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Control of Robot Manipulators in Joint Space - Rafael Kelly 2006-03-30
Tutors can design entry-level courses in robotics with a strong orientation to the fundamental discipline of manipulator control pdf solutions manual Overheads will save a great deal of time with class preparation and will give students a low-effort basis for more detailed class notes Courses for senior undergraduates can be designed around Parts I – III; these can be augmented for masters courses using Part IV
Trends in Intelligent Robotics, Automation, and Manufacturing - S.G. Poonambalam 2012-11-28
This book constitutes the proceedings of the First International Conference on Intelligent Robotics and Manufacturing, IRAM 2012, held in Kuala Lumpur, Malaysia, in November 2012. The 64 revised full papers included in this volume were carefully reviewed and selected from 102 initial submissions. The papers are organized in topical sections named: mobile robots, intelligent autonomous systems, robot vision and robust, autonomous agents, micro, meso and nano-scale automation and assembly, flexible manufacturing systems, CIM and micro-machining, and fabrication techniques.
Soft Robotics: Trends, Applications and Challenges - Cecilia Laschi 2016-09-21
This book offers a comprehensive, timely snapshot of current research, technologies and applications of soft robotics. The different chapters, written by international experts across multiple fields of soft robotics, cover innovative systems and technologies for soft robot legged locomotion, soft robot manipulation, underwater soft robotics, biomimetic soft robotic platforms, plant-inspired soft robots, flying soft robots, soft robotics in surgery, as well as methods for their modeling and control. Based on the results of the second edition of the Soft Robotics Week, held on April 25 – 30, 2016, in Livorno, Italy, the book reports on the major research lines and novel technologies presented and discussed during the event.
Robot Modeling and Control - Mark W. Spong 2020-03-30
A New Edition Featuring Case Studies and Examples of the Fundamentals of Robot Kinematics, Dynamics, and Control In the 2nd Edition of Robot Modeling and Control, students will cover the theoretical fundamentals and the latest technological advances in robot kinematics. With so much advancement in technology, from robotics to motion planning, society can implement more powerful and dynamic algorithms than ever before. This in-depth reference guide educates readers in four distinct parts; the first two serve as a guide to the fundamentals of robotics and motion control, while the last two dive more in-depth into control theory and nonlinear system analysis. With the new edition, readers gain access to new case studies and thoroughly researched information covering topics such as: ● Motion-planning, collision avoidance, trajectory optimization, and control of robots ● Popular topics within the robotics industry and how they apply to various technologies ● An expanded set of examples, simulations, problems, and case studies ● Open-ended suggestions for students to apply the knowledge to real-life situations A four-part reference essential for both undergraduate and graduate students, Robot Modeling and Control serves as a foundation for a solid education in robotics and motion planning.
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.
Planning Algorithms - Steven M. LaValle 2006-05-29
Planning algorithms are impacting technical disciplines and industries around the world, including robotics, computer-aided design, manufacturing, computer graphics, aerospace applications, drug design, and protein folding. This coherent and comprehensive book unifies material from several sources, including robotics, control theory, artificial intelligence, and algorithms. The treatment is centered on robot motion planning, but integrates material on planning in discrete spaces. A major part of the book is devoted to planning under uncertainty, including decision theory, Markov decision processes, and information spaces, which are the 'configuration spaces' of all sensor-based planning problems. The last part of the book delves into planning under differential constraints that arise when automating the motions of virtually any mechanical system. This text and reference is intended for students, engineers, and researchers in robotics, artificial intelligence, and control theory as well as computer graphics, algorithms, and computational biology.
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
Control of Robot Manipulators in Joint Space - Rafael Kelly 2005-06-27
Tutors can design entry-level courses in robotics with a strong orientation to the fundamental discipline of manipulator control pdf solutions manual Overheads will save a great deal of time with class preparation and will give students a low-effort basis for more detailed class notes Courses for senior undergraduates can be designed around Parts I – III; these can be augmented for masters courses using Part IV
Robot Modeling and Control - Mark W. Spong 2020-02-07
A New Edition Featuring Case Studies and Examples of the Fundamentals of Robot Kinematics, Dynamics, and Control In the 2nd Edition of Robot Modeling and Control, students will cover the theoretical fundamentals and the latest technological advances in robot kinematics. With so much advancement in technology, from robotics to motion planning, society can implement more powerful and dynamic algorithms than ever before. This in-depth reference guide educates readers in four distinct parts; the first two serve as a guide to the fundamentals of robotics and motion control, while the last two dive more in-depth into control theory and nonlinear system analysis. With the new edition, readers gain access to new case studies and thoroughly researched information covering topics such as: ● Motion-planning, collision avoidance, trajectory optimization, and control of robots ● Popular topics within the robotics industry and how they apply to various technologies ● An expanded set of examples, simulations, problems, and case studies ● Open-ended suggestions for students to apply the knowledge to real-life situations A four-part reference essential for both

