was written by biologists and engineers leading the research in this crossdisciplinary field. It examines all aspects of the mechanics, technology and intelligence of insects and insectoids. After introductory-level overviews of flight control in insects, dedicated chapters focus on the development of autonomous flying systems using biological principles to sense their surroundings and autonomously navigate. A significant part of the book is dedicated to the mechanics and control of flapping wings both in insects and artificial systems. Finally hybrid locomotion, energy harvesting and manufacturing of small flying robots are covered. A particular feature of the book is the depth on realization topics such as control engineering, electronics, mechanics, optics, robotics and manufacturing. This book will be of interest to academic and industrial researchers engaged with theory and engineering in the domains of aerial robotics, artificial intelligence, and entomology.

"This book argues that computational models in behavioral neuroscience must be taken with caution, and advocates for the study of mathematical models of existing theories as complementary to neuro-psychological models and computational models"--

Flapping wing vehicles (FWVs) have unique flight characteristics and the successful flight of such a vehicle depends upon efficient design of the flapping mechanisms while keeping the minimum weight of the structure. Flapping Wing Vehicles: Numerical and Experimental Approach discusses design and kinematic analysis of various flapping wing mechanisms, measurement of flap angle/flapping frequency, and computational fluid dynamic analysis of motion characteristics including manufacturing techniques. The book also includes wind tunnel experiments, high-speed photographic analysis of aerodynamic performance, soap film visualization of 3D down washing, studies on the effect of wing rotation, figure-of-eight motion characteristics, and more. Features Covers all aspects of FWVs needed to design one and understand how and why it flies Explains related engineering practices including flapping mechanism design, kinematic analysis, materials, manufacturing, and aerodynamic performance measures using wind tunnel experiments Includes CFD analysis of 3D wing profile, formation flight of FWVs, and soap film visualization of flapping wings Discusses dynamics and image-based control of a group of ornithopters Explores indigenous PCB design for achieving altitude and attitude control This book is aimed at researchers and graduate students in mechatronics, materials, aerodynamics, robotics, biomimetics, vehicle design and MAV/UAV.

The advance in robotics has boosted the application of autonomous vehicles to perform tedious and risky tasks or to be cost-effective substitutes for their - man counterparts. Based on their working environment, a rough classi cation of the autonomous vehicles would include unmanned aerial vehicles (UAVs), - manned ground vehicles (UGVs), autonomous underwater vehicles (AUVs), and autonomous surface vehicles (ASVs). UAVs, UGVs, AUVs, and ASVs are called UVs (unmanned vehicles) nowadays. In recent decades, the development of - manned autonomous vehicles have been of great interest, and different kinds of autonomous vehicles have been studied and developed all over the world. In part- ular, UAVs have many applications in emergency situations; humans often cannot come close to a dangerous natural disaster such as an earthquake, a ood, an active volcano, or a nuclear disaster. Since the development of the rst UAVs, research efforts have been focused on military applications. Recently, however, demand has arisen for UAVs such as aero-robotsand ying robotsthat can be used in emergency situations and in industrial applications. Among the wide variety of UAVs that have been developed, small-scale HUAVs (helicopter-based UAVs) have the ability to take off and land vertically as well as the ability to cruise in ight, but their most importantcapability is hovering. Hoveringat a point enables us to make more eff- tive observations of a target. Furthermore, small-scale HUAVs offer the advantages of low cost and easy operation.

Tens of thousands of different animal species live on this planet, having survived for millions of years through adaptation and evolution, which has given them a vast variety of structures and functions. Biomechanical studies of animals swimming and flying can aid understanding of the mechanisms that enable them to move effectively and efficiently in fluids . Based on such understandings and analyses, we can aim to develop environmentally friendly machines that emulate these natu ral movements. The Earth Summit in Rio de Janeiro in 1992 agreed major treaties on biological diversity, addressing the comb ined issues of environmental protection and fair and equitable economic development. With regard to coastal environments, increasing biological diversity has begun to play an important role in reestablishing stable and sustainable ecosystems. This approach has begun to influence research into the behavior of aquatic species, as an understanding of the history of an individual aquatic species is indispensable in constructing an environmental assessment mod el that includes the physical, chemical, and biological effects of that species . From an engineering viewpoint, studying nature's biological diversity is an opportunity to reconsider mechanical systems that were systematically constructed in the wake of the Industrial Revolution. We have been accumulating knowledge of the sys tems inherent in biological creatures and using that knowledge to create new, envi ronmentally friendly technologies.

