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KEY=PROGRAMMING - AGUIRRE FOLEY

ROBOTICS IN STEM EDUCATION

REDESIGNING THE LEARNING EXPERIENCE

Springer This book describes recent approaches in advancing STEM education with the use of robotics, innovative methods in integrating robotics in school subjects, engaging and stimulating students with robotics in classroom-based and out-of-school activities, and new ways of using robotics as an educational tool to provide diverse learning experiences. It addresses issues and challenges in generating enthusiasm among students and revamping curricula to provide application focused and hands-on approaches in learning . The book also provides effective strategies and emerging trends in using robotics, designing learning activities and how robotics impacts the students' interests and achievements in STEM related subjects. The frontiers of education are progressing very rapidly. This volume brought together a collection of projects and ideas which help us keep track of where the frontiers are moving. This book ticks lots of contemporary boxes: STEM, robotics, coding, and computational thinking among them. Most educators interested in the STEM phenomena will find many ideas in this book which challenge, provide evidence and suggest solutions related to both pedagogy and content. Regular reference to 21st Century skills, achieved through active collaborative learning in authentic contexts, ensures the enduring usefulness of this volume. John Williams Professor of Education and Director of the STEM Education Research Group Curtin University, Perth, Australia

SHEET METAL INDUSTRIES

OPTIMIZATION, LEARNING ALGORITHMS AND APPLICATIONS

FIRST INTERNATIONAL CONFERENCE, OL2A 2021, BRAGANÇA, PORTUGAL, JULY 19-21, 2021, REVISED SELECTED PAPERS

Springer Nature This book constitutes selected and revised papers presented at the First International Conference on Optimization, Learning Algorithms and Applications, OL2A 2021, held in Bragança, Portugal, in July 2021. Due to the COVID-19 pandemic the conference was held online. The 39 full papers and 13 short papers were thoroughly reviewed and selected from 134 submissions. They are organized in the topical sections on optimization theory; robotics; measurements with the internet of things; optimization in control systems design; deep learning; data visualization and virtual reality; health informatics; data analysis; trends in engineering education.

HANDBOOK OF INDUSTRIAL ROBOTICS

John Wiley & Sons About the Handbook of Industrial Robotics, Second Edition: "Once again, the Handbook of Industrial Robotics, in its Second Edition, explains the good ideas and knowledge that are needed for solutions." -Christopher B. Galvin, Chief Executive Officer, Motorola, Inc. "The material covered in this Handbook reflects the new generation of robotics developments. It is a powerful educational resource for students, engineers, and managers, written by a leading team of robotics experts." - Yukio Hasegawa, Professor Emeritus, Waseda University, Japan. "The Second Edition of the Handbook of Industrial Robotics organizes and systematizes the current expertise of industrial robotics and its forthcoming capabilities. These efforts are critical to solve the underlying problems of industry. This continuation is a source of power. I believe this Handbook will stimulate those who are concerned with industrial robots, and motivate them to be great contributors to the progress of industrial robotics." -Hiroshi Okuda, President, Toyota Motor Corporation. "This Handbook describes very well the available and emerging robotics capabilities. It is a most comprehensive guide, including valuable information for both the providers and consumers of creative robotics applications." -Donald A. Vincent, Executive Vice President, Robotic Industries Association 120 leading experts from twelve countries have participated in creating this Second Edition of the Handbook of Industrial Robotics. Of its 66 chapters, 33 are new, covering important new topics in the theory, design, control, and applications of robotics. Other key features include a larger glossary of robotics terminology with over 800 terms and a CD-ROM that vividly conveys the colorful motions and intelligence of robotics. With contributions from the most prominent names in robotics worldwide, the Handbook remains the essential resource on all aspects of this complex subject.

