Introduction To Robotics Analysis Systems Applications

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A Mathematical Introduction to Robotic Manipulation - Richard M. Murray 2017-12-14
A Mathematical Introduction to Robotic Manipulation presents a mathematical formulation of the kinematics, dynamics, and control of robot manipulators. It uses an elegant set of mathematical tools that emphasizes the geometry of robot motion and allows a large class of robotic manipulation problems to be analyzed within a unified framework. The foundation of the book is a derivation of robot kinematics using the product of the exponentials formula. The authors explore the kinematics of open-chain manipulators and multifingered robot hands, present an analysis of the dynamics and control of robot systems, discuss the specification and control of internal forces and internal motions, and address the implications of the nonholonomic nature of rolling contact are addressed, as well. The wealth of information, numerous examples, and exercises make A Mathematical Introduction to Robotic Manipulation valuable as both a reference for robotics researchers and a text for students in advanced robotics courses.

Robotics - Bruno Siciliano 2010-08-20
Based on the successful Modelling and Control of Robot Manipulators by Sciavicco and Siciliano (Springer, 2000), Robotics provides the basic know-how on the foundations of robotics: modelling, planning and control. It has been expanded to include coverage of mobile robots, visual control and motion planning. A variety of problems is raised throughout, and the proper tools to find engineering-oriented solutions are introduced and explained. The text includes coverage of fundamental topics like kinematics, and trajectory planning and related technological aspects including actuators and sensors. To impart practical skill, examples and case studies are carefully worked out and interwoven through the text, with frequent resort to simulation. In addition, end-of-chapter exercises are proposed, and the book is accompanied by an electronic solutions manual containing the MATLAB® code for computer problems; this is available free of charge to those adopting this volume as a textbook for courses.

Handbook of Robotic and Image-Guided Surgery - Mohammad Abedin-Nasab 2019-09-25
Handbook of Robotic and Image-Guided Surgery provides state-of-the-art systems and methods for robotic and computer-assisted surgeries. In this masterpiece, contributions of 169 researchers from 19 countries have been gathered to provide 38 chapters. This handbook is 744 pages, includes 659 figures and 61 videos. It also provides basic medical knowledge for engineers and basic engineering principles for surgeons. A key strength of this text is the fusion of engineering, radiology, and surgical principles into one book. A thorough and in-depth handbook on surgical robotics and image-guided surgery which includes both fundamentals and advances in the field A comprehensive reference on robot-assisted laparoscopic, orthopedic, and head-and-neck surgeries Chapters are contributed by worldwide experts from both engineering and surgical backgrounds

Cognitive Computing for Human-Robot Interaction - Mamta Mittal 2021-08-13
Cognitive Computing for Human-Robot Interaction: Principles and Practices explores the efforts that should ultimately enable society to take advantage of the often-heralded potential of robots to provide economical and sustainable computing applications. This book discusses each of these applications, presents working implementations, and combines coherent and original deliberative architecture for human–robot interactions (HRI). Supported by experimental results, it shows how explicit knowledge management promises to be instrumental in building richer and more natural HRI, by pushing for pervasive, human-level semantics within the robot's deliberative system for sustainable computing applications. This book will be of special interest to academics, postgraduate students, and researchers working in the area of artificial intelligence and machine learning. Key features: Introduces several new contributions to the representation and management of humans in autonomous robotic systems; Explores the potential of cognitive computing, robots, and HRI to generate a deeper understanding and to provide a better contribution from robots to society; Engages with the potential repercussions of cognitive computing and HRI in the real world. Introduces several new contributions to the representation and management of humans in an autonomous robotic system Explores cognitive computing, robots and HRI, presenting a more in-depth understanding to make robots better for society Gives a challenging approach to those several repercussions of cognitive computing and HRI in the actual global scenario

Optical Fiber Sensors for the Next Generation of Rehabilitation Robotics - Arnaldo Leal-Junior 2021-10-26
Optical Fiber Sensors for the Next Generation of Rehabilitation Robotics presents development concepts and applications of optical fiber sensors made of compliant materials in rehabilitation robotics. The book provides methods for the instrumentation of novel compliant devices. It presents the development, characterization and application of optical fiber sensors in robotics, ranging from conventional robots with rigid structures to novel wearable systems with soft structures, including smart textiles and intelligent structures for healthcare. Readers can look to this book for help in designing robotic structures for different applications, including problem-solving tactics in soft robotics. This book will be a great resource for mechanical, electrical and electronics engineers and photonics and optical sensing engineers. Addresses optical fiber sensing solutions in wearable systems and soft robotics Presents developments—from foundational, to novel and future applications—of optical fiber sensors in the next generation of robotic devices Provides methods for the instrumentation of novel compliant devices
Introduction to Robotics in CIM Systems - James A. Rehg 1992

