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Snake Robots - Pål Liljebäck 2012-06-13
Snake Robots is a novel treatment of theoretical and practical topics related to snake robots: robotic mechanisms designed to move like biological snakes and able to operate in challenging environments in which human presence is either undesirable or impossible. Future applications of such robots include search and rescue, inspection and maintenance, and subsea operations. Locomotion in unstructured environments is a focus for this book. The text targets the disparate muddle of approaches to modelling, development and control of snake robots in current literature, giving a unified presentation of recent research results on snake robot locomotion to increase the reader's basic understanding of these mechanisms and their motion dynamics and clarify the state of the art in the field. The book is a complete treatment of snake robotics, with topics ranging from mathematical modelling techniques, through mechatronic design and implementation, to control design strategies. The development of two snake robots is described and both are used to provide experimental validation of many of the theoretical results. Snake Robots is written in a clear and easily understandable manner which makes the material accessible by specialists in the field and non-experts alike. Numerous illustrative figures and images help readers to visualize the material. The book is particularly useful to new researchers taking on a topic related to snake robots because it provides an extensive overview of the snake robot literature and also represents a suitable starting point for research in this area.
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.
Robot Motion and Control - Krzysztof R. Kozlowski 2006-07-26
This book presents recent results in robot motion and control. Twenty papers presented at the Fourth International Workshop on Robot Motion and Control held in 2004 have been expanded. The authors of these papers were carefully selected and represent leading institutions in this field. The book covers nonlinear control of nonholonomic systems and legged robots as well as trajectory planning for these systems, topics not covered in previous books.

Robot Manipulator Redundancy Resolution - Yunong Zhang 2017-09-11

Introduces a revolutionary, quadratic-programming based approach to solving long-standing problems in motion planning and control of redundant manipulators This book describes a novel quadratic programming approach to solving redundancy resolutions problems with redundant manipulators. Known as ``QP-unified motion planning and control of redundant manipulators'' theory, it systematically solves difficult optimization problems of inequality-constrained motion planning and control of redundant manipulators that have plagued robotics engineers and systems designers for more than a quarter century. An example of redundancy resolution could involve a robotic limb with six joints, or degrees of freedom (DOFs), with which to position an object. As only five numbers are required to specify the position and orientation of the object, the robot can move with one remaining DOF through practically infinite poses while performing a specified task. In this case redundancy resolution refers to the process of choosing an optimal pose from among that infinite set. A critical issue in robotic systems control, the redundancy resolution problem has been widely studied for decades, and numerous solutions have been proposed. This book investigates various approaches to motion planning and control of redundant robot manipulators and describes the most successful strategy thus far developed for resolving redundancy resolution problems. Provides a fully connected, systematic, methodological, consecutive, and easy approach to solving redundancy resolution problems Describes a new approach to the time-varying Jacobian matrix pseudoinversion, applied to the redundant-manipulator kinematic control Introduces The QP-based unification of robots' redundancy resolution Illustrates the effectiveness of the methods presented using a large number of computer simulation results based on PUMA560, PA10, and planar robot manipulators Provides technical details for all schemes and solvers presented, for readers to adopt and customize them for specific industrial applications Robot Manipulator Redundancy Resolution is must-reading for advanced undergraduates and graduate students of robotics, mechatronics, mechanical engineering, tracking control, neural dynamics/neural networks, numerical algorithms, computation and optimization, simulation and modelling, analog, and digital circuits. It is also a valuable working resource for practicing robotics engineers and systems designers and industrial researchers.

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.

Intelligent Marine Robotics Modelling, Simulation and Applications - Cheng Siong Chin 2020-04-24

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

Multibody System Dynamics, Robotics and Control - Hubert Gattringer 2013-01-06

The volume contains 19 contributions by international experts in the field of multibody system dynamics, robotics and control. The book aims to bridge the gap between the modeling of mechanical systems by means of

multibody dynamics formulations and robotics. In the classical approach, a multibody dynamics model contains a very high level of detail, however, the application of such models to robotics or control is usually limited. The papers aim to connect the different scientific communities in multibody dynamics, robotics and control. Main topics are flexible multibody systems, humanoid robots, elastic robots, nonlinear control, optimal path planning, and identification.