CONGRESS ON INTELLIGENT SYSTEMS

PROCEEDINGS OF CIS 2020, VOLUME 1

Springer Nature This book is a collection of selected papers presented at the First Congress on Intelligent Systems (CIS 2020), held in New Delhi, India during September 5 - 6, 2020. It includes novel and innovative work from experts, practitioners, scientists and decision-makers from academia and industry. It covers topics such as Internet of Things, information security, embedded systems, real-time systems, cloud computing, big data analysis, quantum computing, automation systems, bio-inspired intelligence, cognitive systems, cyber physical systems, data analytics, data/web mining, data science, intelligence for security, intelligent decision making systems, intelligent information processing, intelligent transportation, artificial intelligence for machine vision, imaging sensors technology, image segmentation, convolutional neural network, image/video classification, soft computing for machine vision, pattern recognition, human computer interaction, robotic devices and systems, autonomous vehicles, intelligent control systems, human motor control, game playing, evolutionary algorithms, swarm optimization, neural network, deep learning, supervised learning, unsupervised learning, fuzzy logic, rough sets, computational optimization, and neuro fuzzy systems.

INDUSTRIAL ROBOTS AND COBOTS

EVERYTHING YOU NEED TO KNOW ABOUT YOUR FUTURE CO-WORKER

Michał Gurgul In the modern world, highly repetitive and tiresome tasks are being delegated to machines. The demand for industrial robots is growing not only because of the need to improve production efficiency and the quality of the end products, but also due to rising employment costs and a shortage of skilled professionals. The industrial robot market is projected to grow by 16% year-on-year in the immediate future. The industry's progressing automation is increasing the demand for specialists who can operate robots. If you would like to join this sought-after and well-paid professional group, it's time to learn how to operate and program robots using modern methods. This book provides all the information you will need to enter the industry without spending money on training or looking for someone willing to introduce you to the world of robotics. You will learn about all aspects of programming and implementing robots in a company. The book consists of four parts: general introduction to robotics for non-technical people; part two describes industry robotisation; part three depicts the principles and methods of programming robots; the final part touches upon the safety of industrial robots and cobots. Are you a student of a technical faculty, or even a manager of a plant who would like to robotise production? If you are interested in this subject, you won't find a better book!

CNC FANUC TURNING CYCLES

DESCRIPTION OF THE PARAMETERS AND PROGRAMMING EXAMPLES

CNC Web School The purpose of this book is to explain the Fanuc turning canned cycles through a new didactic concept. In different manuals it is easy to find contrasting descriptions regarding the Fanuc turning canned cycles. Some manuals present the G74 function as an axial drilling cycle and others present it as a grooving cycle along the Z-axis. The G75 function is also described in some texts as a radial grooving cycle, while in others it is defined as a radial drilling cycle. It should be added that the G75 function is also able to perform a facing cut with chip breaking. The book aims to explain the Fanuc turning cycles in a definite way by adopting a new didactic method that is not limited to the simple description of cycle parameters, but includes all the machining operations that each cycle is able to perform.

INDUSTRIAL ROBOTICS

SELECTION, DESIGN, AND MAINTENANCE

TAB/Electronics With so many industries taking advantage of the tremendous advances in robotics, entities ranging from small family businesses to large corporations need assistance in the selection, design, set-up, maintenance, and economic considerations of industrial automation. This detailed reference shows how to achieve maximum productivity with robotics, classifies robots according to their complexity and function, and explains how to avoid common automation mistakes. * Covers a wide range of industries--from automobile to smaller creative areas such as painting, plastic, glass work, and brick manufacturing * Includes a world-wide survey of various companies successfully using robots in industrial applications

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

PRECISION ASSEMBLY IN THE DIGITAL AGE

8TH IFIP WG 5.5 INTERNATIONAL PRECISION ASSEMBLY SEMINAR, IPAS 2018, CHAMONIX, FRANCE, JANUARY 14–16, 2018, REVISED SELECTED PAPERS

Springer This book constitutes the refereed post-conference proceedings of the 8th IFIP WG 5.5 International Precision Assembly Seminar, IPAS 2018, held in Chamonix, France, in January 2018. The 20 revised full papers were carefully reviewed and selected from numerous submissions. The papers address topics such as machine vision and metrology for assembly operations, gripping and handling technologies, numerical methods and planning in assembly, digital technologies and Industry 4.0 applications, precision assembly methods, assembly systems and platforms and human cooperation, and machine learning. They are organized in the following topical sections: design and deployment of assembly systems; human robot cooperation and machine vision; assembly methods and models; digital technologies and industry 4.0 applications; and gripping and handling solutions in assembly.

