Underwater Robotics Science Design And Fabrication

All life came from sea but all robots were born on land. The vast majority of both industrial and mobile robots operate on land, since the technology to allow them to operate in and under the ocean has only become available in recent years. A number of complex issues due to the unstructured, hazardous undersea environment, makes it difficult to travel in the ocean while today's technologies allow humans to land on the moon and robots to travel to Mars . . Clearly, the obstacles to allowing robots to operate in a saline, aqueous, and pressurized environment are formidable. Mobile robots operating on land work under nearly constant atmospheric pressure; their legs (or wheels or tracks) can operate on a firm footing; their bearings are not subjected to moisture and corrosion; they can use simple visual sensing and be observed by their creators working in simple environments. In contrast, consider the environment where undersea robots must operate. The pressure they are subjected to can be enormous, thus requiring extremely rugged designs. The deep oceans range between 19,000 to 36,000 ft. At a mere 33-foot depth, the pressure will be twice the normal one atmosphere pressure of 29. 4 psi. The chemical environment of the sea is highly corrosive, thus requiring the use of special materials. Lubrication of moving parts in water is also difficult, and may require special sealed, waterproof joints.

An update to the previous edition, detailing advances from this rapidly developing field.

"Underwater Vehicles: Design and Applications first explores the application of the adaptive Kalman filter algorithm to the estimation of high speed autonomous underwater vehicle dynamics. The authors investigate the performances of different control schemes, from non-model-based to model-based and adaptive model-based, implemented on a low-inertia underwater vehicle for three-dimensional helical trajectory tracking. Control laws for collision avoidance in three-dimensional environments are introduced, considering scenarios where a vehicle detects arbitrarily shaped and nonconvex obstacles using sensors"--

This book presents the proceedings of the 30th International Conference on Robotics in Alpe-Adria-Danube Region, RAAD 2021, held in Poitiers, France, 21–23 June 2021. It gathers contributions by researchers from several countries on all major areas of robotic research, development and innovation, as well as new applications and current trends. The topics covered include: novel designs and applications of robotic systems, intelligent cooperating and service robots, advanced robot control, human-robot interfaces, robot vision systems, mobile robots, humanoid and walking robots, bio-inspired and swarm robotic systems, aerial, underwater and spatial robots, robots for ambient assisted living, medical robots and bionic prostheses, cognitive robots, cloud robotics, ethical and social issues in robotics, etc. Given its scope, the book offers a source of information and inspiration for researchers seeking to improve their work and gather new ideas for future developments.

What can be created in 30 minutes or less? How about a robot? With clear step-by-step instructions and photos, these fun robotics projects with delight young makers and tech fans.

Modern dynamics was established many centuries ago by Galileo and Newton before the beginning of the industrial era.

Presently, we are in the presence of the fourth industrial revolution, and mechanical systems are increasingly being integrated with electronic, electrical, and fluidic systems. This trend is present not only in the industrial environment, which will soon be characterized by the cyber-physical systems of industry 4.0, but also in other environments like mobility, health and bio-engineering, food and natural resources, safety, and sustainable living. In this context, purely mechanical systems with quasi-static behavior will become less common and the state-of-the-art will soon be represented by integrated mechanical systems, which need accurate dynamic models to predict their behavior. Therefore, mechanical system dynamics are going to play an increasingly central role. Significant research efforts are needed to improve the identification of the mechanical properties of systems in order to develop models that take non-linearity into account, and to develop efficient simulation tools. This Special Issue aims at disseminating the latest research achievements, findings, and ideas in mechanical systems dynamics, with particular emphasis on applications that are strongly integrated with other systems and require a multi-physical approach.

An overview of the basic concepts and methodologies of evolutionary robotics, which views robots as autonomous artificial organisms that develop their own skills in close interaction with the environment and without human intervention.