undergraduate and graduate students, Robot Modeling and Control serves as a foundation for a solid education in robotics and motion planning.

Humanoid Robots - Armando Carlos De Pina Filho 2007-06-01

For many years, the human being has been trying, in all ways, to recreate the complex mechanisms that form the human body. Such task is extremely complicated and the results are not totally satisfactory. However, with increasing technological advances based on theoretical and experimental researches, man gets, in a way, to copy or to imitate some systems of the human body. These researches not only intended to create humanoid robots, great part of them constituting autonomous systems, but also, in some way, to offer a higher knowledge of the systems that form the human body, objectifying possible applications in the technology of rehabilitation of human beings, gathering in a whole studies related not only to Robotics, but also to Biomechanics, Biomimmetics, Cybernetics, among other areas. This book presents a series of researches inspired by this ideal, carried through by various researchers worldwide, looking for to analyze and to discuss diverse subjects related to humanoid robots. The presented contributions explore aspects about robotic hands, learning, language, vision and locomotion.

Modelling and Control of Robot Manipulators - Lorenzo Sciavicco 2012-12-06

Fundamental and technological topics are blended uniquely and developed clearly in nine chapters with a gradually increasing level of complexity. A wide variety of relevant problems is raised throughout, and the proper tools to find engineering-oriented solutions are introduced and explained, step by step. Fundamental coverage includes: Kinematics; Statics and dynamics of manipulators; Trajectory planning and motion control in free space. Technological aspects include: Actuators; Sensors; Hardware/software control architectures; Industrial robot-control algorithms. Furthermore, established research results involving description of end-effector orientation, closed kinematic chains, kinematic redundancy and singularities, dynamic parameter identification, robust and adaptive control and force/motion control are provided. To provide readers with a homogeneous background, three appendices are included on: Linear algebra; Rigid-body mechanics; Feedback control. To acquire practical skill, more than 50 examples and case studies are carefully worked out and interwoven through the text, with frequent resort to simulation. In addition, more than 80 end-of-chapter exercises are proposed, and the book is accompanied by a solutions manual containing the MATLAB code for computer problems; this is available from the publisher free of charge to those adopting this work as a textbook for courses.

Modeling, Identification and Control of Robots - W. Khalil 2004-07-01

Written by two of Europe’s leading robotics experts, this book provides the tools for a unified approach to the modelling of robotic manipulators, whatever their mechanical structure. No other publication covers the three fundamental issues of robotics: modelling, identification and control. It covers the development of various mathematical models required for the control and simulation of robots. · World class authority · Unique range of coverage not available in any other book · Provides a complete course on robotic control at an undergraduate and graduate level