Motion and Operation Planning of Robotic Systems - Giuseppe Carbone 2015-03-12
This book addresses the broad multi-disciplinary topic of robotics, and presents the basic techniques for motion and operation planning in robotics systems. Gathering contributions from experts in diverse and wide ranging fields, it offers an overview of the most recent and cutting-edge practical applications of these methodologies. It covers both theoretical and practical approaches, and elucidates the transition from theory to implementation. An extensive analysis is provided, including humanoids, manipulators, aerial robots and ground mobile robots. 'Motion and Operation Planning of Robotic Systems' addresses the following topics: *The theoretical background of robotics. *Application of motion planning techniques to manipulators, such as serial and parallel manipulators. *Mobile robots planning, including robotic applications related to aerial robots, large scale robots and traditional wheeled robots. *Motion planning for humanoid robots. An invaluable reference text for graduate students and researchers in robotics, this book is also intended for researchers studying robotics control design, user interfaces, modelling, simulation,

sensors, humanoid robotics.

Introduction to Robotics - Saeed B. Niku 2020-02-10
The revised text to the analysis, control, and applications of robotics The revised and updated third edition of Introduction to Robotics: Analysis, Control, Applications, offers a guide to the fundamentals of robotics, robot components and subsystems and applications. The author—a noted expert on the topic—covers the mechanics and kinematics of serial and parallel robots, both with the Denavit-Hartenberg approach as well as screw-based mechanics. In addition, the text contains information on microprocessor applications, control systems, vision systems, sensors, and actuators. Introduction to Robotics gives engineering students and practicing engineers the information needed to design a robot, to integrate a robot in appropriate applications, or to analyze a robot. The updated third edition contains many new subjects and the content has been streamlined throughout the text. The new edition includes two completely new chapters on screw-based mechanics and parallel robots. The book is filled with many new illustrative examples and includes homework problems designed to enhance learning. This important text: Offers a revised and updated guide to the fundamental of robotics Contains information on robot components, robot characteristics, robot languages, and robotic applications Covers the kinematics of serial robots with Denavit-Hartenberg methodology and screw-based mechanics Includes the fundamentals of control engineering, including analysis and design tools Discusses kinematics of parallel robots Written for students of engineering as well as practicing engineers, Introduction to Robotics, Third Edition reviews the basics of robotics, robot components and subsystems, applications, and has been revised to include the most recent developments in the field.

Robots and Screw Theory - J. K. Davidson 2004-03-25
Robots and Screw Theory describes the mathematical foundations, especially geometric, underlying the motions and force-transfers in robots. The principles developed in the book are used in the control of robots and in the design of their major moving parts. The illustrative examples and the exercises in the book are taken principally from robotic machinery used for manufacturing and construction, but the principles apply equally well to miniature robotic devices and to those used in other industries. The comprehensive coverage of the screw and its geometry lead to reciprocal screw systems for statics and instantaneous kinematics. These screw systems are brought together in a unique way to show many cross-relationships between the force-systems that support a body equivalently to a kinematic serial connection of joints and links. No prior knowledge of screw theory is assumed. The reader is introduced to the screw with a simple planar example yet most of the book applies to robots that move three-dimensionally. Consequently, the book is suitable both as a text at the graduate-course level and as a reference book for the professional. Worked examples on every major topic and over 300 exercises clarify and reinforce the principles covered in the text. A chapter-length list of references gives the reader source-material and opportunities to pursue more fully topics contained in the text.