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

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!

Human-Aware Robotics: Modeling Human Motor Skills for the Design, Planning and Control of a New Generation of Robotic Devices - Giuseppe Averta 2022-01-25

This book moves from a thorough investigation of human capabilities during movements and interactions with objects and environment and translates those principles into the design planning and control of innovative mechatronic systems, providing significant advancements in the fields of human–robot interaction, autonomous robots, prosthetics and assistive devices. The work presented in this monograph is characterized by a significant paradigmatic shift with respect to typical approaches, as it always place the human at the center of the technology developed, and the human represents the starting point and the actual beneficiary of the developed solutions. The content of this book is targeted to robotics and neuroscience enthusiasts, researchers and makers, students and simple lovers of the matter.

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

Robot Manipulator Control - Frank L. Lewis 2003-12-12

Robot Manipulator Control offers a complete survey of control systems for serial-link robot arms and acknowledges how robotic device performance hinges upon a well-developed control system. Containing over 750 essential equations, this thoroughly up-to-date Second Edition, the book explicates theoretical and mathematical requisites for controls design and summarizes current techniques in computer simulation and implementation of controllers. It also addresses procedures and issues in computed-torque, robust, adaptive, neural network, and force control. New chapters relay practical information on commercial robot manipulators and devices and cutting-edge methods in neural network control.

Modern Robotics - Kevin M. Lynch 2017-05-25

A modern and unified treatment of the mechanics, planning, and control of robots, suitable for a first course in robotics.

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.

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.

Optimization of Motion Planning and Control for Automatic Machines, Robots and Multibody Systems - Paolo Boscariol 2020-09-11

The optimization of motion and trajectory planning is an effective and usually costless approach to improving the performance of robots, mechatronic systems, automatic machines and multibody systems. Indeed, wise planning increases precision and machine productivity, while reducing vibrations, motion time, actuation effort and energy consumption. On the other hand, the availability of optimized methods for motion planning allows for a cheaper and lighter system construction. The issue of motion planning is also tightly linked with the synthesis of high-performance feedback and feedforward control schemes, which can either enhance the effectiveness of motion planning or compensate for its gaps. To collect and disseminate a meaningful collection of these applications, this book proposes 15 novel research studies that cover different sub-areas, in the framework of motion planning and control.

Autonomous Robots - Farbod Fahimi 2008-10-25

It is at least two decades since the conventional robotic manipulators have become a common manufacturing tool for different industries, from automotive to pharmaceutical. The proven benefits of utilizing robotic manipulators for manufacturing in different industries motivated scientists and researchers to try to extend the applications of robots to many other areas by inventing several new types of robots other than conventional manipulators. The new types of robots can be categorized in two groups; redundant (and hyper-redundant) manipulators, and mobile (ground, marine, and aerial) robots. These groups of robots, known as advanced robots, have more freedom for their mobility, which allows them to do tasks that the conventional manipulators cannot do. Engineers have taken advantage of the extra mobility of the advanced robots to make them work in constrained environments, ranging from limited joint motions for redundant (or hyper-redundant) manipulators to obstacles in the way of mobile (ground, marine, and aerial) robots. Since these constraints usually depend on the work environment, they are variable. Engineers have had to invent methods to allow the robots to deal with a variety of constraints automatically. A robot that is equipped with those methods is called an Autonomous Robot. Autonomous Robots: Kinematics, Path Planning, and Control covers the kinematics and dynamic modeling/analysis of Autonomous Robots, as well as the methods suitable for their control. The text is suitable for mechanical and electrical engineers who want to familiarize themselves with methods of modeling/analysis/control that have been proven efficient through research.