Robot Dynamics and Control - Spong 1989-05-24

Geometric Algebra Applications Vol. II - Eduardo Bayro-Corrochano 2020-06-19

This book presents a unified mathematical treatment of diverse problems in the general domain of robotics and associated fields using Clifford or geometric alge- bra. By addressing a wide spectrum of problems in a common language, it offers both fresh insights and new solutions that are useful to scientists and engineers working in areas related with robotics. It introduces non-specialists to Clifford and geometric algebra, and provides ex- amples to help readers learn how to compute using geometric entities and geomet- ric formulations. It also includes an in-depth study of applications of Lie group theory, Lie algebra, spinors and versors and the algebra of incidence using the universal geometric algebra generated by reciprocal null cones. Featuring a detailed study of kinematics, differential kinematics and dynamics using geometric algebra, the book also develops Euler Lagrange and Hamiltoni- ans equations for dynamics using conformal geometric algebra, and the recursive Newton-Euler using screw theory in the motor algebra framework. Further, it comprehensively explores robot modeling and nonlinear controllers, and discusses several applications in computer vision, graphics, neurocomputing, quantum com- puting, robotics and control engineering using the geometric algebra framework. The book also includes over 200 exercises and tips for the development of future computer software packages for extensive calculations in geometric algebra, and a entire section focusing on how to write the subroutines in C++, Matlab and Maple to carry out efficient geometric computations in the geometric algebra framework. Lastly, it shows how program code can be optimized for real-time computations. An essential resource for applied physicists, computer scientists, AI researchers, roboticists and mechanical and electrical engineers, the book clarifies and demonstrates the importance of geometric computing for building autonomous systems to advance cognitive systems research.

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

Mobile Robots - Gerald Cook 2011-10-14

An important feature of this book is the particular combination of topics included. These are (1) control, (2) navigation and (3) remote sensing, all with application to mobile robots. Much of the material is readily extended to any type ground vehicle. In the controls area, robot steering is the issue. Both linear and nonlinear models are treated. Various control schemes are utilized, and through these applications the reader is introduced to methods such as: (1) Linearization and use of linear control design methods for control about a reference trajectory, (2) Use of Lyapunov stability theory for nonlinear control design, (3) Derivation of optimal control strategies via Pontryagin’s maximum principle, (4) Derivation of a local coordinate system which is fundamental for the steering of vehicles along a path never before traversed. This local coordinate system has application regardless of the control design methods utilized. In the navigation area, various coordinate systems are introduced, and the transformations among them are derived. (1) The Global Positioning System (GPS) is introduced and described in significant detail. (2) Also introduced and discussed are inertial navigation systems (INS). These two methods are treated in terms of their ability to provide vehicle position as well as attitude. A preceding chapter is devoted to coordinate rotations and transformations since they play an important role in the understanding of this body of theory.

Human and Robot Hands - Matteo Bianchi 2016-02-24

This book looks at the common problems both human and robotic hands encounter when controlling the large number of joints, actuators and sensors required to efficiently perform motor tasks such as object exploration, manipulation and grasping. The authors adopt an integrated approach to explore the control of the hand based on sensorimotor synergies that can be applied in both neuroscience and robotics. Hand synergies are based on goal-directed, combined muscle and kinematic activation leading to a reduction of the dimensionality of the motor and sensory space, presenting a highly effective solution for the fast and simplified design of artificial systems. Presented in two parts, the first part, Neuroscience, provides the theoretical and experimental foundations to describe the synergistic organization of the human hand. The second part, Robotics, Models and Sensing Tools, exploits the

framework of hand synergies to better control and design robotic hands and haptic/sensing systems/tools, using a reduced number of control inputs/sensors, with the goal of pushing their effectiveness close to the natural one. Human and Robot Hands provides a valuable reference for students, researchers and designers who are interested in the study and design of the artificial hand.

Robotics, Vision and Control - Peter Corke 2011-09-05

The author has maintained two open-source MATLAB Toolboxes for more than 10 years: one for robotics and one for vision. The key strength of the Toolboxes provide a set of tools that allow the user to work with real problems, not trivial examples. For the student the book makes the algorithms accessible, the Toolbox code can be read to gain understanding, and the examples illustrate how it can be used —instant gratification in just a couple of lines of MATLAB code. The code can also be the starting point for new work, for researchers or students, by writing programs based on Toolbox functions, or modifying the Toolbox code itself. The purpose of this book is to expand on the tutorial material provided with the toolboxes, add many more examples, and to weave this into a narrative that covers robotics and computer vision separately and together. The author shows how complex problems can be decomposed and solved using just a few simple lines of code, and hopefully to inspire up and coming researchers. The topics covered are guided by the real problems observed over many years as a practitioner of both robotics and computer vision. It is written in a light but informative style, it is easy to read and absorb, and includes a lot of Matlab examples and figures. The book is a real walk through the fundamentals of robot kinematics, dynamics and joint level control, then camera models, image processing, feature extraction and epipolar geometry, and bring it all together in a visual servo system. Additional material is provided at http://www.petercorke.com/RVC