Parallel Robots - Hamid D. Taghirad 2013-04-08
Parallel structures are more effective than serial ones for industrial automation applications that require high precision and stiffness, or a high load capacity relative to robot weight. Although many industrial applications have adopted parallel structures for their design, few textbooks introduce the analysis of such robots in terms of dynamics and control. Filling this gap, Parallel Robots: Mechanics and Control presents a systematic approach to analyze the kinematics, dynamics, and control of parallel robots. It brings together analysis and design tools for engineers and researchers who want to design and implement parallel structures in industry. Covers Kinematics, Dynamics, and Control in One Volume The book begins with the representation of motion of robots and the kinematic analysis of parallel manipulators. Moving beyond static positioning, it then examines a systematic approach to performing Jacobian analysis. A special feature of the book is its detailed coverage of the dynamics and control of parallel manipulators. The text examines dynamic analysis using the Newton-Euler method, the principle of virtual work, and the Lagrange formulations. Finally, the book elaborates on the control of parallel robots, considering both motion and force control. It introduces various model-free and model-based controllers and develops robust and adaptive control schemes. It also addresses redundancy resolution schemes in detail. Analysis and Design Tools to Help You Create Parallel Robots In each chapter, the author revisits the same case studies to show

how the techniques may be applied. The case studies include a planar cable-driven parallel robot, part of a promising new generation of parallel structures that will allow for larger workspaces. The MATLAB® code used for analysis and simulation is available online. Combining the analysis of kinematics and dynamics with methods of designing controllers, this text offers a holistic introduction for anyone interested in designing and implementing parallel robots.

Control Systems Design of Bio-Robotics and Bio-Mechatronics with Advanced Applications - Ahmad Taher Azar 2019-11-30
Control Systems Design of Bio-Robotics and Bio-Mechatronics with Advanced Applications delivers essential and advanced bioengineering information on the application of control and robotics technologies in the life sciences. Judging by what we have witnessed so far, this exciting field of control systems and robotics in bioengineering is likely to produce revolutionary breakthroughs over the next decade. While this book is intended for senior undergraduate or graduate students in both control engineering and biomedical engineering programs, it will also appeal to medical researchers and practitioners who want to enhance their quantitative understanding of physiological processes. Focuses on the engineering and scientific principles underlying the extraordinary performance of biomedical robotics and bio-mechatronics Demonstrates the application of principles for designing corresponding algorithms Presents the latest innovative approaches to medical diagnostics and procedures, as well as clinical rehabilitation from the point-of-view of dynamic modeling, system analysis and control

Robot Analysis - Lung-Wen Tsai 1999-02-22
Complete, state-of-the-art coverage of robot analysis This unique book provides the fundamental knowledge needed for understanding the mechanics of both serial and parallel manipulators. Presenting fresh and authoritative material on parallel manipulators that is not available in any other resource, it offers an in-depth treatment of position analysis, Jacobian analysis, statics and stiffness analysis, and dynamical analysis of both types of manipulators, including a discussion of industrial and research applications. It also features: * The homotopy continuation method and dialytic elimination method for solving polynomial systems that apply to robot kinematics * Numerous worked examples and problems to reinforce learning * An extensive bibliography offering many resources for more advanced study Drawing on Dr. Lung-Wen Tsai's vast experience in the field as well as recent research publications, Robot Analysis is a first-rate text for upper-level undergraduate and graduate students in mechanical engineering, electrical engineering, and computer studies, as well as an excellent desktop reference for robotics researchers working in industry or in government.

Robots and Robotics: Principles, Systems, and Industrial Applications - Rex Miller 2017-07-07
Master the principles and practices of industrial robotics Written by a pair of technology experts and accomplished educators, this comprehensive resource provides a solid foundation in applied industrial robotics and robot technology. You will get straightforward explanations of the latest components, techniques, and capabilities along with practical examples and detailed illustrations. The book takes a look at the entire field of robotics—from design and production to deployment, operation, and maintenance. Valuable appendices provide information on specific robot models, pendants, and controllers. Robots and Robotics: Principles, Systems and Industrial Applications covers: • Robot and robotics fundamentals • Identification of components • Robot parts and robotic motion capabilities • Programs, programming languages, and microprocessors • Drive systems, pumps, motors, and sensors • Control methods • Industrial applications • Specifications and capabilities • Troubleshooting and maintenance • Emerging technologies and the future of robotics

Endorobotics - Luigi Manfredi 2022-01-04
The book comprises three parts. The first part provides the state-of-the-art of robots for endoscopy (endorobots), including devices already available in the market and those that are still at the R&D stage. The second part focusses on the engineering design; it includes the use of polymers for soft robotics, comparing their advantages and limitations with those of their more rigid counterparts. The third part includes the project management of a multidisciplinary team, the health cost of current technology, and how a cost-effective device can have a substantial impact on the market. It also includes information on data governance, ethical and legal frameworks, and all steps needed to make this new technology available.