PROCEEDINGS OF THE NATIONAL CONFERENCE ON ADVANCED MANUFACTURING & ROBOTICS, JANUARY 10-11, 2004

Allied Publishers Contributed papers presented at the conference held at Central Mechanical Engineering Research Institute, Durgapur.

HUMAN-FRIENDLY ROBOTICS 2019

12TH INTERNATIONAL WORKSHOP

Springer Nature This book covers a wide range of topics related to human-robot interaction, both physical and cognitive, including theories, methodologies, technologies, and empirical and experimental studies. The International Workshop on Human-Friendly Robotics (HFR) is an annual meeting that brings together academic scientists, researchers and research scholars to present their latest, original findings on all aspects concerning the introduction of robots into everyday life. The growing need to automate daily tasks, combined with new robot technologies, is driving the development of human-friendly robots, i.e., safe and dependable machines that operate in close proximity to humans or directly interact with them in a wide range of contexts. The technological shift from classical industrial robots, which are safely kept away from humans in cages, to robots that are used in close collaboration with humans, is faced with major challenges that need to be overcome. The objective of the workshop was to stimulate discussion and exchange knowledge on design, control, safety and ethical issues concerning the introduction of robots into everyday life. The 12th installment was organized by the University of Modena and Reggio Emilia and took place in Reggio Emilia, Italy.

FANUC CNC CUSTOM MACROS

PROGRAMMING RESOURCES FOR FANUC CUSTOM MACRO B USERS

Industrial Press Inc. "CNC programmers and service technicians will find this book a very useful training and reference tool to use in a production environment. Also, it will provide the basis for exploring in great depth the extremely wide and rich field of programming tools that macros truly are."--BOOK JACKET.

BASIC ROBOTICS

Cengage Learning With no previous experience required, BASIC ROBOTICS walks readers step by step through the fundamentals of the industrial robot system. It begins with an exploration of the fascinating technological history that led to the modern robot, starting with events from Before the Common Era and ending with a glimpse of what the robots of tomorrow might become. From there the book explores safety, various parts of the robot, tooling, power transmission systems, the basics of programming, troubleshooting, maintenance, and much more. Engaging photos highlight various robotic systems and their parts, while stories of real-world events bring text concepts to life. This innovative First Edition incorporates many of the initiatives of STEM and is the culmination of lessons learned from the author's years of teaching robotics in various formats--from the traditional classroom to the industrial production floor with systems ranging from the LEGO Mindstorms NXT to the FANUC robot. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

THE SPECIFICATIONS AND APPLICATIONS OF INDUSTRIAL ROBOTS IN JAPAN

THEORY AND DESIGN OF CNC SYSTEMS

Springer Science & Business Media Computer Numerical Control (CNC) controllers are high value-added products counting for over 30% of the price of machine tools. The development of CNC technology depends on the integration of technologies from many different industries, and requires strategic long-term support. "Theory and Design of CNC Systems" covers the elements of control, the design of control systems, and modern open-architecture control systems. Topics covered include Numerical Control Kernel (NCK) design of CNC, Programmable Logic Control (PLC), and the Man-Machine Interface (MMI), as well as the major modules for the development of conversational programming methods. The concepts and primary elements of STEP-NC are also introduced. A collaboration of several authors with considerable experience in CNC development, education, and research, this highly focused textbook on the principles and development technologies of CNC controllers can also be used as a guide for those working on CNC development in industry.

NEW APPROACHES IN MANAGEMENT OF SMART MANUFACTURING SYSTEMS

KNOWLEDGE AND PRACTICE

Springer Nature This book provides a comprehensive and effective exchange of information on current developments in the management of manufacturing systems and Industry 4.0. The book aims to establish channels of communication and disseminate knowledge among professionals working in manufacturing and related institutions. In the book, researchers, academicians and practitioners in relevant fields share their knowledge from the sectors of management of manufacturing systems. The chapters were selected from several conferences in the field, with the topics including management of manufacturing systems with support for Industry 4.0, logistics and intelligent manufacturing systems and applications, cooperation management, and its effective applications. The book also includes case studies in logistics, RFID applications, and economic impacts in logistics, ICT support for industry 4.0, industrial and smart logistics, intelligent manufacturing systems and applications