An introduction to the science and practice of autonomous robots that reviews over 300 current systems and examines the underlying technology. Autonomous robots are intelligent machines capable of performing tasks in the world by themselves, without explicit human control. Examples range from autonomous helicopters to Roomba, the robot vacuum cleaner. In this book, George Bekey offers an introduction to the science and practice of autonomous robots that can be used both in the classroom and as a reference for industry professionals. He surveys the hardware implementations of more than 300 current systems, reviews some of their application areas, and examines the underlying technology, including control, architectures, learning, manipulation, grasping, navigation, and mapping. Living systems can be considered the prototypes of autonomous systems, and Bekey explores the biological inspiration that forms the basis of many recent developments in robotics. He also discusses robot control issues and the design of control architectures. After an overview of the field that introduces some of its fundamental concepts, the book presents background material on hardware, control (from both biological and engineering perspectives), software architecture, and robot intelligence. It then examines a broad range of implementations and applications, including locomotion (wheeled, legged, flying, swimming, and crawling robots), manipulation (both arms and hands), localization, navigation, and mapping. The many case studies and specific applications include robots built for research, industry, and the military, among them underwater robotic vehicles, walking machines with four, six, and eight legs, and the famous humanoid robots Cog, Kismet, ASIMO, and QRIO. The book concludes with reflections on the future of robotics—the potential benefits as well as the possible dangers that may arise from large numbers of increasingly intelligent and autonomous robots.

As a segment of the broader science of automation, robotics has achieved tremendous progress in recent decades due to the advances in supporting technologies such as computers, control systems, cameras and electronic vision, as well as micro and nanotechnology.

Prototyping a design helps in determining system parameters, ranges, and in structuring an overall better system. Robotics is one of the

industrial design fields in which prototyping is crucial for improved functionality. Prototyping of Robotic Systems: Applications of Design and Implementation provides a framework for conceptual, theoretical, and applied research in robotic prototyping and its applications. Covering the prototyping of various robotic systems including the complicated industrial robots, the tiny and delicate nanorobots, medical robots for disease diagnosis and treatment, as well as the simple robots for educational purposes, this book is a useful tool for those in the field of robotics prototyping and as a general reference tool for those in related fields.

Written by two well-known experts in the field with input from a broad network of industry specialists, The ROV Manual, Second Edition provides a complete training and reference guide to the use of observation class ROVs for surveying, inspection, and research purposes. This new edition has been thoroughly revised and substantially expanded, with nine new chapters, increased coverage of mid-sized ROVs, and extensive information on subsystems and enabling technologies. Useful tips are included throughout to guide users in gaining the maximum benefit from ROV technology in deep water applications. Intended for marine and offshore engineers and technicians using ROVs, The ROV Manual, Second Edition is also suitable for use by ROV designers and project managers in client companies making use of ROV technology. A complete user guide to observation class ROV (remotely operated vehicle) technology and underwater deployment for industrial, commercial, scientific, and recreational tasks Substantially expanded, with nine new chapters and a new five-part structure separating information on the industry, the vehicle, payload sensors, and other aspects Packed with hard-won insights and advice to help you achieve mission results quickly and efficiently

Furthering the aim of reducing human exposure to hazardous environments, this monograph presents a detailed study of the modeling and control of vehicle-manipulator systems. The text shows how complex interactions can be performed at remote locations using systems that combine the manipulability of robotic manipulators with the ability of mobile robots to locomote over large areas. The first part studies the kinematics and dynamics of rigid bodies and standard robotic manipulators and can be used as an introduction to robotics focussing on robust mathematical modeling. The monograph then moves on to study vehicle-manipulator systems in great detail with emphasis on combining two different configuration spaces in a mathematically sound way. Robustness of these systems is extremely important and Modeling and Control of Vehicle-manipulator Systems effectively represents the dynamic equations using a mathematically robust framework. Several tools from Lie theory and differential geometry are used to obtain globally valid representations of the dynamic equations of vehicle-manipulator systems. The specific characteristics of several different types of vehicle-manipulator systems are included and the various application areas of these systems are discussed in detail. For underwater robots buoyancy and gravity, drag forces, added mass properties, and ocean currents are considered. For space robotics the effects of free fall environments and the strong dynamic coupling between the spacecraft and the manipulator are discussed. For wheeled robots wheel kinematics and non-holonomic motion is treated, and finally the inertial forces are included for robots mounted on a forced moving base. Modeling and Control of Vehicle-manipulator Systems will be of interest to researchers and engineers studying and working on many applications of robotics: underwater, space, personal assistance, and mobile manipulation in general, all of which have similarities in the equations required for modeling and control.