Focuses on a new design paradigm for endorobots applications Provides a unique collection of engineering, medical and management contributions for endorobotics design Describes endorobotics, starting from available devices in both clinical use and academia

Embedded Systems and Robotics with Open Source Tools - Nilanjan Dey 2018-09-03
Embedded Systems and Robotics with Open-Source Tools provides easy-to-understand and easy-to-implement guidance for rapid prototype development. Designed for readers unfamiliar with advanced computing technologies, this highly accessible book: Describes several cutting-edge open-source software and hardware technologies Examines a number of embedded computer systems and their practical applications Includes detailed projects for applying rapid prototype development skills in real time Embedded Systems and Robotics with Open-Source Tools effectively demonstrates that, with the help of high-performance microprocessors, microcontrollers, and highly optimized algorithms, one can develop smarter embedded devices.

Modern Robotics - Kevin M. Lynch 2017-05-25
This introduction to robotics offers a distinct and unified perspective of the mechanics, planning and control of robots. Ideal for self-learning, or for courses, as it assumes only freshman-level physics, ordinary differential equations, linear algebra and a little bit of computing background. Modern Robotics presents the state-of-the-art, screw-theoretic techniques capturing the most salient physical features of a robot in an intuitive geometrical way. With numerous exercises at the end of each chapter, accompanying software written to reinforce the concepts in the book and video lectures aimed at changing the classroom experience, this is the go-to textbook for learning about this fascinating subject.

Bioinspired Sensing, Actuation, and Control in Underwater Soft Robotic Systems - Derek A. Paley 2020-11-06
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.

Introduction to Robotics - Saeed B. Niku 2010-09-22
Niku offers comprehensive, yet concise coverage of robotics that will appeal to engineers. Robotic applications are drawn from a wide variety of fields. Emphasis is placed on design along with analysis and modeling. Kinematics and dynamics are covered extensively in an accessible style. Vision systems are discussed in detail, which is a cutting-edge area in robotics. Engineers will also find a running design project that reinforces the concepts by having them apply what they've learned.

Introduction to Mobile Robot Control - Spyros G Tzafestas 2013-10-03
Introduction to Mobile Robot Control provides a complete and concise study of modeling, control, and navigation methods for wheeled non-holonomic and omnidirectional mobile robots and manipulators. The book begins with a study of mobile robot drives and corresponding kinematic and dynamic models, and discusses the sensors used in mobile robotics. It then examines a variety of model-based, model-free, and vision-based controllers with unified proof of their stabilization and tracking performance, also addressing the problems of path, motion, and task planning, along with localization and mapping topics. The book provides a host of experimental results, a conceptual overview of systemic and software mobile robot control architectures, and a tour of the use of wheeled mobile robots and manipulators in industry and society. Introduction to Mobile Robot Control is an essential reference, and is also a textbook suitable as a supplement for many university robotics courses. It is accessible to all and can be used as a reference for professionals and researchers in the mobile robotics field. Clearly and authoritatively presents mobile robot concepts Richly illustrated throughout with figures and examples Key concepts demonstrated with a host of experimental and simulation examples No prior knowledge of the subject is required; each chapter commences with an introduction and background

Industrial Robotics - Mikell P. Groover 1986

Theory of Applied Robotics - Reza N. Jazar 2010-06-14
The second edition of this book would not have been possible without the comments and suggestions from students, especially those at Columbia University. Many of the new topics introduced here are a direct result of student feedback that helped refine and clarify the material. The intention of this book was to develop material that the author would have liked to have had available as a student. Theory of Applied Robotics: Kinematics, Dynamics, and Control (2nd Edition) explains robotics concepts in detail, concentrating on their practical use. Related theorems and formal proofs are provided, as are real-life applications. The second edition includes updated and expanded exercise sets and problems. New coverage includes: components and mechanisms of a robotic system with actuators, sensors and controllers, along with updated and expanded material on kinematics. New coverage is also provided in sensing and control including position sensors, speed sensors and acceleration sensors. Students, researchers, and practicing engineers alike will appreciate this user-friendly presentation of a wealth of robotics topics, most notably orientation, velocity, and forward kinematics.

Introduction to Robotics - John J. Craig 2005
Written for senior level or first year graduate level robotics courses, this text includes material from traditional mechanical engineering, control theoretical material and computer science. It includes coverage of rigid-body transformations and forward and inverse positional kinematics.

