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Robot Kinematics: Forward and Inverse Kinematics-Serdar Kucuk 2006

Forward and Inverse Kinematic Analysis of Robots-Noor Saeed 2020-07-23 In order to control a robot we have to know its kinematics (what is attached to what, how many joints are there, how many degree of freedom, ect.). This book presents an approach that formalizes all of these mathematically for several robot configurations and get equations that can: 1) Convert from angular position of each joint (joint space) to the cartesian positions of the end effector called forward kinematics. 2) Convert from cartesian space to the joint space that is called inverse kinematics. The derived equations for forward kinematics and inverse kinematics have been invested in this work to represent the work space for different physical structures of robots. In this work an adopted user interface software (Visual Basic) that contains several types of windows have been built to simplify the solution for both forward and inverse kinematics for different robot configurations. In addition a program has been built using mat lab for representing, modeling and simulating the joint positions and the work space.

Forward and Inverse Kinematics Using Pseudoinverse and Transposition Method for Robotic Arm DOBOT-Ondrej Hock 2017 Kinematic structure of the DOBOT manipulator is presented in this chapter. Joint coordinates and end-effector coordinates of the manipulator are functions of independent coordinates, id est, joint parameters. This chapter explained forward kinematics task and issue of inverse kinematics task on the structure of the DOBOT manipulator. Linearization of forward kinematic equations is made with usage of Taylor Series for multiple variables. The inversion of Jacobian matrix was used for numerical solution of the inverse kinematics task. The chapter contains analytical equations, which are solution of inverse kinematics task. It should be noted that the analytical solution exists only for simple kinematic structures, for example DOBOT manipulator structure. Subsequently, simulation of the inverse kinematics of the above-mentioned kinematic structure was performed in the Matlab Simulink environment using the SimMechanics toolbox.

Simulation of Forward and Inverse Kinematics of a Robotic Arm-Mahavishnu Murugesan 2017 Robots are the main part of flexible manufacturing systems. They are used in various applications where human work can be replaced and automated. In this project, I have simulated a robotic arm manipulator with six degrees of freedom in MATLAB. There are various applications where a robotic arm is used like painting, carpentry and hardware verification. In hardware verification labs, robotic arms are used to hold passive and power rail probes that connect from instruments like scopes and power supplies to pcb boards to protect the pcb layout from rip off due to sudden movement of the probes. Robot kinematics uses the geometry (position and orientation) of rigid bodies (links) and joints to control the movement of the robot. In this project, I have demonstrated the forward and inverse kinematics of a robot to control its movement. Forward kinematics calculates the end-effector position of the robot using the angles of the joints. Inverse kinematics calculates the angles of the joints with the end-effector position as the reference. There are several methods to calculate the forward and inverse kinematics such as analytical methods, numerical hit and trial, and iterative methods. The complexity of the vi kinematics increases as a function of the workspace of the manipulator. Thus, I have adopted the DH parameters to calculate the forward and inverse kinematics.

Advances in Robot Kinematics-Jadran Lenarčič 2014-05-19 The topics addressed in this book cover the whole range of kinematic analysis, synthesis and design and consider robotic systems possessing serial, parallel and cable driven mechanisms. The robotic systems range from being less than fully mobile to kinematically redundant to over constrained. The fifty-six contributions report the latest results in robot kinematics with emphasis on emerging areas such as design and control of humanoids or humanoid subsystems. The book is of interest to researchers wanting to bring their knowledge up to date regarding modern topics in one of the basic disciplines in robotics, which relates to the essential property of robots, the motion of mechanisms.

Advances in Robot Kinematics 2018-Jadran Lenarcic 2018-07-15 This is the proceedings of ARK 2018, the 16th International Symposium on Advances in Robot Kinematics, that was organized by the Group of Robotics, Automation and Biomechanics (GRAB) from the University of Bologna, Italy. ARK are international symposia of the highest level organized every two years since 1988. ARK provides a forum for researchers working in robot kinematics and stimulates new directions of research by forging links between robot kinematics and other areas.The main topics of the symposium of 2018 were: kinematic analysis of robots, robot modeling and simulation, kinematic design of robots, kinematics in robot control, theories and methods in kinematics, singularity analysis, kinematic problems in parallel robots, redundant robots, cable robots, over-constrained linkages, kinematics in biological systems, humanoid robots and humanoid subsystems.