The second edition of this handbook provides a state-of-the-art overview on the various aspects in the rapidly developing field of robotics. Reaching for the human frontier, robotics is vigorously engaged in the growing challenges of new emerging domains. Interacting, exploring, and working with humans, the new generation of robots will increasingly touch people and their lives. The credible prospect of practical robots among humans is the result of the scientific endeavour of a half a century of robotic developments that established robotics as a modern

scientific discipline. The ongoing vibrant expansion and strong growth of the field during the last decade has fueled this second edition of the Springer Handbook of Robotics. The first edition of the handbook soon became a landmark in robotics publishing and won the American Association of Publishers PROSE Award for Excellence in Physical Sciences & Mathematics as well as the organization's Award for Engineering & Technology. The second edition of the handbook, edited by two internationally renowned scientists with the support of an outstanding team of seven part editors and more than 200 authors, continues to be an authoritative reference for robotics researchers, newcomers to the field, and scholars from related disciplines. The contents have been restructured to achieve four main objectives: the enlargement of foundational topics for robotics, the enlightenment of design of various types of robotic systems, the extension of the treatment on robots moving in the environment, and the enrichment of advanced robotics applications. Further to an extensive update, fifteen new chapters have been introduced on emerging topics, and a new generation of authors have joined the handbook's team. A novel addition to the second edition is a comprehensive collection of multimedia references to more than 700 videos, which bring valuable insight into the contents. The videos can be viewed directly augmented into the text with a smartphone or tablet using a unique and specially designed app. Springer Handbook of Robotics Multimedia Extension Portal: http://handbookofrobotics.org/

The emergence of wireless robotic systems has provided new perspectives on technology. With the combination of disciplines such as robotic systems, ad hoc networking, telecommunications and more, mobile ad hoc robots have proven essential in aiding future possibilities of technology. Mobile Ad Hoc Robots and Wireless Robotic Systems: Design and Implementation aims to introduce robotic theories, wireless technologies, and routing applications involved in the development of mobile ad hoc robots. This reference source brings together topics on the communication and control of network ad hoc robots, describing how they work together to carry out coordinated functions.

This book gives a state-of-the-art overview of the hot topic of autonomous underwater vehicle (AUV) design and practice. It covers a wide range of AUV application areas such as education and research, biological and oceanographic studies, surveillance purposes, military and security applications and industrial underwater applications.

Fundamental Design and Automation Technologies in Offshore Robotics introduces technological design, modelling, stability analysis, control synthesis, filtering problem and real time operation of robotics vehicles in offshore environments. The book gives numerical and simulation results in each chapter to reflect the engineering practice yet demonstrate the focus of the developed analysis and synthesis approaches. The book is ideal to be used as a reference book for senior and graduate students. It is written in a way that the presentation is simple, clear, and easy to read and understand which would be appreciated by graduate students. Researchers working on marine vehicles and robotics would be able to find reference material on related topics from the book. The book could be of a significant interest to the researchers within offshore and deep see society, including both academic and industrial parts. Provides a series of latest results in, including but not limited to, motion control, robotics, and multi-vehicle systems towards offshore environment Presents recent advances of theory, technological aspects, and applications of robotics in offshore environment Offers a comprehensive and up-to-date references, which plays an indicative role for further study of the reader

This book is the proceedings of the 9th International Symposium of Robotics Research, one of the oldest and most prestigious conferences in robotics. The goal of the symposium was to bring together active, leading robotics researchers from academia, government and industry, to define the state of the art of robotics and its future direction. The broad spectrum of robotics research is covered, with an eye on what will be important in robotics in the next millennium.