Hands-On Introduction to LabVIEW for Scientists and Engineers - John Essick 2013

"Introduction to LabView programming for scientists and engineers"--

Learning for Adaptive and Reactive Robot Control - Aude Billard 2022-02-08

Methods by which robots can learn control laws that enable real-time reactivity using dynamical systems; with applications and exercises. This book presents a wealth of machine learning techniques to make the control of robots more flexible and safe when interacting with humans. It introduces a set of control laws that enable reactivity using dynamical systems, a widely used method for solving motion-planning problems in robotics. These control approaches can replan in milliseconds to adapt to new environmental constraints and offer safe and compliant control of forces in contact. The techniques offer theoretical advantages, including convergence to a goal, non-penetration of obstacles, and passivity. The coverage of learning begins with low-level control parameters and progresses to higher-level competencies composed of combinations of skills. Learning for Adaptive and Reactive Robot Control is designed for graduate-level courses in robotics, with chapters that proceed from fundamentals to more advanced content. Techniques covered include learning from demonstration, optimization, and reinforcement learning, and using dynamical systems in learning control laws, trajectory planning, and methods for compliant and force control . Features for teaching in each chapter: • applications, which range from arm manipulators to whole-body control of humanoid robots; • pencil-and-paper and programming exercises; • lecture videos, slides, and MATLAB code examples available on the author’s website . • an eTextbook platform website offering protected material[EPS2] for instructors including solutions.

Robot Dynamics And Control - Mark W Spong 2008-08-04

This self-contained introduction to practical robot kinematics and dynamics includes a comprehensive treatment of robot control. It provides background material on terminology and linear transformations, followed by coverage of kinematics and inverse kinematics, dynamics, manipulator control, robust control, force control, use of feedback in nonlinear systems, and adaptive control. Each topic is supported by examples of specific applications. Derivations and proofs are included in many cases. The book includes many worked examples, examples illustrating all aspects of the theory, and problems.

Bioinspired Legged Locomotion - Maziar Ahmad Sharbafi 2017-11-21

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

Wheeled Mobile Robotics - Gregor Klancar 2017-02-02

Wheeled Mobile Robotics: From Fundamentals Towards Autonomous Systemscovers the main topics from the wide area of mobile robotics, explaining all applied theory and application. The book gives the reader a good foundation, enabling them to continue to more advanced topics. Several examples are included for better understanding, many of them accompanied by short MATLAB® script code making it easy to reuse in practical work. The book includes several examples of discussed methods and projects for wheeled mobile robots and some advanced methods for their control and localization. It is an ideal resource for those seeking an understanding of robotics, mechanics, and control, and for engineers and researchers in industrial and other specialized research institutions in the field of wheeled mobile robotics. Beginners with basic math knowledge will benefit from the examples, and engineers with an understanding of basic system theory and control will find it easy to follow the more demanding fundamental parts and advanced methods explained. Offers comprehensive coverage of the essentials of the field that are suitable for both academics and practitioners Includes several examples of the application of algorithms in simulations and real laboratory projects Presents foundation in mobile robotics theory before continuing with more advanced topics Self-sufficient to beginner readers, covering all important topics in the mobile robotics field Contains specific topics on modeling, control, sensing, path planning, localization, design architectures, and multi-agent systems

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.

Local Stability and Ultimate Boundedness in the Control of Robot Manipulators - Marco A. Arteaga 2021-11-08

This book offers a unique compendium of the authors´ own research on the use of theoretical stability analysis, showing how to take advantage of local stability design and ultimate boundedness for practical robot control. It addresses researchers and postgraduate students dealing with control theory, particularly with nonlinear systems. Thanks to the numerous worked examples, it could also be used as a textbook in postgraduate courses.