Advances in Robot Kinematics 2020-Jadran Lenarčič 2020-07-17 This book is of interest to researchers wanting to know more about the latest topics and methods in the fields of the kinematics, control and design of robotic systems. The papers cover the full range of robotic systems, including serial, parallel and cable-driven manipulators. The systems range from being less than fully mobile, to kinematically redundant, to over-constrained. The book brings together 43 peer-reviewed papers. They report on the latest scientific and applied achievements. The main theme that connects them is the movement of robots in the most diverse areas of application.

Robotics Process Automation-S. Muhkerjee This Robotics Process Automation book describes the RPA platform for the future of business process automation. More precisely this RPA book has tried to innumerate the followings: 1. RPA that brings speed to your digital transformation. 2. RPA helps to get rid of resource burden and it's consequences. 3. This emphasizes Business process automation must be in the hands forntline. 4. Only Automation Anywhere Enterprise combines consumer-like usability with enterprise-class reliability, and security for RPA that empowers the workforce to automate on their own, in real time. 5. What does RPA mean for business? Optimize labour investment Increase capacity on demand Increase speed and productivity Maximize availability Improve business process compliance Improve controls Improve auditability Enhance security deliver business intelligence Enable digital transformation Improve employee morale 6. Putting RPA to work and deploy your digital workforce in your businesses like insurance, finance, manufacturing and health care and also other. Deploy, manage and audit your Digital Workforce through a highly-intuitive RPA central command center, on-premise or in the cloud. This RPA book also enable you to learn more about AI and machine language also factory automation, safeguard your data, analyze ald predict business performance, streamline your blended anywhere, big data ready for analytics. This book is made for BS/B,TECH and MS/M.TECH/MCA/MBA student who will have in-depth knowledge about RPA and its associated technologies falls in the same platform.

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Dynamics and Control of Robotic Manipulators with Contact and Friction-Shiping Liu 2019-01-29 A comprehensive guide to the friction, contact and impact on robot control and force feedback mechanism Dynamics and Control of Robotic Manipulators with Contact and Friction offers an authoritative guide to the basic principles of robot dynamics and control with a focus on contact and friction. The authors discuss problems in interaction between human and real or virtual robot where dynamics with friction and contact are relevant. The book fills a void in the literature with a need for a text that considers the contact and friction generated in robot joints during their movements. Designed as a practical resource, the text provides the information needed for task planning in view of contact, impact and friction for the designer of a robot control system for high accuracy and long durability. The authors include a review of the most up-to-date advancements in robot dynamics and control. It contains a comprehensive resource to the effective design and fabrication of robot systems and components for engineering and scientific purposes. This important guide: Offers a comprehensive reference with systematic treatment and a unified framework Includes simulation and experiments used in dynamics and control of robot considering contact, impact and friction Discusses the most current tribology methodology used to treat the multiple–scale effects Contains valuable descriptions of experiments and software used Presents illustrative accounts on the methods employed to handle friction in the closed loop, including the principles, implementation, application scope, merits and demerits Offers a cohesive treatment that covers tribology and multi-scales, multi-physics and nonlinear stochastic dynamics control Written for graduate students of robotics, mechatronics, mechanical engineering, tracking control and practicing professionals and industrial researchers, Dynamics and Control of Robotic Manipulators with Contact and Friction offers a review to effective design and fabrication of stable and durable robot system and components.

Kinematics-Efren Gorrostieta Hurtado 2017-12-20 The present work contains a selection of research that is focused on the development of the kinematics; in this way, we can find the evolution of the kinematics in recent years, like applications in navigation systems, parallel robots, manipulators, and mobile robots. This work also includes new methods for the analysis in different applications, which are important in the proposal of new paradigms. Modeling is presented in applications oriented to a better understanding of biosystems; on the other hand, we also have applications of intelligent systems that enrich and complement the analysis of movement and position. Definitely, we hope that the present research work enriches and contributes with ideas and elements of interest for each of our readers.

Advances in Robot Kinematics-Jadran Lenarčič 2013-06-29 This book presents the most recent research advances in the theory, design, control, and application of robotic systems, which are intended for a variety of purposes such as manipulation, manufacturing, automation, surgery, locomotion, and biomechanics.