Human Modeling for Bio-Inspired Robotics - Jun Ueda 2016-09-02
Human Modelling for Bio-inspired Robotics: Mechanical Engineering in Assistive Technologies presents the most cutting-edge research outcomes in the area of mechanical and control aspects of human functions for macro-scale (human size) applications. Intended to provide researchers both in academia and industry with key content on which to base their developments, this book is organized and written by senior experts in their fields. Human Modeling for Bio-Inspired Robotics: Mechanical Engineering in Assistive Technologies offers a system-level investigation into human mechanisms that inspire the development of assistive technologies and humanoid robotics, including topics in modelling of anatomical, musculoskeletal, neural and cognitive systems, as well as motor skills, adaptation and integration. Each chapter is written by a subject expert and discusses its background, research challenges, key outcomes, application, and future trends. This book will be especially useful for academic and industry researchers in this exciting field, as well as graduate-level students to bring them up to speed with the latest technology in mechanical design and control aspects of the area. Previous knowledge of the fundamentals of kinematics, dynamics, control, and signal processing is assumed. Presents the most recent research outcomes in the area of mechanical and control aspects of human functions for macro-scale (human size) applications Covers background information and fundamental concepts of human modelling Includes modelling of anatomical, musculoskeletal, neural and cognitive systems, as well as motor skills, adaptation, integration, and safety issues Assumes previous knowledge of the fundamentals of kinematics, dynamics, control, and signal processing

Robotics and Automation Handbook - Thomas R. Kurfess 2018-10-03
As the capability and utility of robots has increased dramatically with new technology, robotic systems can perform tasks that are physically dangerous for humans, repetitive in nature, or require increased accuracy, precision, and sterile conditions to radically minimize human error. The Robotics and Automation Handbook addresses the major aspects of designing, fabricating, and enabling robotic systems and their various applications. It presents kinetic and dynamic methods for analyzing robotic systems, considering factors such as force and torque. From these analyses, the book develops several controls approaches, including servo actuation, hybrid control, and trajectory planning. Design aspects include determining specifications for a robot, determining its configuration, and utilizing sensors and actuators. The featured applications focus on how the specific difficulties are overcome in the development of the robotic system. With the ability to increase human safety and precision in applications ranging from handling hazardous materials and exploring extreme environments to manufacturing and medicine, the uses for robots are

growing steadily. The Robotics and Automation Handbook provides a solid foundation for engineers and scientists interested in designing, fabricating, or utilizing robotic systems.

Advanced Theory of Constraint and Motion Analysis for Robot Mechanisms - Jingshan Zhao 2013-11-22
Advanced Theory of Constraint and Motion Analysis for Robot Mechanisms provides a complete analytical approach to the invention of new robot mechanisms and the analysis of existing designs based on a unified mathematical description of the kinematic and geometric constraints of mechanisms. Beginning with a high level introduction to mechanisms and components, the book moves on to present a new analytical theory of terminal constraints for use in the development of new spatial mechanisms and structures. It clearly describes the application of screw theory to kinematic problems and provides tools that students, engineers and researchers can use for investigation of critical factors such as workspace, dexterity and singularity. Combines constraint and free motion analysis and design, offering a new approach to robot mechanism innovation and improvement Clearly describes the use of screw theory in robot kinematic analysis, allowing for concise representation of motion and static forces when compared to conventional analysis methods Includes worked examples to translate theory into practice and demonstrate the application of new analytical methods to critical robotics problems

Wearable Robotics - Jacob Rosen 2019-11-16
Wearable Robotics: Systems and Applications provides a comprehensive overview of the entire field of wearable robotics, including active orthotics (exoskeleton) and active prosthetics for the upper and lower limb and full body. In its two major sections, wearable robotics systems are described from both engineering perspectives and their application in medicine and industry. Systems and applications at various levels of the development cycle are presented, including those that are still under active research and development, systems that are under preliminary or full clinical trials, and those in commercialized products. This book is a great resource for anyone working in this field, including researchers, industry professionals and those who want to use it as a teaching mechanism. Provides a comprehensive overview of the entire field, with both engineering and medical perspectives Helps readers quickly and efficiently design and develop wearable robotics for healthcare applications