INFORMATION CONTROL PROBLEMS IN MANUFACTURING TECHNOLOGY 1979

PROCEEDINGS OF THE SECOND IFAC/IFIP SYMPOSIUM, STUTTGART, FEDERAL REPUBLIC OF GERMANY, 22-24 OCTOBER 1979

Elsevier Information Control Problems in Manufacturing Technology 1979 is a compilation of papers presented at the second IFAC/IFIP Symposium held at Stuttgart, Germany on October 22-24, 1979. The book discusses the following topics: flexible manufacturing systems research; information processing in large and small systems; materials handling in a manufacturing system; control requirements in industrial robot use; and quality assurance in automated manufacturing processes. The text gives an overview of the Integrated Computer Aided Manufacturing program employed in aerospace batch manufacturing. One paper then presents a research and development program of Japan pertaining to use of lasers in a flexible manufacturing system complex. Another paper discusses the development and set-up of two flexible and different manufacturing systems; the paper also explains the appropriate information processing system that will control such complicated manufacturing processes. Another paper presents the advances in computers for quality control applications that are expected through lower hardware costs and better utilization of statistical methods. Mechanical engineers, technical designers, and students with serious interest in automatic control and computer-aided systems will find this book valuable.

INTRODUCTION TO ROBOTICS

John Wiley & Sons 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.

CAD/CAM, ROBOTICS, AND FACTORIES OF THE FUTURE

PROCEEDINGS OF THE TWELFTH INTERNATIONAL CONFERENCE ON CAD/CAM, ROBOTICS, AND FACTORIES OF THE FUTURE : MIDDLESEX UNIVERSITY, LONDON, ENGLAND, 14-16 AUGUST 1996

UNDERSTANDING ARTIFICIAL INTELLIGENCE

FUNDAMENTALS AND APPLICATIONS

John Wiley & Sons Provides students across majors with a clear and accessible overview of new artificial intelligence technologies and applications Artificial intelligence (AI) is broadly defined as computers programmed to simulate the cognitive functions of the human mind. In combination with the Neural Network (NN), Big Data (BD), and the Internet of Things (IoT), artificial intelligence has transformed everyday life: self-driving cars, delivery drones, digital assistants, facial recognition devices, autonomous vacuum cleaners, and mobile navigation apps all rely on AI to perform tasks. With the rise of artificial intelligence, the job market of the near future will be radically different — many jobs will disappear, yet new jobs and opportunities will emerge. Understanding Artificial Intelligence: Fundamentals and Applications covers the fundamental concepts and key technologies of AI while exploring its impact on the future of work. Requiring no previous background in artificial intelligence, this easy-to-understand textbook addresses AI challenges in

healthcare, finance, retail, manufacturing, agriculture, government, and smart city development. Each chapter includes simple computer laboratories to teach students how to develop artificial intelligence applications and integrate software and hardware for robotic development. In addition, this text: Focuses on artificial intelligence applications in different industries and sectors Traces the history of neural networks and explains popular neural network architectures Covers AI technologies, such as Machine Vision (MV), Natural Language Processing (NLP), and Unmanned Aerial Vehicles (UAV) Describes various artificial intelligence computational platforms, including Google Tensor Processing Unit (TPU) and Kneron Neural Processing Unit (NPU) Highlights the development of new artificial intelligence hardware and architectures Understanding Artificial Intelligence: Fundamentals and Applications is an excellent textbook for undergraduates in business, humanities, the arts, science, healthcare, engineering, and many other disciplines. It is also an invaluable guide for working professionals wanting to learn about the ways AI is changing their particular field.

ROBOTICS AND THE FACTORY OF THE FUTURE

University of Michigan Inst of Science &

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PATENTS

ARTIFICIAL INTELLIGENCE & AUTOMATION: TECHNOLOGY CHANGING THE WORLD

Blue Hill Publications Automation and artificial intelligence (AI) are transforming the world and contributing to the overall economic growth with futuristic approach. Automation and AI are future decoded, with the recent technological progress pushing the frontier of what machines can do and doing till today. This book provides insights that society needs these improvements to provide value to contribute to the growth and make onceunimaginable progress on some of our most difficult societal challenges. AI has made especially large strides in recent years, as machine-learning algorithms have become more sophisticated and made use of huge increases in computing power and of the exponential growth in data available to train them. These technologies are already generating value in various products and services, and companies across sectors use them in an array of processes to personalize product recommendations, to making you pro in sports, to making you commute, as well as assisting you in growing more food, healthy food, providing you holistic living.