Advances in Robot Kinematics 2016-Jadran Lenarčič 2017-07-26 This book brings together 46 peer-reviewed papers that are of interest to researchers wanting to know more about the latest topics and methods in the fields of the kinematics, control and design of robotic systems. These papers cover the full range of robotic systems, including serial, parallel and cable-driven manipulators, both planar and spatial. The systems range from being less than fully mobile, to kinematically redundant, to over-constrained. In addition to these more familiar areas, the book also highlights recent advances in some emerging areas: such as the design and control of humanoids and humanoid subsystems; the analysis, modeling and simulation of human-body motions; mobility analyses of protein molecules; and the development of machines that incorporate man.

3D Animation of Robot Kinematics-Rebecca Innes 2003 The main aim of this project was to create a software application to allow the 3D visual simulation of robot forward and inverse kinematics to be used as a teaching aid in the university studies in this area.

W.U.R. Werstands universal Robots-Karel Čapek 2017-02-07 Karel Čapek: W.U.R. Werstands universal Robots Originaltitel: »R.U.R. Rossum's Universal Robots«. Erstdruck 1920. Hier in der deutschen Übersetzung von Otto Pick, Prag, 1922. Neuausgabe. Herausgegeben von Karl-Maria Guth. Berlin 2017. Umschlaggestaltung von Thomas Schultz-Overhage. Gesetzt aus der Minion Pro, 11 pt.

Inverse Kinematics Problem in Robotics Using Neural Networks-Benjamin B. Choi 1992

Proceedings, IEEE Control Systems Society ... Symposium on Computer-Aided Control System Design (CACSD).- 1986

Advances in Robot Kinematics: Analysis and Design-Jadran Lenarčič 2008-05-29 This book presents the most recent research advances in the theory, design, control and application of robotic systems, which are intended for a variety of purposes such as manipulation, manufacturing, automation, surgery, locomotion and biomechanics.

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

Cable-Driven Parallel Robots-Andreas Pott 2018-03-27 Cable-driven parallel robots are a new kind of lightweight manipulators with excellent scalability in terms of size, payload, and dynamics capacities. For the first time, a comprehensive compendium is presented of the field of cable-driven parallel robots. A thorough theory of cable robots is setup leading the reader from first principles to the latest results in research. The main topics covered in the book are classification, terminology, and fields of application for cable-driven parallel robots. The geometric foundation of the standard cable model is introduced followed by statics, force distribution, and stiffness. Inverse and forward kinematics are addressed by elaborating efficient algorithms. Furthermore, the workspace is introduced and different algorithms are detailed. The book contains the dynamic equations as well as simulation models with applicable parameters. Advanced cable models are described taking into account pulleys, elastic cables, and sagging cables. For practitioner, a descriptive design method is stated including methodology, parameter synthesis, construction design, component selection, and calibration. Rich examples are presented by means of simulation results from sample robots as well as experimental validation on reference demonstrators. The book contains a representative overview of reference demonstrator system. Tables with physical parameters for geometry, cable properties, and robot parameterizations support case studies and are valuable references for building custom cable robots. For scientist, the book provides the starting point to address new scientific challenges as open problems are named and a commented review of the literature on cable robot with more than 500 references are given.

Recent Advances in Robot Kinematics-Jadran Lenarčič 2012-12-06 The articles of this book were reported and discussed at the fifth international symposium on Advances in Robot Kinematics. As is known, the first symposium of this series was organised in 1988 in Ljubljana. The following meetings took place every other year in Austria, Italy, and Slovenia (Linz, Ferrara, Ljubljana, Portoroz Bernardin). It must be emphasised that the symposia run under the patronage of the International Federation for the Theory of Machinesand Mechanisms, IFToMM. In this period, Advances in Robot Kinematics has been able to attract the most outstanding authors in the area and also to create an optimum combination of a scientific pragmatism and a friendly atmosphere. Hence, it has managed to

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survive in a strong competition of many international conferences and meetings. In the most ancient way, robot kinematics is regarded as an application of the kinematics of rigid hodies. However, there are topics and problems that are typical for robot kinematics that cannot easily be found in any other scientific field. It is our belief that the initiative of Advances in Robot Kinematics has contributed to develop a remarkable scientific community. The present book is of interest to researchers, doctoral students and teachers, engineers and mathematicians specialising in kinematics of robots and mechanisms, mathematical modelling, simulation, design, and control of robots.

