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Artificial Intelligence for Future Generation Robotics
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Control and Performance, Volume 1 No Starch Press
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

Modern Robotics Tata McGraw-Hill Education
This two-volume book set explores how sensors and computer vision technologies are used for the navigation, control, stability, reliability, guidance, fault detection, self-maintenance, strategic re-planning and reconfiguration of unmanned aircraft systems (UAS). Volume 1 concentrates on UAS control and performance methodologies including Computer Vision and Data Storage, Integrated Optical Flow for Detection and Avoidance Systems, Navigation and Intelligence, Modeling and Simulation, Multisensor Data Fusion, Vision in Micro-Aerial Vehicles (MAVs), Computer Vision in UAV using ROS, Security Aspects of UAV and Robot Operating System, Vision in Indoor and Outdoor Drones, Sensors and Computer Vision, and Small UAV for Persistent Surveillance. Volume 2 focuses on UAS deployment and applications including UAV-CPSs as a Testbed for New Technologies and a Primer to Industry 5.0, Human-Machine Interface Design, Open Source Software (OSS) and Hardware (OSH), Image Transmission in MIMO-OSTBC System, Image Database, Communications Requirements, Video Streaming, and Communications Links, Multispectral vs Hyperspectral Imaging, Aerial Imaging and Reconstruction of Infrastructures, Deep Learning as an Alternative to Super Resolution Imaging, and Quality of Experience (QoE) and Quality of Service (QoS).
Mechanics and Control McGraw-Hill Companies
Over the past century, mechanization has been an important means for optimizing resource utilization, improving worker health and safety and reducing labor requirements in farming while increasing productivity and quality of 4F (Food, Fuel, Fiber, Feed). Recognizing this contribution, agricultural mechanization was considered as one of the top ten engineering achievements of 20th century by the National Academy of Engineering. Accordingly farming communities have adopted increasing level of automation and robotics to further improve the precision management of crops (including input resources), increase productivity and reduce farm labor beyond what has been possible with conventional mechanization technologies. It is more important than ever to continue to develop and adopt novel automation and robotic solutions into farming so that some of the most complex agricultural tasks, which require huge amount of seasonal labor such as fruit and vegetable harvesting, could be automated while meeting the rapidly increasing need for 4F. In addition, continual innovation in and adoption of agricultural automation and robotic technologies is essential to minimize the use of depleting resources including water, minerals and other chemicals so that sufficient amount of safe and healthy food can be produced for current generation while not compromising the potential for the future generation. This book aims at presenting the fundamental principles of various aspects of automation and robotics as they relate to production agriculture (the branch of agriculture dealing with farming operations from field preparation to seeding, to harvesting and field logistics). The building blocks of agricultural automation and robotics that are discussed in the book include sensing and machine vision, control, guidance, manipulation and end-effector technologies. The fundamentals and operating principles of these technologies are explained with examples from cutting-edge research and development currently going on around the word. This book brings together scientists, engineers, students and professionals working in these and

related technologies to present their latest examples of agricultural automation and robotics research, innovation and development while explaining the fundamentals of the technology. The book, therefore, benefits those who wish to develop novel agricultural engineering solutions and/or to adopt them in the future. .

Sensory Robotics for the Handling of Limp Materials Academic Press

Limp materials are used in many economically impo~tant industries such as garment manufacture, shoe manufacture, aerospace (composites) and automobiles (seats and trim). The use of sensors is essential for reliable robotic handling of these materials, which are often based on naturally occurring substances such as cotton and leather. The materials are limp and have non-homogeneous mechanical properties which are often impossible to predict accurately. The applications are very demanding for vision and tactile sensing and signal processing, adaptive control systems, planning and systems integration. This book comprises the collection of papers presented at the NATO Advanced Research Workshop on 'Sensory Robotics for the Handling of Limp Materials', held in October 1988 at Il Ciocco, Tuscany, Italy. The aim of the workshop was to examine the state of the art and determine what research is needed to provide the theoretical and technological tools for the successful application of sensory robotics to the handling of limp materials. The meeting also acted as the first-ever forum for the interchange of knowledge between applications-driven researchers and those researching into the provision of fundamental tools. The participants were drawn from academia (20), industry (5), and other non-university research organisations (5).

Robotics Springer Science & Business Media

Focusing on the important control problems in state-of-the-art robotics and automation, this volume features invited papers from a workshop held at CDC, San Diego, California. As well as looking at current problems, it aims to identify and discuss challenging issues that are yet to be solved but which will be vital to future research directions. The many topics covered include: automatic control, distributed multi-agent control, multirobots, dexterous hands, flexible manipulators, walking robots, free-floating systems, nonholonomic robots, sensor fusion, fuzzy control, virtual reality, visual servoing, and task synchronization. Control Problems in Robotics and Automation will be of interest to all researchers, scientists and graduate students who wish to broaden their knowledge in robotics and automation and prepare themselves to address and resolve the control problems that will be faced in this field as we enter the twenty-first century.