VEHICLE AND AUTOMOTIVE ENGINEERING 4

SELECT PROCEEDINGS OF THE 4TH VAE2022, MISKOLC, HUNGARY

Springer Nature This book presents the selected proceedings of the (third) fourth Vehicle and Automotive Engineering conference, reflecting the outcomes of theoretical and practical studies and outlining future development trends in a broad field of automotive research. The conference's main themes included design, manufacturing, economic and educational topics.

MANUFACTURING TECHNOLOGIES FOR MACHINES OF THE FUTURE

21ST CENTURY TECHNOLOGIES ; WITH 41 TABLES

Springer Science & Business Media This work provides a visionary survey on modern and future technologies and management methods in engineering design and manufacturing.

STUDENT ACTIVITIES MANUAL TO ACCOMPANY BASIC ROBOTICS, 1E

The student activities manual is design to help you retain key chapter content. Included within this resource are chapter objective questions; key-term definition queries; and multiple choice, fill-in-the-blank, and true-or-false problems.

OFFICIAL GAZETTE OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

TRADEMARKS

HIGH TECHNOLOGY

LEARNING ROBOTICS USING PYTHON

Packt Publishing Ltd 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.

INTELLIGENT SYSTEMS IN PRODUCTION ENGINEERING AND MAINTENANCE

Springer The book presents a collection of 103 peer-reviewed articles from the Second International Conference on Intelligent Systems in Production Engineering and Maintenance (ISPEM 2018). The conference was organized by the Faculty of Mechanical Engineering and CAMT (Centre for Advanced Manufacturing Technologies), Wrocław University of Science and Technology and was held in Wrocław (Poland) on 17-18 September 2018. The conferences topics included the possibility of using a wide range of intelligent methods in production engineering, presenting and discussing new solutions for innovative plants, research findings and case studies demonstrating advances in production and maintenance from the point of view of Industry 4.0 - particularly applications of intelligent systems, methods and tools in production engineering, maintenance, logistics, quality management, information systems and product development. The book is divided into two parts: the first includes papers related to intelligent systems in production engineering, while the second is dedicated to special sessions focusing on: 1. Computer Aided methods in Production Engineering 2. Mining 4.0 and Intelligent Mining Transportation 3. Modelling and Simulation of Production Processes 4. Multi-Faceted Modelling of Networks and Processes 5. Product Design and Product Manufacturing in Industry 4.0 This book is an excellent source of information for scientists in the field of manufacturing engineering and for top managers in production enterprises.

SYSTEMS MODELING AND COMPUTER SIMULATION

Routledge This second edition describes the fundamentals of modelling and simulation of continuous-time, discrete time, discrete-event and large-scale systems. Coverage new to this edition includes: a chapter on non-linear systems analysis and modelling, complementing the treatment of of continuous-time and discrete-time systems and a chapter on the computer animation and visualization of dynamical systems motion.

FLEXIBLE MANUFACTURING SYSTEMS: RECENT DEVELOPMENTS

Elsevier Flexible Manufacturing Systems (FMS) involve substituting machines capable of performing a wide and redefinable variety of tasks for machines dedicated to the performance of specific tasks. FMS can also be programmed to handle new products, thus extending the machines' life cycles. Thus they represent a change from "standardized goods produced by customized machines" to "customized goods produced by standardized machines". This volume contains new and updated material in this field, and will be of great interest to researchers, managers and students concerned with problems related to flexible manufacturing systems.