This book deals with the state of the art in underwater robotics experiments of dynamic control of an underwater vehicle. The author presents experimental results on motion control and fault tolerance to thrusters' faults with the autonomous vehicle ODIN. This second substantially improved and expanded edition new features are presented dealing with fault-tolerant control and coordinated control of autonomous underwater vehicles.

This book gathers contributions by researchers from several countries on all major areas of robotic research, development and innovation, as well as new applications and current trends. The topics covered include: novel designs and applications of robotic systems, intelligent cooperating and service robots, advanced robot control, human-robot interfaces, robot vision systems, mobile robots, humanoid and walking robots, bio-inspired and swarm robotic systems, aerial, underwater and spatial robots, robots for ambient assisted living, medical robots and bionic prostheses, cognitive robots, cloud robotics, ethical and social issues in robotics, etc. Given its scope, the book offers a source of information and inspiration for researchers seeking to improve their work and gather new ideas for future developments. The contents reflect the outcomes of the activities of RAAD (International Conference on Robotics in Alpe-Adria-Danube Region) in 2020.

Presents the mechanics of the cleaning processes, experimental results, and different applications, including laser cleaning of art.

This book gathers the proceedings of the 15th IFToMM World Congress, which was held in Krakow, Poland, from June 30 to July 4, 2019. Having been organized every four years since 1965, the Congress represents the world's largest scientific event on mechanism and machine science (MMS). The contributions cover an extremely diverse range of topics, including biomechanical engineering, computational kinematics, design methodologies, dynamics of machinery, multibody dynamics, gearing and transmissions, history of MMS, linkage and mechanical controls, robotics and mechatronics, micro-mechanisms, reliability of machines and mechanisms, rotor dynamics, standardization of terminology, sustainable energy systems, transportation machinery, tribology and vibration. Selected by means of a rigorous international peer-review process, they highlight numerous exciting advances and ideas that will spur novel research directions and foster new multidisciplinary collaborations.

How British Columbia became an international hotspot for submarines, submersibles, Newt Suits, underwater robotics and a host of other cutting-edge undersea technologies. In Deep, Dark and Dangerous, maritime historian Vickie Jensen explores the fascinating story of British Columbia's rise to become a world leader in the underwater tech industry, tracing BC's colourful history and bright future as a front runner in the world of subsea technology innovation. This little-known saga began with the remarkable story of Pisces I. In the early 1960s, two commercial hard-hat divers from the Vancouver

area, Don Sorte and Al Trice, and engineer Mack Thompson realized that they needed a small manned submersible with robot arms for deep-sea work. They couldn't find one to buy, so they decided to build their own. Experts told them such things could only be built in specialized facilities and it would be suicidal to try a home-made version. Just over two years and $100,000 later their Pisces I was successfully making two-thousand-foot dives. The three innovators formed a company called International Hydrodynamics (HYCO) as orders started to arrive from around the world. In the process of building some fourteen submersibles, HYCO would serve as an incubator for a generation of experts that would launch an entire industry of subsea companies in BC. Drawing on her background in documenting both history and industry, Vickie Jensen uncovers stories, both historical and current, detailing the submarines, submersibles, robots, torpedo recovery technology and inventions that are responsible for BC's remarkable and continuing subsea reputation. Written with colour and flair, this is a fascinating and exciting story that anyone can enjoy.

UNDERWATER ROBOTICS: Science, Design & Fabrication is written for advanced high school classes or college and university entry-level courses. Each chapter begins with ¿Stories From Real Life,¿ a true scenario that sets the stage for the ocean science, physics, math, electronics, and engineering concepts that follow. One chapter features step-by-step plans for building SeaMATE, a basic shallow-diving ROV. There¿s also a ¿Going Deeper¿ chapter that discusses considerations and modifications for deeper-diving vehicles.