Introduction To Robotics: Mechanics And Control, 3/E - John J. Craig 2009

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.

Trajectory Planning for Automatic Machines and Robots - Luigi Biagiotti 2008-10-23

This book deals with the problems related to planning motion laws and t- jectories for the actuation system of automatic machines, in particular for those based on electric drives, and robots. The problem of planning suitable trajectories is relevant not only for the proper use of these machines, in order to avoid undesired e?ects such as vibrations or even damages on the mech- ical structure, but also in some phases of their design and in the choice and sizing of the actuators. This is particularly true now that the concept of “el- tronic cams” has replaced, in the design of automatic machines, the classical approach based on “mechanical cams”. The choice of a particular trajectory has direct and relevant implications on several aspects of the design and use of an automatic machine, like the dimensioning of the actuators and of the reduction gears, the vibrations and e?orts generated on the machine and on the load, the tracking errors during the motion execution. For these reasons, in order to understand and appreciate the peculiarities of the di?erent techniques available for trajectory planning, besides the ma- ematical aspects of their implementation also a detailed analysis in the time and frequency domains, a comparison of their main properties under di?erent points of view, and general considerations related to their practical use are reported.

Modelling and Control for Intelligent Industrial Systems - Gerasimos Rigatos 2011-02-02

Incorporating intelligence in industrial systems can help to increase productivity, cut-off production costs, and to improve working conditions and safety in industrial environments. This need has resulted in the rapid development of modeling and control methods for industrial systems and robots, of fault detection and isolation methods for the prevention of critical situations in industrial work-cells and production plants, of optimization methods aiming at a more profitable functioning of industrial installations and robotic devices and of machine intelligence methods aiming at reducing human intervention in industrial systems operation. To this end, the book analyzes and extends some main directions of research in modeling and control for industrial systems. These are: (i) industrial robots, (ii) mobile robots and autonomous vehicles, (iii) adaptive and robust control of electromechanical systems, (iv) filtering and stochastic estimation for multisensor fusion and sensorless control of industrial systems (iv) fault detection and isolation in robotic and industrial systems, (v) optimization in industrial automation and robotic systems design, and (vi) machine intelligence for robots autonomy. The book will be a useful companion to engineers and researchers since it covers a wide spectrum of problems in the area of industrial systems. Moreover, the book is addressed to undergraduate and post-graduate students, as an upper-level course supplement of automatic control and robotics courses.

Mechanics of Robotic Manipulation - Matthew T. Mason 2001-06-08

The science and engineering of robotic manipulation. "Manipulation" refers to a variety of physical changes made to the world around us. Mechanics of Robotic Manipulation addresses one form of robotic manipulation, moving objects, and the various processes involved—grasping, carrying, pushing, dropping, throwing, and so on. Unlike most books on the subject, it focuses on manipulation rather than manipulators. This attention to processes rather than devices allows a more fundamental approach, leading to results that apply to a broad range of devices, not just robotic arms. The book draws both on classical mechanics and on classical planning, which introduces the element of imperfect information. The book does not propose a specific solution to the problem of manipulation, but rather outlines a path of inquiry.

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.

Numerical Modelling in Robotics - Edgar Alonso Martínez García 2015-10-06

Modern robotic systems are tied to operate autonomously in real-world environments performing a variety of complex tasks. Autonomous robots must rely on fundamental capabilities such as locomotion, trajectory tracking control, multi-sensor fusion, task/path planning, navigation, and real-time perception. Combining this knowledge is essential to design rolling, walking, aquatic, and hovering robots that sense and self-control. This book contains a mathematical modelling framework to support the learning of modern robotics and mechatronics, aimed at advanced undergraduates or first-year PhD students, as well as researchers and practitioners. The volume exposes a solid understanding of mathematical methods as a common modelling framework to properly interpret advanced robotic systems. Including numerical approximations, solution of linear and non-linear systems of equations, curves fitting, differentiation and integration of functions. The book is suitable for courses on robotics, mechatronics, sensing models, vehicles design and control, modelling, simulation, and mechanisms analysis. It is organised with 17 chapters divided in five parts that conceptualise classical mechanics to model a wide variety of applied robotics. It comprehends a hover-craft, an amphibious hexapod, self-reconfiguration and under-actuation of rolling and passive walking robots with Hoekens, Klann, and Jansen limbs for bipedal, quadruped, and octapod robots.