MODERN ROBOTICS

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

CE MARKING FOR EMC DIRECTIVE

Amer Society of Mechanical All electric and electronic products designed and produced for export to the European Economic Area (EEA) must now conform to the new EMC Directive 89/336/EEC, which came into force in 1996. Under these regulations, all devices designated for free trade must satisfy certain minimum requirements regarding safety and electromagnetic compatibility. CE Marking for the EMC Directive is a pivotal guide to achieving certification. It examines the requirements imposed by the EMC Directive and the various routes, which must be taken to achieve full compliance. This comprehensive volume explains how companies can certify their own products, saving both time and money. It contains the complete text of the EMC Directive and answers frequently asked questions on the certification process. Practical examples and well-organized diagrams and drawings make this book invaluable to the electrical and electronic product designer or manufacturer.

ROBOT ORIENTED DESIGN

Cambridge University Press The Cambridge Handbooks on Construction Robotics discuss progress in robot systems theory and demonstrate their integration using real systematic applications and projections for offsite as well as onsite building production. The series is intended to give professionals, researchers, lecturers, and students conceptual and technical skills and implementation strategies to manage, research or teach the implementation of advanced automation and robot-technology-based processes in construction. Robot-Oriented Design introduces the design, innovation and management methodologies that are key to the realization and implementation of the advanced concepts and technologies presented in the subsequent volumes. This book describes the efficient deployment of advanced construction and building technology. It is concerned with the coadaptation of construction products, processes, organization and management, and with automated/robotic technology, so that the implementation of modern technology becomes easier and more efficient. It is also concerned with technology and innovation management methodologies and the generation of life cycle-oriented views related to the use

of advanced technologies in construction.

DEVICES AND SYSTEMS FOR LABORATORY AUTOMATION

John Wiley & Sons Devices and Systems for Laboratory Automation Structured Overview on the Available Systems and Devices for Laboratory Automation Choosing the right systems and devices for the automation in any given laboratory is an essential part for the process to succeed. As relevant information to make an informed choice is not always readily available, a structured overview is essential for modern scientists. This book provides an introduction into laboratory automation and an overview of the necessary devices and systems. Sample topics discussed by the two well-qualified authors include: Specific requirements the automation needs to fulfill such as liquid delivery, low volume delivery, solid delivery, and sample preparation An overview on robots and mobile robots Common interfaces in laboratory automation For scientists and all individuals working in laboratories, the work serves as an indispensable resource in helping to make laboratory processes more streamlined, effective, and efficient.

MODERN PROBLEMS OF ROBOTICS

SECOND INTERNATIONAL CONFERENCE, MPOR 2020, MOSCOW, RUSSIA, MARCH 25-26, 2020, REVISED SELECTED PAPERS

Springer Nature This book constitutes the post-conference proceedings of the 2nd International Conference on Modern Problems of Robotics, MPoR 2020, held in Moscow, Russia, in March 2020. The 16 revised full papers were carefully reviewed and selected from 21 submissions. The volume includes the following topical sections: Collaborative Robotic Systems, Robotic Systems Design and Simulation, and Robots Control. The papers are devoted to the most interesting today's investigations in Robotics, such as the problems of the human-robot interaction, the problems of robot design and simulation, and the problems of robot and robotic complexes control.

PROGRAMMING ROBOTS WITH ROS

A PRACTICAL INTRODUCTION TO THE ROBOT OPERATING SYSTEM

"O'Reilly Media, Inc." Want to develop novel robot applications, but don't know how to write a mapping or object-recognition system? You're not alone, but you're certainly not without help. By combining real-world examples with valuable knowledge from the Robot Operating System (ROS) community, this practical book provides a set of motivating recipes for solving specific robotics use cases. Ideal for enthusiasts, from students in robotics clubs to professional robotics scientists and engineers, each recipe describes a complete solution using ROS open source libraries and tools. You'll learn how to complete tasks described in the recipes, as well as how to configure and recombine components for other tasks. If you're familiar with Python, you're ready to go. Learn fundamentals, including key ROS concepts, tools, and patterns Program robots that perform an increasingly complex set of behaviors, using the powerful packages in ROS See how to easily add perception and navigation abilities to your robots Integrate your own sensors, actuators, software libraries, and even a whole robot into the ROS ecosystem Learn tips and tricks for using ROS tools and community resources, debugging robot behavior, and using C++ in ROS

INDUSTRIAL ROBOTS: FUNDAMENTALS