A revolutionary new framework that draws on insights from ecology for the design and analysis of long-duration robots Robots are increasingly leaving the confines of laboratories, warehouses, and manufacturing facilities, venturing into agriculture and other settings where they must operate in uncertain conditions over long timescales. This multidisciplinary book draws on the principles of ecology to show how robots can take full advantage of the environments they inhabit, including as sources of energy. Magnus Egerstedt introduces a revolutionary new design paradigm—robot ecology—that makes it possible to achieve long-duration autonomy while avoiding catastrophic failures. Central to ecology is the idea that the richness of an organism's behavior is a function of the environmental constraints imposed by its habitat. Moving beyond traditional strategies that focus on optimal policies for making robots achieve targeted tasks, Egerstedt explores how to use survivability constraints to produce both effective and provably safe robot behaviors. He blends discussions of ecological principles with the development of control barrier functions as a formal approach to constraint-based control design, and provides an in-depth look at the design of the SlothBot, a slow and energy-efficient robot used for environmental monitoring and conservation. Visionary in scope, Robot Ecology presents a comprehensive and unified methodology for designing robots that can function over long durations in diverse natural environments.

Tells the story of how, with the help of two inspiring science teachers, four undocumented Mexican immigrants in Arizona

put together an underwater robot from scavenged parts and went on to win the National Underwater Robotics Competition at UC Santa Barbara.

Through expanded intelligence, the use of robotics has fundamentally transformed the business industry. Providing successful techniques in robotic design allows for increased autonomous mobility, which leads to a greater productivity and production level. Rapid Automation: Concepts, Methodologies, Tools, and Applications provides innovative insights into the state-of-the-art technologies in the design and development of robotics and their real-world applications in business processes. Highlighting a range of topics such as workflow automation tools, human-computer interaction, and swarm robotics, this multi-volume book is ideally designed for computer engineers, business managers, robotic developers, business and IT professionals, academicians, and researchers.

We are facing a new technological challenge on how to store and retrieve knowledge and manipulate intelligence for autonomous services by intelligent systems which should be capable of carrying out real world tasks autonomously. To address this issue, robot researchers have been developing intelligence technology (InT) for "robots that think" which is in the focus of this book. The book covers all aspects of intelligence from perception at sensor level and reasoning at cognitive level to behavior planning at execution level for each low level segment of the machine. It also presents the technologies for cognitive reasoning, social interaction with humans, behavior generation, ability to cooperate with other robots, ambience awareness and an artificial genome that can be passed on to other robots. These technologies are to materialize cognitive intelligence, social intelligence, behavioral intelligence, collective intelligence, ambient intelligence and genetic intelligence. The book aims at serving researchers and practitioners with a timely dissemination of the recent progress on robot intelligence technology and its applications, based on a collection of papers presented at the at the 2nd International Conference on Robot Intelligence Technology and Applications (RiTA), held in Denver, USA, December 18-20, 2013.

This book includes representative research from the state?of?the?art in the emerging field of soft robotics, with a special focus on bioinspired soft robotics for underwater applications. Topics include novel materials, sensors, actuators, and system design for distributed estimation and control of soft robotic appendages inspired by the octopus and seastar. It summarizes the latest findings in an emerging field of bioinspired soft robotics for the underwater domain, primarily drawing from (but not limited to) an ongoing research program in bioinspired autonomous systems sponsored by the Office of Naval Research. The program has stimulated cross?disciplinary research in biology, material science, computational mechanics, and systems and control for the purpose of creating novel robotic appendages for maritime applications. The book collects recent results in this area.

This book provides exclusive insight into the development of a new generation of robotic underwater technologies. Deploying and using even the most simple and robust mechanical tools is presenting a challenge, and is often associated with an enormous amount of preparation, continuous monitoring, and maintenance. Therefore, all disciplinary aspects (e.g. system design, communication, machine learning, mapping and coordination, adaptive mission planning) are examined in detail and together this gives an extensive overview on research areas influencing next generation underwater robots. These robotic underwater systems will operate autonomously with the help of the most modern artificial intelligence procedures and perform environmental monitoring as well as inspection and maintenance of underwater structures. The systems are designed as modular and reconfigurable systems for long term autonomy to remain at the site for longer periods of time. New communication methods using AI enable missions of hybrid teams of humans and heterogeneous robots. Thus this volume will be an important reference for scientists on every qualification level in ?the field of underwater technologies, industrial maritime applications, and maritime science.