Modelling and Control of Robot Manipulators - Lorenzo Sciavicco 2001-02-19

Fundamental and technological topics are blended uniquely and developed clearly in nine chapters with a gradually increasing level of complexity. A wide variety of relevant problems is raised throughout, and the proper tools to find engineering-oriented solutions are introduced and explained, step by step. Fundamental coverage includes: Kinematics;

Statics and dynamics of manipulators; Trajectory planning and motion control in free space. Technological aspects include: Actuators; Sensors; Hardware/software control architectures; Industrial robot-control algorithms. Furthermore, established research results involving description of end-effector orientation, closed kinematic chains, kinematic redundancy and singularities, dynamic parameter identification, robust and adaptive control and force/motion control are provided. To provide readers with a homogeneous background, three appendices are included on: Linear algebra; Rigid-body mechanics; Feedback control. To acquire practical skill, more than 50 examples and case studies are carefully worked out and interwoven through the text, with frequent resort to simulation. In addition, more than 80 end-of-chapter exercises are proposed, and the book is accompanied by a solutions manual containing the MATLAB code for computer problems; this is available from the publisher free of charge to those adopting this work as a textbook for courses.

Mobile Robotics - Alonzo Kelly 2013-11-11

Introduction -- Math fundamentals -- Numerical methods -- Dynamics -- Optimal estimation -- State estimation -- Control -- Perception -- Localization and mapping -- Motion planning

Design and Control of Intelligent Robotic Systems - Dikai Liu 2009-01-22

With the increasing applications of intelligent robotic systems in various ?elds, the - sign and control of these systems have increasingly attracted interest from researchers. This edited book entitled “Design and Control of Intelligent Robotic Systems” in the book series of “Studies in Computational Intelligence” is a collection of some advanced research on design and control of intelligent robots. The works presented range in scope from design methodologies to robot development. Various design approaches and al- rithms, such as evolutionary computation, neural networks, fuzzy logic, learning, etc. are included. We also would like to mention that most studies reported in this book have been implemented in physical systems. An overview on the applications of computational intelligence in bio-inspired robotics is given in Chapter 1 by M. Begum and F. Karray, with highlights of the recent progress in bio-inspired robotics research and a focus on the usage of computational intelligence tools to design human-like cognitive abilities in the robotic systems. In Chapter 2, Lisa L. Grant and Ganesh K. Venayagamoorthy present greedy search, particle swarm optimization and fuzzy logic based strategies for navigating a swarm of robots for target search in a hazardous environment, with potential applications in high-risk tasks such as disaster recovery and hazardous material detection.

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.

The Reaction Wheel Pendulum - Daniel J. Block 2007-12-01

This monograph describes the Reaction Wheel Pendulum, the newest inverted-pendulum-like device for control education and research. We discuss the history and background of the reaction wheel pendulum and other similar experimental devices. We develop mathematical models of the reaction wheel pendulum in depth, including linear and nonlinear models, and models of the sensors and actuators that are used for feedback control. We treat various aspects of the control problem, from linear control of themotor, to stabilization of the pendulum about an equilibrium configuration using linear control, to the nonlinear control problem of swingup control. We also discuss hybrid and switching control, which is useful for switching between the swingup and balance controllers. We also discuss important practical issues such as friction modeling and friction compensation, quantization of sensor signals, and saturation. This monograph can be used as a supplement for courses in feedback control at the undergraduate level, courses in mechatronics, or courses in linear and nonlinear state space control at the graduate level. It can also be used as a laboratory manual and as a reference for research in nonlinear control.

Humanoid Robots - Dragomir N. Nenchev 2018-11-21

Humanoid Robots: Modeling and Control provides systematic presentation of the models used in the analysis, design and control of humanoid robots. The book starts with a historical overview of the field, a summary of the current state of the art achievements and an outline of the related fields of research. It moves on to explain the theoretical foundations in terms of kinematic, kineto-static and dynamic relations. Further on, a detailed overview of biped balance control approaches is presented. Models and control algorithms for cooperative object manipulation with a multi-finger hand, a dual-arm and a multi-robot system are also discussed. One of the chapters is devoted to selected topics from the area of motion generation and control and their applications. The final chapter focuses on simulation environments, specifically on the step-by-step design of a simulator using the Matlab® environment and tools. This book will benefit readers with an advanced level of understanding of robotics, mechanics and control such as graduate students, academic and industrial researchers and professional engineers. Researchers in the related fields of multi-legged robots, biomechanics, physical therapy and physics-based computer animation of articulated figures can also benefit from the models and computational algorithms presented in the book. Provides a firm theoretical basis for modelling and control algorithm design Gives a systematic presentation of models and control algorithms Contains numerous implementation examples demonstrated with 43 video clips