The International Journal of Applied Engineering Education- 1989

Kinematics Analysis of Two Parallel Locomotion Mechanisms- 2010 This dissertation presents the kinematics study on two cases of parallel locomotion mechanisms. A parallel locomotion mechanism can be defined as "a mechanism with parallel configuration and discrete contact with respect to the ground which renders a platform the ability to move". The first case is a tripedal robot and the second case is an actuated spoke wheel robot. The kinematics study on these two mobile robots mainly includes mobility, inverse and forward kinematics, instantaneous kinematics, singularity and so on. The tripedal robot STriDER (Self-excited Tripedal Dynamic Experimental Robot) is expected to walk utilizing its built-in passive dynamics, but in its triple stance phase, the kinematic configuration of the robot behaves like an in-parallel manipulator. The locomotion of this novel walking robot and its unique tripedal gait are discussed, followed by the definitions of its coordinate frames. Geometric methods are adopted for the forward and inverse displacement analysis in its triple stance phase. Simulations are presented to validate both the inverse and the forward displacement solutions. The instantaneous kinematics and singularity analysis are developed respectively. Based on the screw theory, the Jacobian matrices are assembled. Using Grassmann Line Geometry, each row of the Jacobian matrices is interpreted as a line in 3D space and the analytical conditions of the linear dependency cases are identified, which corresponds to the forward singular configurations of the robot. The actuated spoke wheel robot IMPASS (Intelligent Mobility Platform with Active Spoke System) is investigated as the second case. It is revealed that this robot has multiple modes of locomotion on the ground and it is able to change its topology by changing the contact scheme of its spokes with the ground. This robot is treated as a mechanism with variable topologies and Modified Grubler-Kutzbach criterion and Grassmann Line Geometry are adopted to identify the degrees of freedom (DOF) for each case of its topological structures. The characteristic DOF are then verified through the testing on the robot prototype. The forward and inverse kinematics is investigated for two cases of its topologies. In order to improve the computation efficiency of the inverse kinematics formulation, virtual serial manipulator models are constructed. The effectiveness of the virtual serial manipulator models has been validated with numerical simulations. In conclusion, kinematics analyses have been successfully performed on the two parallel locomotion mechanisms. The results are utilized to control the robots' motions in specific configurations. The foundation has been laid for the future development of the robot prototypes and the future research on dynamics, control, intelligence and so on.

Advances in Reconfigurable Mechanisms and Robots II-Xilun Ding 2015-11-23 This book presents the most recent advances in the research and applications of reconfigurable mechanisms and robots. It collects 93 independently reviewed papers presented at the Third ASME/IFToMM International Conference on Reconfigurable Mechanisms and Robots (ReMAR 2015) held in Beijing, China, 20-22 July 2015. The conference papers are organized into seven parts to cover the reconfiguration theory, topology, kinematics and design of reconfigurable mechanisms including reconfigurable parallel mechanisms. The most recent results on reconfigurable robots are presented including their analysis, design, simulation and control. Bio-inspired mechanisms are also explored in the challenging fields of rehabilitation and minimally invasive surgery. This book further addresses deployable mechanisms and origami-inspired mechanisms and showcases a wide range of successful applications of reconfigurable mechanisms and robots. Advances in Reconfigurable Mechanisms and Robots II should be of interest for researchers, engineers and postgraduate students in mechanical engineering, electrical engineering, computer science and mathematics.

Time-Optimal Trajectory Planning for Redundant Robots-Alexander Reiter 2016-03-11 This master’s thesis presents a novel approach to finding trajectories with minimal end time for kinematically redundant manipulators. Emphasis is given to a general applicability of the developed method to industrial tasks such as gluing or welding. Minimum-time trajectories may yield economic advantages as a shorter trajectory duration results in a lower task cycle time. Whereas kinematically redundant manipulators possess increased dexterity, compared to conventional non-redundant manipulators, their inverse kinematics is not unique and requires further treatment. In this work a joint space decomposition approach is introduced that takes advantage of the closed form inverse kinematics solution of non-redundant robots. Kinematic redundancy can be fully exploited to achieve minimum-time trajectories for prescribed end-effector paths.