The biennial Congress of the Italian Society of Oral Pathology and Medicine (SIPMO) is an International meeting dedicated to the growing diagnostic challenges in the oral pathology and medicine field. The III International and XV National edition will be a chance to discuss clinical conditions which are unusual, rare, or difficult to define. Many consolidated national and international research groups will be involved in the debate and discussion through special guest lecturers, academic dissertations, single clinical case presentations, posters, and degree thesis discussions. The SIPMO Congress took place from the 17th to the 19th of October 2019 in Bari (Italy), and the enclosed copy of Proceedings is a non-exhaustive collection of abstracts from the SIPMO 2019 contributions.

Studies on robotics applications have grown substantially in recent years, with swarm robotics being a relatively new area of research. Inspired by studies in swarm intelligence and robotics, swarm robotics facilitates interactions between robots as well as their interactions with the environment. The Handbook of Research on Design, Control, and Modeling of Swarm Robotics is a collection of the most important research achievements in swarm robotics thus far, covering the growing areas of design, control, and modeling of swarm robotics. This handbook serves as an essential resource for researchers, engineers, graduates, and senior undergraduates with interests in swarm robotics and its applications.

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.

Discover the emerging science and engineering of System ofSystems Many challenges of the twenty-first century, such as fossil fuelenergy resources, require a new approach. The emergence of Systemof Systems (SoS) and System of Systems Engineering (SoSE) presentsengineers and professionals with the potential for solving many ofthe challenges facing our world today. This groundbreaking bookbrings together the viewpoints of key global players in the fieldto not only define these challenges, but to provide possiblesolutions. Each chapter has been contributed by an international expert,and topics covered include modeling, simulation, architecture, theemergence of SoS and SoSE, net-centricity, standards, management,and optimization, with various applications to defense,transportation, energy, the environment, healthcare, serviceindustry, aerospace, robotics, infrastructure, and informationtechnology. The book has been complemented with several casestudies—Space Exploration, Future Energy Resources,Commercial Airlines Maintenance, Manufacturing Sector, ServiceSector, Intelligent Transportation, Future Combat Missions, GlobalEarth Observation System of Systems project, and many more—togive readers an understanding of the real-world applications ofthis relatively new technology. System of SystemsEngineering is an indispensable resource for aerospace anddefense engineers and professionals in related fields.

The ROV Manual: A User Guide for Observation-Class Remotely Operated Vehicles is the first manual to provide a basic ""How To"" for using small observation-class ROVs for surveying, inspection and research procedures. It serves as a user guide that offers complete training and information about ROV operations for technicians, underwater activities enthusiasts, and engineers working offshore. The book focuses on the observation-class ROV and underwater uses for industrial, recreational, commercial, and scientific studies. It provides information about marine robotics and navigation tools used to obtain mission results and data faster and more efficiently. This manual also covers two common denominators: the technology and its application. It introduces the basic technologies needed and their relationship to specific requirements; and it helps identify the equipment essential for a cost-effective and efficient operation. This user guide can be invaluable in marine research and surveying, crime investigations, harbor security, military and coast guarding, commercial boating, diving and fishing, nuclear energy and hydroelectric inspection, and ROV courses in marine and petroleum engineering. * The first book to focus on observation class ROV (Remotely Operated Vehicle) underwater deployment in real conditions for industrial, commercial, scientific and recreational tasks * A complete user guide to ROV operation with basic information on underwater robotics and navigation equipment to obtain mission results quickly and efficiently * Ideal for anyone involved with ROVs complete with self-learning questions and answers

Mobile Robotics presents the different tools and methods that enable the design of mobile robots; a discipline booming with the emergence of flying drones, underwater mine-detector robots, robot sailboats and vacuum cleaners. Illustrated with simulations, exercises and examples, this book describes the fundamentals of modeling robots, developing the concepts of actuators, sensors, control and guidance. Three-dimensional simulation tools are also explored, as well as the theoretical basis for the reliable localization of robots within their environment. This revised and updated edition contains additional exercises and a completely new chapter on the Bayes filter, an observer that enhances

our understanding of the Kalman filter and facilitates certain proofs.