Robotic Manipulators and Vehicles - Gerasimos Rigatos 2018-05-24

This monograph addresses problems of: • nonlinear control, estimation and filtering for robotic manipulators (multi-degree-of freedom rigid-link robots, flexible-link robots, underactuated, redundant and cooperating manipulators and closed-chain robotic mechanisms); and• nonlinear control, estimation and filtering for autonomous robotic vehicles operating on the ground, in the air, and on and under water, independently and in cooperating groups. The book is a thorough treatment of the entire range of applications of robotic manipulators and autonomous vehicles. The nonlinear control and estimation methods it develops can be used generically, being suitable for a wide range of robotic systems. Such methods can improve robustness, precision and fault-tolerance in robotic manipulators and vehicles at the same time as enabling the reliable functioning of these systems under variable conditions, model uncertainty and external perturbations.

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.

Modern Control Systems - Richard C. Dorf 2011

Modern Control Systems, 12e, is ideal for an introductory undergraduate course in control systems for engineering students. Written to be equally useful for all engineering disciplines, this text is organized around the concept of control systems theory as it has been developed in the frequency and time domains. It provides coverage of classical control, employing root locus design, frequency and response design using Bode and Nyquist plots. It also covers modern control methods based on state variable models including pole placement design techniques with full-state feedback controllers and full-state observers. Many examples throughout give students ample opportunity to apply the theory to the design and analysis of control systems. Incorporates computer-aided design and analysis using MATLAB and LabVIEW MathScript.

Bipedal Robots - Christine Chevallereau 2013-03-01

This book presents various techniques to carry out the gait modeling, the gait patterns synthesis, and the control of biped robots. Some general information on the human walking, a presentation of the current experimental biped robots, and the application of walking bipeds are

given. The modeling is based on the decomposition on a walking step into different sub-phases depending on the way each foot stands into contact on the ground. The robot design is dealt with according to the mass repartition and the choice of the actuators. Different ways to generate walking patterns are considered, such as passive walking and gait synthesis performed using optimization technique. Control based on the robot modeling, neural network methods, or intuitive approaches are presented. The unilaterality of contact is dealt with using on-line adaptation of the desired motion.

Mastering ROS for Robotics Programming - Lentin Joseph 2015-12-21

Design, build and simulate complex robots using Robot Operating System and master its out-of-the-box functionalities About This Book Develop complex robotic applications using ROS for interfacing robot manipulators and mobile robots with the help of high end robotic sensors Gain insights into autonomous navigation in mobile robot and motion planning in robot manipulators Discover the best practices and troubleshooting solutions everyone needs when working on ROS Who This Book Is For If you are a robotics enthusiast or researcher who wants to learn more about building robot applications using ROS, this book is for you. In order to learn from this book, you should have a basic knowledge of ROS, GNU/Linux, and C++ programming concepts. The book will also be good for programmers who want to explore the advanced features of ROS. What You Will Learn Create a robot model of a Seven-DOF robotic arm and a differential wheeled mobile robot Work with motion planning of a Seven-DOF arm using MoveIt! Implement autonomous navigation in differential drive robots using SLAM and AMCL packages in ROS Dig deep into the ROS Pluginlib, ROS nodelets, and Gazebo plugins Interface I/O boards such as Arduino, Robot sensors, and High end actuators with ROS Simulation and motion planning of ABB and Universal arm using ROS Industrial Explore the ROS framework using its latest version In Detail The area of robotics is gaining huge momentum among corporate people, researchers, hobbyists, and students. The major challenge in robotics is its controlling software. The Robot Operating System (ROS) is a modular software platform to develop generic robotic applications. This book discusses the advanced concepts in robotics and how to program using ROS. It starts with deep overview of the ROS framework, which will give you a clear idea of how ROS really works. During the course of the book, you will learn how to build models of complex robots, and simulate and interface the robot using the ROS MoveIt motion planning library and ROS navigation stacks. After discussing robot manipulation and navigation in robots, you will get to grips with the interfacing I/O boards, sensors, and actuators of ROS. One of the essential ingredients of robots are vision sensors, and an entire chapter is dedicated to the vision sensor, its interfacing in ROS, and its programming. You will discuss the hardware interfacing and simulation of complex robot to ROS and ROS Industrial (Package used for interfacing industrial robots). Finally, you will get to know the best practices to follow when programming using ROS. Style and approach This is a simplified guide to help you learn and master advanced topics in ROS using hands-on examples.