This book demonstrates how bio-inspiration can lead to fully autonomous flying robots without relying on external aids. Most existing aerial robots fly in open skies, far from obstacles, and rely on external beacons, mainly GPS, to localise and navigate. However, these robots are not able to fly at low altitude or in confined environments, and yet this poses absolutely no difficulty to insects. Indeed, flying insects display efficient flight control capabilities in complex environments despite their limited weight and relatively tiny brain size. From sensor suite to control strategies, the literature on flying insects is reviewed from an engineering perspective in order to extract useful principles that are then applied to the synthesis of artificial indoor flyers. Artificial evolution is also utilised to search for alternative control systems and behaviors that match the constraints of small flying robots. Specifically, the basic sensory modalities of insects, vision, gyroscopes and airflow sense, are applied to develop navigation controllers for indoor flying robots. These robots are capable of mapping sensor information onto actuator commands in real time to maintain altitude, stabilize the course and avoid obstacles. The most prominent result of this novel approach is a 10-gram microflyer capable of fully autonomous operation in an office-sized room using fly-inspired vision, inertial and airspeed sensors. This book is intended for all those interested in autonomous robotics, in academia and industry.

Engineered Biomimicry covers a broad range of research topics in the emerging discipline of biomimicry. Biologically inspired science and technology, using the principles of math and physics, has led to the development of products as ubiquitous as VelcroTM (modeled after the spiny hooks on plant seeds and fruits). Readers will learn to take ideas and concepts like this from nature, implement them in research, and understand and explain diverse phenomena and their related functions. From bioinspired computing and medical products to biomimetic applications like artificial muscles, MEMS, textiles and vision sensors, Engineered Biomimicry explores a wide range of technologies informed by living natural systems. Engineered Biomimicry helps physicists, engineers and material scientists seek solutions in nature to the most pressing technical problems of our times, while providing a solid understanding of the important role of biophysics. Some physical applications include adhesion superhydrophobicity and self-cleaning, structural coloration, photonic devices, biomaterials and composite materials, sensor systems, robotics and locomotion, and ultra-lightweight structures. Explores biomimicry, a fast-growing, cross-disciplinary field in which researchers study biological activities in nature to make critical advancements in science and engineering Introduces bioinspiration, biomimetics, and bioreplication, and provides biological background and practical applications for each Cutting-edge topics include bio-inspired robotics, microflyers, surface modification and more

Master simple to advanced biomaterials and structures with this essential text. Featuring topics ranging from bionanoengineered materials to bio-inspired structures for spacecraft and bio-

inspired robots, and covering issues such as motility, sensing, control and morphology, this highly illustrated text walks the reader through key scientific and practical engineering principles, discussing properties, applications and design. Presenting case studies for the design of materials and structures at the nano, micro, meso and macro-scales, and written by some of the leading experts on the subject, this is the ideal introduction to this emerging field for students in engineering and science as well as researchers.

This book constitutes the refereed proceedings of the Second International Workshop on Biologically Motivated Computer Vision, BMCV 2002, held in Tübingen, Germany, in November 2002. The 22 revised full papers and 37 revised short papers presented together with 6 invited papers were carefully reviewed and selected from 97 submissions. The papers are organized in topical sections on neurons and features, motion, mid-level vision, recognition - from scenes to neurons, attention, robotics, and cognitive vision.

This monograph presents the development of novel model-based methodologies for engineering self-organized and self-assembled systems. The work bridges the gap between statistical mechanics and control theory by tackling a number of challenges for a class of distributed systems involving a specific type of constitutive components, namely referred to as Smart Minimal Particles. The results described in the volume are expected to lead to more robust, dependable, and inexpensive distributed systems such as those endowed with complex and advanced sensing, actuation, computation, and communication capabilities.

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