State Estimation for Robotics - Timothy D. Barfoot 2017-07-31

A key aspect of robotics today is estimating the state, such as position and orientation, of a robot as it moves through the world. Most robots and autonomous vehicles depend on noisy data from sensors such as cameras or laser rangefinders to navigate in a three-dimensional world. This book presents common sensor models and practical advice on how to carry out state estimation for rotations and other state variables. It covers both classical state estimation methods such as the Kalman filter, as well as important modern topics such as batch estimation, the Bayes filter, sigmapoint and particle filters, robust estimation for outlier rejection, and continuous-time trajectory estimation and its connection to Gaussian-process regression. The methods are demonstrated in the context of important applications such as point-cloud alignment, pose-graph relaxation, bundle adjustment, and simultaneous localization and mapping. Students and practitioners of robotics alike will find this a valuable resource.

Robotics - Bruno Siciliano 2010-10-21

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.

Motion and Operation Planning of Robotic Systems - Giuseppe Carbone 2016-10-05

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.

Encyclopedia of Robotics - Marcelo H. Ang 2018-07-13

The Encyclopedia of Robotics addresses the existing need for an easily accessible yet authoritative and granular knowledge resource in robotic science and engineering. The encyclopedia is a work that comprehensively explains the scientific, application-based, interactive and socio-ethical parameters of robotics. It is the first work that explains at the concept and fact level the state of the field of robotics and its future directions. The encyclopedia is a complement to Springer’s highly successful Handbook of Robotics that has analyzed the state of robotics through the medium of descriptive essays. Organized in an A-Z format for quick and easy understanding of both the basic and advanced topics across a broad spectrum of areas in a self-contained form. The entries in this Encyclopedia will be a comprehensive description of terms used in robotics science and technology. Each term, when useful, is described concisely with online illustrations and enhanced user interactivity (on SpringerReference.com).

Introduction to Autonomous Robots - Nikolaus Correll 2016-04-25

This book introduces concepts in mobile, autonomous robotics to 3rd-4th year students in Computer Science or a related discipline. The book covers principles of robot motion, forward and inverse kinematics of robotic arms and simple wheeled platforms, perception, error propagation, localization and simultaneous localization and mapping. The cover picture shows a wind-up toy that is smart enough to not fall off a table just using intelligent mechanism design and illustrate the importance of the mechanism in designing intelligent, autonomous systems. This book is open source, open to contributions, and released under a creative common license.

Handbook of Research on Design, Control, and Modeling of Swarm Robotics - Tan, Ying 2015-12-09

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

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

Robotics - Bruno Siciliano 2009-08-29

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.

Robot Motion Planning and Control - Jean-Paul Laumond 2014-03-12

How can a robot decide what motions to perform in order to achieve tasks in the physical world? Robot motion planning encompasses several different disciplines, most notably robotics, computer science, control theory and mathematics. This volume presents an interdisciplinary account of recent developments in the field. Topics covered include: combining geometric algorithms and control techniques to account for the nonholonomic constraints of most mobile robots; the mathematical machinery necessary for understanding nonholonomic systems; applying optimal techniques to compute optimal paths; feedback control for nonholonomic mobile robots; probabilistic algorithms and new motion planning approaches; and a survey of recent techniques for dealing with collision detection.