th This volume contains the papers selected for the 13 FIRA Robot World Congress, held at Amrita Vishwa Vidyapeetham Bangalore, India, September 15-17, 2010. The Federation of International Robot-soccer Association (FIRA – www.fira.net) is a non-profit organization that annually organizes robotic competitions and meetings around the globe. The robot soccer competitions started in 1996, and FIRA was est- lished on, June 5, 1997. The robot soccer competitions are aimed at promoting the spirit of science and technology to the younger generation. The congress is a forum to share ideas and future directions of technologies, and to enlarge the human networks in the robotics area. The objectives of the FIRA Cup and Congress are to explore the technical dev- opments and achievements in the field of robotics, and provide participants with a robot festival including technical presentations, robot soccer competitions, and exh- its under the theme "Where Theory and Practice Meet." FIRA India aims to propagate and popularize robotics and robotic competitions across India.

Includes index.

Robotic marine vessels can be used for a wide range of purposes, including defence, marine science, offshore energy and hydrographic surveys, and environmental surveys and protection. Such vessels need to meet a variety of criteria: they must be able to operate in salt water, and to communicate and be controlled over large distances, even when submerged or in inclement weather. Further challenges include 3D navigation of individual vehicles, groups or squadrons. This book covers the current state of research in navigation, modelling and control of marine autonomous vehicles, and deals with various related topics, including collision avoidance, communication, and a range of applications. It provides valuable insights for an audience of researchers, academics and postgraduate students interested in autonomous marine vessels, robotics, and electrical and automobile engineering.

"This book explores the theory and practice of educational robotics in the K-12 formal and informal educational settings, providing empirical research supporting the use of robotics for STEM learning"--Provided by publisher.

Snake Robots is a novel treatment of theoretical and practical topics related to snake robots: robotic mechanisms designed to move like biological snakes and able to operate in challenging environments in which human presence is either undesirable or impossible. Future applications of such robots include search and rescue, inspection and maintenance, and subsea operations. Locomotion in unstructured environments is a focus for this book. The text targets the disparate muddle of approaches to modelling, development and control of snake robots in current literature, giving a unified presentation of recent research results on snake robot locomotion to increase the reader's basic understanding of these mechanisms and their motion dynamics and clarify the state of the art in the field. The book is a complete treatment of snake robotics, with topics ranging from mathematical modelling techniques, through mechatronic design and implementation, to control design strategies. The development of two snake robots is described and both are used to provide experimental validation of many of the theoretical results. Snake Robots is written in a clear and easily understandable manner which makes the material accessible by specialists in the field and non-experts alike. Numerous illustrative figures and images help readers to visualize the material. The book is particularly useful to new researchers taking on a topic related to snake robots because it provides an extensive overview of the snake robot literature and also represents a suitable starting point for research in this area.

Visual Perception and Control of Underwater Robots covers theories and applications from aquatic visual perception and underwater robotics. Within the framework of visual perception for underwater operations, image restoration, binocular measurement, and object detection are addressed. More specifically, the book includes adversarial critic learning for visual restoration, NSGA-II-based calibration for

binocular measurement, prior knowledge refinement for object detection, analysis of temporal detection performance, as well as the effect of the aquatic data domain on object detection. With the aid of visual perception technologies, two up-to-date underwater robot systems are demonstrated. The first system focuses on underwater robotic operation for the task of object collection in the sea. The second is an untethered biomimetic robotic fish with a camera stabilizer, its control methods based on visual tracking. The authors provide a self-contained and comprehensive guide to understand underwater visual perception and control. Bridging the gap between theory and practice in underwater vision, the book features implementable algorithms, numerical examples, and tests, where codes are publicly available. Additionally, the mainstream technologies covered in the book include deep learning, adversarial learning, evolutionary computation, robust control, and underwater bionics. Researchers, senior undergraduate and graduate students, and engineers dealing with underwater visual perception and control will benefit from this work.