Understanding Robotics - V. Daniel Hunt 2012-12-02
Understanding Robotics is an introductory text on robotics and covers topics ranging from from the components of a robotic system, including sensors, to the industrial applications of robotics. The major factors justifying the use of robots for manufacturing are also discussed, along with the use of robots as a manufacturing tool, their impact on people, and the future of robotics. This book is comprised of eight chapters and begins with an overview of the roots of robotics and the use of robots in the manufacturing environment; advances in robot technology and typical applications of robots; reasons for using robots in the manufacturing environment; and the different manufacturing functions they perform, including visual inspection and intricate welding operations. A definition of the word ""robot"" is presented, and the impact of robots on jobs is considered. Subsequent chapters focus on the elements of a robot system, including the computer/controller, actuator power drive, and sensors; sensor applications in robotics; robotic usage by industry; economic justification of robotics; manufacturing technology and the role robotics can play in improving the United States' competitive manufacturing position; and the impact of robots on people and vice versa. The final chapter is devoted to market trends and competitiveness of the U.S. robotics industry and assesses the future prospects of robotics. This monograph should be a valuable resource for technologists and researchers interested in robots and robotics.

CONTROL SYSTEMS, ROBOTICS AND AUTOMATION - Volume II - Heinz Unbehauen 2009-10-11
This Encyclopedia of Control Systems, Robotics, and Automation is a component of the global Encyclopedia of Life Support Systems EOLSS, which is an integrated compendium of twenty one Encyclopedias. This 22-volume set contains 240 chapters, each of size 5000-30000 words, with perspectives, applications and extensive illustrations. It is the only publication of its kind carrying state-of-the-art knowledge in the fields of Control Systems, Robotics, and Automation and is aimed, by virtue of the several applications, at the following five major target audiences: University and College Students, Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers and NGOs.
Statics and Kinematics with Applications to Robotics - Joseph Duffy 1996-05-31

A thorough introduction to statics and first-order instantaneous kinematics with applications to robotics.
Robotics: A Very Short Introduction - Alan Winfield 2012-09-27
Robotics is a key technology in the modern world. Robots are a well-established part of manufacturing and warehouse automation, assembling cars or washing machines, and, for example, moving goods to and from storage racks for Internet mail order. More recently robots have taken their first steps into homes and hospitals, and seen spectacular success in planetary exploration. Yet, despite these successes, robots have failed to live up to the predictions of the 1950s and 60s, when it was widely thought - by scientists and engineers as well as the public - that by turn of the 21st century we would have intelligent robots as butlers, companions, or co-workers. This Very Short Introduction explains how it is that robotics can be both a success story and a disappointment, how robots can be both ordinary and remarkable, and looks at their important developments in science and their applications to everyday life. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Introduction to Robotics - Miomir Vukobratovic 2012-12-06
This book provides a general introduction to robot technology with an emphasis on robot mechanisms and kinematics. It is conceived as a reference book for students in the field of robotics.

Control in Robotics and Automation - Bijoy K. Ghosh 1999-04-09
Microcomputer technology and micromechanical design have contributed to recent rapid advances in Robotics. Particular advances have been made in sensor technology that allow robotic systems to gather data and react "intelligently" in flexible manufacturing systems. The analysis and recording of the data are vital to controlling the robot. In order to solve problems in control and planning for a Robotic system it is necessary to meet the growing need for the integration of sensors in to the system. Control in Robotics and Automation addresses this need. This book covers integration planning and control based on prior knowledge and real-time sensory information. A new task-oriented approach to sensing, planning and control introduces an event-based method for system design together with task planning and three dimensional modeling in the execution of remote operations. Typical remote systems are teleoperated and provide work efficiencies that are on the order of ten times slower than what is directly achievable by humans. Consequently, the effective integration of automation into teleoperated remote systems offers potential to improve remote system work efficiency. The authors introduce visually guided control systems and study the role of computer vision in autonomously guiding a robot system. Sensor-Based Planning and Control in an Event-Based Approach Visually Guided Sensing and Control Multiple Sensor Fuson in Planning and Control System Integration and Implementation Practical Applications
Behavior Trees in Robotics and AI - Michele Colledanchise 2018-07-20
Behavior Trees (BTs) provide a way to structure the behavior of an artificial agent such as a robot or a non-player character in a computer game. Traditional design methods, such as finite state machines, are known to produce brittle behaviors when complexity increases, making it very hard to add features without breaking existing functionality. BTs were created to address this very problem, and enables the creation of systems that are both modular and reactive. Behavior Trees in Robotics and AI: An Introduction provides a broad introduction as well as an in-depth exploration of the topic, and is the first comprehensive book on the use of BTs. This book introduces the subject of BTs from simple topics, such as semantics and design principles, to complex topics, such as learning and task planning. For each topic, the authors provide a set of examples, ranging from simple illustrations to realistic complex behaviors, to enable the reader to successfully combine theory with practice. Starting with an introduction to BTs, the book then describes how BTs relate to, and in many cases, generalize earlier switching structures, or control architectures. These ideas are then used as a foundation for a set of efficient and easy to use design principles. The book then presents a set of important extensions and provides a set of tools for formally analyzing these extensions using a state space formulation of BTs. With the new analysis tools, the book then formalizes the descriptions of how BTs generalize earlier approaches and shows how BTs can be automatically generated using planning and learning. The final part of the book provides an extended set of tools to capture the