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

Modelling and Control of Mechatronic and Robotic Systems - Alessandro Gasparetto 2021-09-02

Currently, the modelling and control of mechatronic and robotic systems is an open and challenging field of investigation in both industry and academia. The book encompasses the kinematic and dynamic modelling, analysis, design, and control of mechatronic and robotic systems, with the scope of improving their performance, as well as simulating and testing novel devices and control architectures. A broad range of disciplines and topics are included, such as robotic manipulation, mobile systems, cable-driven robots, wearable and rehabilitation devices, variable stiffness safety-oriented mechanisms, optimization of robot performance, and energy-saving systems.

Robot Force Control - Bruno Siciliano 2012-12-06

One of the fundamental requirements for the success of a robot task is the capability to handle interaction between manipulator and environment. The quantity that describes the state of interaction more effectively is the contact force at the manipulator's end effector. High values of contact force are generally undesirable since they may stress both the manipulator and the manipulated object; hence the need to seek for effective force control strategies. The book provides a theoretical and experimental treatment of robot interaction control. In the framework of model-based operational space control, stiffness control and impedance control are presented as the basic strategies for indirect force control; a key feature is the coverage of six-degree-of-freedom interaction tasks and manipulator kinematic redundancy. Then, direct force control strategies are presented which are obtained from motion control schemes suitably modified by the closure of an outer force regulation feedback loop. Finally,

advanced force and position control strategies are presented which include passivity-based, adaptive and output feedback control schemes. Remarkably, all control schemes are experimentally tested on a setup consisting of a seven-joint industrial robot with open control architecture and force/torque sensor. The topic of robot force control is not treated in depth in robotics textbooks, in spite of its crucial importance for practical manipulation tasks. In the few books addressing this topic, the material is often limited to single-degree-of-freedom tasks. On the other hand, several results are available in the robotics literature but no dedicated monograph exists. The book is thus aimed at filling this gap by providing a theoretical and experimental treatment of robot force control.

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.

Robotics - Bruno Siciliano 2008-11-07

The classic text on robot manipulators now covers visual control, motion planning and mobile robots too! 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.

Springer Handbook of Robotics - Bruno Siciliano 2016-07-27

The second edition of this handbook provides a state-of-the-art overview on the various aspects in the rapidly developing field of robotics. Reaching for the human frontier, robotics is vigorously engaged in the growing challenges of new emerging domains. Interacting, exploring, and working with humans, the new generation of robots will increasingly touch people and their lives. The credible prospect of practical robots among humans is the result of the scientific endeavour of a half a century of robotic developments that established robotics as a modern scientific discipline. The ongoing vibrant expansion and strong growth of the field during the last decade has fueled this second edition of the Springer Handbook of Robotics. The first edition of the handbook soon became a landmark in robotics publishing and won the American Association of Publishers PROSE Award for Excellence in Physical Sciences & Mathematics as well as the organization’s Award for Engineering & Technology. The second edition of the handbook, edited by two internationally renowned scientists with the support of an outstanding team of seven part editors and more than 200

authors, continues to be an authoritative reference for robotics researchers, newcomers to the field, and scholars from related disciplines. The contents have been restructured to achieve four main objectives: the enlargement of foundational topics for robotics, the enlightenment of design of various types of robotic systems, the extension of the treatment on robots moving in the environment, and the enrichment of advanced robotics applications. Further to an extensive update, fifteen new chapters have been introduced on emerging topics, and a new generation of authors have joined the handbook's team. A novel addition to the second edition is a comprehensive collection of multimedia references to more than 700 videos, which bring valuable insight into the contents. The videos can be viewed directly augmented into the text with a smartphone or tablet using a unique and specially designed app. Springer Handbook of Robotics Multimedia Extension Portal: http://handbookofrobotics.org/

Robot Modelling - Paul G. Ranky 1985

This book provides a step-by-step survey of the theory and applications of industrial robots. It includes case studies, numerical examples, and sample robot programs. Robot Modeling develops a mathematical model that is general in purpose and applicable to any robot.