Introduction to Autonomous Mobile Robots, second edition Institution of Engineering and Technology

If you are an engineer, a researcher, or a hobbyist, and you are interested in robotics and want to build your own robot, this book is for you. Readers are assumed to be new to robotics but should have experience with Python.

ROBOTICS AND CONTROL Elsevier

The areas of intelligent machines or robotic systems is of enormous technological and economic interest as competition in productivity intensifies. This volume gives the proceedings of the 1990 Advanced Study Institute on Expert Systems and Robotics. It presents research work already accomplished in the analytical

theory of intelligent machines, work in progress and of current interest and some specific examples for further research. The papers in the volume range from the most theoretical to some descriptions of very practical working robots. The papers are organized into sections on vision and image analysis, robotic sensory systems, software/hardware and system simulation, robot control, applications, and reports of group meetings.

A Robot Engineering Textbook MIT Press

A broadly accessible introduction to robotics that spans the most basic concepts and the most novel applications; for students, teachers, and hobbyists. The Robotics Primer offers a broadly accessible introduction to robotics for students at pre-university and university levels, robot hobbyists, and anyone interested in this burgeoning field. The text takes the reader from the most basic concepts (including perception and movement) to the most novel and sophisticated applications and topics (humanoids, shape-shifting robots, space robotics), with an emphasis on what it takes to create autonomous intelligent robot behavior. The core concepts of robotics are carried through from fundamental definitions to more complex explanations, all presented in an engaging, conversational style that will appeal to readers of different backgrounds. The Robotics Primer covers such topics as the definition of robotics, the history of robotics (“Where do Robots Come From?”), robot components, locomotion, manipulation, sensors, control, control architectures, representation, behavior (“Making Your Robot Behave”), navigation, group robotics, learning, and the future of robotics (and its ethical implications). To encourage further engagement, experimentation, and course and lesson design, The Robotics Primer is accompanied by a free robot programming exercise workbook that implements many of the ideas on the book on iRobot platforms. The Robotics Primer is unique as a principled, pedagogical treatment of the topic that is accessible to a broad audience; the only prerequisites are curiosity and attention. It can be used effectively in an educational setting or more informally for self-instruction. The Robotics Primer is a springboard for readers of all backgrounds—including students taking robotics as an elective outside the major, graduate students preparing to specialize in robotics, and K-12 teachers who bring robotics into their classrooms.

Sensor Based Integration MIT Press

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.

Learning Robotics Using Python Springer

This book presents essentially a collection of proceedings that deliberate on the key challenges and recent trends on robotics, automation and data analytics which are the pillars of Industry 4.0. Solutions that are employed in the multitude spectra of

innovative robotics & automation and data analytics are discussed. The readers are expected to gain an insightful view on the current trends, issues, mitigating factors as well as solutions from the book. This book consists of selected papers presented at the 2nd International Conference on Innovative Technology, Engineering and Sciences 2020 (iCITES) hosted virtually by Universiti Malaysia Pahang on 22nd December 2020. iCITES is a biennial conference, aimed at building a platform that allows relevant stakeholders to share and discuss their latest researches, ideas and survey reports from theoretical to a practical standpoint especially in the Innovative Robotics & Automation and Data Analytics tracks which was published in this book.

Designing and Building Robust, Dependable Real-time Systems Springer Nature

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.

Advances in Robotics, Automation and Data Analytics Springer

Robotics, Second Edition is an essential addition to the toolbox of any engineer or hobbyist involved in the design of any type of robot or automated mechanical system. It is the only book available that takes the reader through a step-by step design process in this rapidly advancing specialty area of machine design. This book provides the professional engineer and student with important and detailed methods and examples of how to design the mechanical parts of robots and automated systems. Most robotics and automation books today emphasis the electrical and control aspects of design without any practical coverage of how to design and build the components, the machine or the system. The author draws on his years of industrial design experience to show the reader the design process by focusing on the real, physical parts of robots and automated systems. Answers the questions: How are machines built? How do they work? How does one best approach the design process for a specific machine? Thoroughly updated with new coverage of modern concepts and techniques, such as rapid modeling, automated assembly, parallel-driven robots and mechatronic systems Calculations for design completed with Mathematica which will help the reader through its ease of use, time-saving methods, solutions to nonlinear equations, and graphical display of design processes Use of real-world examples and problems that every reader can understand without difficulty Large number of high-quality illustrations Self-study and homework problems are integrated into the text along with their solutions so that the engineering professional and the student will each find the text very useful

Open-Source Robotics and Process Control Cookbook MIT Press

In this practical reference, popular author Lewin Edwards shows how to develop robust, dependable real-time systems for robotics and other control applications, using open-source tools. It demonstrates efficient and low-cost embedded hardware and

software design techniques, based on Linux as the development platform and operating system and the Atmel AVR as the primary microcontroller. The book provides comprehensive examples of sensor, actuator and control applications and circuits, along with source code for a number of projects. It walks the reader through the process of setting up the Linux-based controller, from creating a custom kernel to customizing the BIOS, to implementing graphical control interfaces. Including detailed design information on: · ESBUS PC-host interface · Host-module communications protocol · A speed-controlled DC motor with tach feedback and thermal cut-off · A stepper motor controller · A two-axis attitude sensor using a MEMS accelerometer · Infrared remote control in Linux using LIRC · Machine vision using Video4Linux The first-ever book on using open source technology for robotics design! Covers hot topics such as GPS navigation, 3-D sensing, and machine vision, all using a Linux platform!