behavior of Stochastic BTs, where the outcomes of actions are described by probabilities. These tools enable the computation of both success probabilities and time to completion. This book targets a broad audience, including both students and professionals interested in modeling complex behaviors for robots, game characters, or other AI agents. Readers can choose at which depth and pace they want to learn the subject, depending on their needs and background.

Probabilistic Robotics - Sebastian Thrun 2005-08-19
An introduction to the techniques and algorithms of the newest field in robotics. Probabilistic robotics is a new and growing area in robotics, concerned with perception and control in the face of uncertainty. Building on the field of mathematical statistics, probabilistic robotics endows robots with a new level of robustness in real-world situations. This book introduces the reader to a wealth of techniques and algorithms in the field. All algorithms are based on a single overarching mathematical foundation. Each chapter provides example implementations in pseudo code, detailed mathematical derivations, discussions from a practitioner's perspective, and extensive lists of exercises and class projects. The book's Web site, www.probabilistic-robotics.org, has additional material. The book is relevant for anyone involved in robotic software development and scientific research. It will also be of interest to applied statisticians and engineers dealing with real-world sensor data.

Robotics - Peter McKinnon 2016-01-28
Explore the Fascinating World of Robotics! Do you love robots? Are you fascinated with modern advances in technology? Do you want to know how robots work? If so, you'll be delighted with Robotics: Everything You Need to Know About Robotics from Beginner to Expert. You'll learn the history of robotics, learn the 3 Rules, and meet the very first robots. This book also describes the many essential hardware components of today's robots: - Analog and Digital brains - DC, Servo, and Stepper Motors - Bump Sensors and Light Sensors - and even Robotic Bodywork Would you like to build and program your own robot? You can use Robotics: Everything You Need to Know About Robotics from Beginner to Expert to learn the software basics of RoboCORE and how to create "brains" for creations like the Obstacle Avoiding Robot. You'll also learn which materials to use to build your robot body and which sensors you need to help your new friend perceive the world around it. This book even explains how you can construct an Autonomous Wall Climbing Robot! Don't delay - Start Reading Robotics: Everything You Need to Know About Robotics from Beginner to Expert right away! You'll be so glad you gained this exciting and powerful knowledge!

Advanced Control Systems - Theory and Applications - Yuriy P. Kondratenko 2021-07-08
Advanced Control Systems: Theory and Applications provides an overview of advanced research lines in control systems as well as in design, development and implementation methodologies for perspective control systems and their components in different areas of industrial and special applications. It consists of extended versions of the selected papers presented at the XXV International Conference on Automatic Control "Automatics 2018" (September 18-19, 2018, Lviv, Ukraine) which is the main Ukrainian Control Conference organized by Ukrainian Association on Automatic Control (National member organization of IFAC) and Lviv National University "Lvivska Politechnica." More than 100 papers were presented at the conference with topics including: mathematical problems of control, optimization and game theory; control and identification under uncertainty; automated control of technical, technological and biotechnical objects; controlling the aerospace craft, marine vessels and other moving objects; intelligent control and information processing; mechatronics and robotics; information measuring technologies in automation; automation and IT training of personnel; the Internet of things and the latest technologies. The book is divided into two main parts, the first concerning theory (7 chapters) and the second concerning applications (7 chapters) of advanced control systems. The first part "Advances in Theoretical Research on Automatic Control" consists of theoretical research results which deal with descriptor control impulsive-delay systems, motion control in condition of conflict, inverse dynamic models, invariant relations in optimal control, robust adaptive control, bio-inspired algorithms, optimization of fuzzy control systems, and extremal routing problem with constraints and complicated cost functions. The second part "Advances in Control Systems Applications" is based on the chapters which consider different aspects of practical implementation of advanced control systems, in particular, special cases in determining the spacecraft position and attitude using computer vision system, the spacecraft orientation by information from a system of stellar sensors, control synthesis of rotational and spatial spacecraft motion at approaching stage of docking, intelligent algorithms for the automation of complex biotechnical objects, an automatic control system for the slow pyrolysis of organic substances with variable composition, simulation complex of hierarchical systems based on the foresight and cognitive modelling, and advanced identification of impulse processes in cognitive maps. The chapters have been structured to provide an easy-to-follow introduction to the topics that are addressed, including the most relevant references, so that anyone interested in this field can get started in the area. This book may be useful for researchers and students who are interested in advanced control systems.