RoboCup 2002: Robot Soccer World Cup VI - Gal A. Kaminka 2003-08-04

RoboCup 2002, the 6th Robot World Cup Soccer and Rescue Competitions and Conference, took place during June 19–25, 2002, at the Fukuoka Dome (main venue) in Fukuoka, Japan. It was, by far, the RoboCup event with the largestnumberofregisteredparticipants(1004persons,distributedin188teams from 29 countries) and visitors (around 120,000 persons). As was done in its previous editions since 1997, the event included several robotic competitions and aninternationalsymposium.Thepapersandposterspresentedatthesymposium constitutethemainpartofthisbook.Leaguereportsinthe?nalsectiondescribe signi?cant advances in each league and the results. The symposium organizers received 76 submissions, among which 17 papers (22%) were accepted for oral presentation at the symposium (?rst section of the book), and 21 papers (29%) were accepted as posters (second section of the book). Most papers were evaluated by three reviewers each, chosen from the members of the International Program Committee (IPC). The IPC consisted of a balanced combination of regular RoboCup participants and researchers from outside this community. The reviewers worked hard to guarantee a fair review process – the result of their work was a high-quality symposium with very - teresting presentations.

Robot Control 1991 (SYROCO'91) - I. Troch 2014-05-23

This volume contains 92 papers on the state-of-the-art in robotics research. In this volume topics on modelling and identification are treated first as they build the basis for practically all control aspects. Then, the most basic control tasks are discussed i.e. problems of inverse kinematics. Groups of papers follow which deal with various advanced control aspects. They range from rather general methods to more specialized topics such as force control and control of hydraulic robots. The problem of path planning is addressed and strategies for robots with one arm, for mobile robots and for multiple arm robots are presented. Also covered are computational improvements and software tools for simulation and control, the integration of sensors and sensor signals in robot control.

Modeling and Control of a Tracked Mobile Robot for Pipeline Inspection - Michał Ciszewski 2020-03-18

This book describes the design, mathematical modeling, control system development and experimental validation of a versatile mobile pipe inspection robot. It also discusses a versatile robotic system for pipeline inspection, together with an original, adaptable tracked mobile robot featuring a patented motion unit. Pipeline inspection is a common field of application for mobile robots because the monitoring of inaccessible, long and narrow pipelines is a very difficult task for humans. The main design objective is to minimize the number of robots needed to inspect different types of horizontal and vertical pipelines, with both smooth and rough surfaces. The book includes extensive information on the various design phases, mathematical modeling, simulations and control system development. In closing, the prototype construction process and testing procedures are presented and supplemented with laboratory and field experiments.

Robot Modeling and Kinematics - Rachid Manseur 2006

Robot Modeling and Kinematics teaches the fundamental topics of robotics, using cutting-edge visualization software and computer tools to illustrate topics and provide a comprehensive process of teaching and learning. The book provides an introduction to robotics with an emphasis on the study of robotic arms, their mathematical description, and the equations describing their motion. It teaches how to model robotic arms efficiently and analyze their kinematics. The kinematics of robot manipulators is also presented beginning with the use of simple robot mechanisms and progressing to the most complex robot manipulator structures. While mathematically rigorous, the book's focus is on ease of understanding of the concepts with interactive animated computer graphics illustrations and modeling software that allow clear understanding of the material covered in the book. All necessary computations are concisely explained and software is provided that greatly eases the computational burden normally associated with robotics. Written for use in a robotics course or as a professional reference, Robot Modeling and Kinematics is an essential resource that provides a thorough understanding of the topics of modeling and kinematics.