Tcl/Tk for Programmers Pearson Educación

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.

Robotics, Vision and Control John Wiley & Sons

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

With Solved Exercises that Work with Unix and Windows Elsevier

In Learn Robotics with Raspberry Pi, you'll learn how to build and code your own robot projects with just the Raspberry Pi microcomputer and a few easy-to-get components - no prior experience necessary! Learn Robotics with Raspberry Pi will take you from inexperienced maker to robot builder. You'll start off building a two-wheeled robot powered by a Raspberry Pi minicomputer and then program it using Python, the world's most popular programming language. Gradually, you'll improve your robot by adding increasingly advanced functionality until it can follow lines, avoid obstacles, and even recognize objects of a certain size and color using computer vision. Learn how to: - Control your robot remotely using only a Wii remote - Teach your robot to use sensors to avoid obstacles - Program your robot to follow a line autonomously - Customize your robot with LEDs and speakers to make it light up and play sounds - See what your robot sees with a Pi Camera As you work through the book, you'll learn fundamental electronics skills like how to wire up parts, use resistors and regulators, and determine how much power your robot needs. By the end, you'll have learned the basics of coding in Python and know enough about working with hardware like LEDs, motors, and sensors to expand your creations beyond simple robots.

Robotics: Control Sensing. Vis. Elsevier

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

Visual Control of Robots Tata McGraw-Hill Education

Features The book provides a compressive overview of the fundamental skills underlying the mechanism and control of manipulators. Detailed chapter on Velocity Transformations, jacobian and Singularities. Trajectory Planning is developed using both joint space and Cartesian space methods. Dynamic Modeling is treated by Lagrange-Euler and Euler-Newton formulations; complex derivations are put in the appendix to ensure a smooth flow for the reader. A comprehensive chapter on Robotic Control covering control strategies like PD, PID, computed torque control, force and impedance control at an appropriate level. A METLAB tutorial on using the package for Robotics is included as an appendix. A full chapter on the industrial applications of robots. All important industrial robot configurations with varying degrees of freedom are covered in various chapters and solved examples. An elaborate chapter (Chapter 9) devoted to Robotic Sensors and Vision. Includes over 50 solved examples and more than 270 simple-to-complex end-of-chapter exercises. Appendix on the underlying maths – Linear Algebra, Moment of Inertia Tensor and Equations of Motion

Elements of Robotics Cambridge University Press

The book offers an insight on artificial neural networks for giving a robot a high level of autonomous tasks, such as navigation, cost mapping, object recognition, intelligent control of ground and aerial robots, and clustering, with real-time implementations. The reader will learn various methodologies that can be used to solve each stage on autonomous navigation for robots, from object recognition, clustering of obstacles, cost mapping of environments, path planning, and vision to low level control. These methodologies include real-life scenarios to implement a wide range of artificial neural network architectures. Includes real-time examples for various robotic platforms. Discusses real-time implementation for land and aerial robots. Presents solutions for problems encountered in autonomous navigation. Explores the mathematical preliminaries needed to understand the proposed methodologies. Integrates computing, communications, control, sensing, planning, and other techniques by means of artificial neural networks for robotics.

Robot Manipulator Control Springer Science & Business Media

This book describes recent work on active sensors for mobile robots. An active sensor interacts with its surroundings to supply data on demand for a particular function, gathering and abstracting information according to need rather than acting as a generic data gatherer. Details of the physical operation are hidden. The book deals mainly with active range sensors, which provide rapid information for local planning, describing extraction of two-dimensional features such as lines, corners and cylinders to reconstruct a plan of a building. It is structured according to the physical principles of the sensors, since to a large extent these determine the function of the sensors and the methods of processing. Recent work using sonar, optoelectronic sensors and radar is described. Sections on vision and on sensor management develop the idea of software adaptation for efficient operation in a changing environment. Contents: The Mapping and Localisation Problem; Perception at Millimetre Wavelengths; Advanced Sonar: Principles of Operation and Interpretation; Smooth and Rough

Target Modelling: Examples in Mapping and Texture Classification; Sonar Systems: A Biological Perspective; Map Building from Range Data Using Mathematical Morphology; Millimetre Wave Radar for Robotics; Optoelectronic Range Sensors; AMCW LIDAR Range Acquisition; Extracting Lines and Curves from Optoelectronic Range Data; Active Vision for Mobile Robot Navigation; Strategies for Active Sensor Management. Readership: Graduate students and final year undergraduate students in electrical and electronic engineering, systems and knowledge, robotics, image processing and artificial intelligence.