AI and IoT-Based Intelligent Automation in Robotics - Ashutosh Kumar Dubey 2021-04-13
The 24 chapters in this book provides a deep overview of robotics and the application of AI and IoT in robotics. It contains the exploration of AI and IoT based intelligent automation in robotics. The various algorithms and frameworks for robotics based on AI and IoT are presented, analyzed, and discussed. This book also provides insights on application of robotics in education, healthcare, defense and many other fields which utilize IoT and AI. It also introduces the idea of smart cities using robotics.

Introduction to Robotics - Saeed Benjamin Niku 2011
"Niku offers comprehensive, yet concise coverage of robotics that will appeal to engineers. Robotic applications are drawn from a wide variety of fields. Emphasis is placed on design along with analysis and modeling. Kinematics and dynamics are covered extensively in an accessible style. Vision systems are discussed in detail, which is a cutting-edge area in robotics. Engineers will also find a running design project that reinforces the concepts by having them apply what they've learned."--

Elements of Robotics - Mordechai Ben-Ari 2017-10-25
This open access book bridges the gap between playing with robots in school and studying robotics at the upper undergraduate and graduate levels to prepare for careers in industry and research. Robotic algorithms are presented formally, but using only mathematics known by high-school and first-year college students, such as calculus, matrices and probability. Concepts and algorithms are explained through detailed diagrams and calculations. Elements of Robotics presents an overview of different types of robots and the components used to build robots, but focuses on robotic algorithms: simple algorithms like odometry and feedback control, as well as algorithms for advanced topics like localization, mapping, image processing, machine learning and swarm robotics. These algorithms are demonstrated in simplified contexts that enable detailed computations to be performed and feasible activities to be posed. Students who study these simplified demonstrations will be well prepared for advanced study of robotics. The algorithms are presented at a relatively abstract level, not tied to any specific robot. Instead a generic robot is defined that uses elements common to most educational robots: differential drive with two motors, proximity sensors and some method of displaying output to the user. The theory is supplemented with over 100 activities, most of which can be successfully implemented using inexpensive educational robots. Activities that require more computation can be programmed on a computer. Archives are available with suggested implementations for the Thymio robot and standalone programs in Python.

Rehabilitation Robotics - Roberto Colombo 2018-03-08
Rehabilitation Robotics gives an introduction and overview of all areas of rehabilitation robotics, perfect for anyone new to the field. It also summarizes available robot technologies and their application to different pathologies for skilled researchers and clinicians. The editors have been involved in the development and application of robotic devices for neurorehabilitation for more than 15 years. This experience using several commercial devices for robotic rehabilitation has enabled them to develop the know-how and expertise necessary to guide those seeking comprehensive understanding of this topic. Each chapter is written by an expert in the respective field, pulling in perspectives from both engineers and clinicians to present a multi-disciplinary view. The book targets the implementation of efficient robot strategies to facilitate the re-acquisition of motor skills. This technology incorporates the outcomes of behavioral studies on motor learning and its neural correlates into the design, implementation and validation of robot agents that behave as 'optimal' trainers, efficiently exploiting the structure and plasticity of the human sensorimotor systems. In this context, human-robot interaction plays a paramount role, at both the physical and cognitive level, toward achieving a symbiotic interaction where the human body and the robot can benefit from each

other's dynamics. Provides a comprehensive review of recent developments in the area of rehabilitation robotics Includes information on both therapeutic and assistive robots Focuses on the state-of-the-art and representative advancements in the design, control, analysis, implementation and validation of rehabilitation robotic systems