Advances in Robot Kinematics: Analysis and Control-Jadran Lenarčič 2013-04-17 The contributions in this book were presented at the sixth international symposium on Advances in Robot Kinematics organised in June/July 1998 in Strobl/Salzburg in Austria. The preceding symposia of the series took place in Ljubljana (1988), Linz (1990), Ferrara (1992), Ljubljana (1994), and Piran (1996). Ever since its first event, ARK has attracted the most outstanding authors in the area and managed to create a perfect combination of professionalism and friendly athmosphere. We are glad to observe that, in spite of a strong competition of many international conferences and meetings, ARK is continuing to grow in terms of the number of participants and in terms of its scientific impact. In its ten years, ARK has contributed to develop a remarkable scientific community in the area of robot kinematics. The last four symposia were organised under the patronage of the International Federation for the Theory of Machines and Mechanisms -IFToMM. interest to researchers, doctoral students and teachers, The book is of engineers and mathematicians specialising in kinematics of robots and mechanisms, mathematical modelling, simulation, design, and control of robots. It is divided into sections that were found as the prevalent areas of the contemporary kinematics research. As it can easily be noticed, an important part of the book is dedicated to various aspects of the kinematics of parallel mechanisms that persist to be one of the most attractive areas of research in robot kinematics.

Dynamics of Systems of Rigid Bodies-Jens Wittenburg 2013-04-17

On Advances in Robot Kinematics-Jadran Lenarčič 2014-10-05 In the last decade, we have seen an extraordinary progress in the the ory and applications of robot kinematics. This has been motivated espe cially by the development of complex parallel and humanoid robots. The present book reports the most recent research advances in the theory, design, control and application of robotic systems, which are intended for a variety of purposes such as manipulation, manufacturing, automa tion, surgery, locomotion and biomechanics. The issues addressed are fundamentally kinematic in nature, including synthesis, calibration, re dundancy, force control, dexterity, inverse and forward kinematics, kine matic singularities, as well as over-constrained systems. Methods used include line geometry, quaternion algebra, screw algebra, and linear alge bra. These methods are applied to both parallel and serial multi-degree of-freedom systems. The results should interest researchers, teachers and students, in fields of engineering and mathematics related to robot theory, design, control and application. This is the sixth book of the series Advances in Robot Kinematics published by Kluwer. The contributions in this book had been rigorously reviewed by in dependent reviewers and fifty one articles had been recommended for publication. They were introduced in seven chapters. These articles were also reported and discussed at the ninth international symposium on Advances in Robot Kinematics which was held in June 2004 in Sestri Levante in Italy. Indexed in Conference Proceedings Citation Index- Science (CPCI-S)

Mechatronic Systems and Materials IV-Zdzis?aw Gosiewski 2013-03-11 Volume is indexed by Thomson Reuters BCI (WoS). The 121 peer reviewed papers on Mechatronic Systems and Materials are grouped as follows: I. Robotics: Industrial Robots, Microrobotics; II. Mobile Robots; III. Unmanned Aerial Vehicles; IV. Teleoperation, Telerobotics, Teleoperated Semi-Autonomous Systems; V. Sensors and Actuators in Mechatronics; VI. Control of Mechatronic Systems; VII. Analysis of Vibration and Deformation.

An Environment for Computer Graphic Simulation of Robotic Applications-Dinesh K. Pai 1986

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Adaptive Internal Models for Motor Control and Visual Prediction-Wolfram Schenck 2008 In this thesis, computational models of adaptive motor control and visuomotor coordination are explored and developed. These models relate to hypotheses on how sensorimotor processing in biological organisms might be organized at an abstract level; furthermore, these models and their specific implementations offer solutions for technical problems in the domain of adaptive robotics. For this reason, both biological and technical aspects are addressed. On the one hand, this thesis focuses on the learning of so-called internal models (Miall et al., 1993; Kawato, 1999): "forward models," which predict the sensory consequences of the agent's own actions, and "inverse models," which act like motor controllers and generate motor commands. In this area, new strategies and algorithms for learning are suggested and tested on both simulated and real-world robot setups. This work contributes to the understanding of the "building blocks" of integrated sensorimotor processing. On the other hand, this thesis suggests complex models of sensorimotor coordination: In a study on the grasping to extrafoveal targets with a robot arm, it is explored how forward and inverse models may interact, and a second study addresses the question how visual perception of space might arise from the learning of sensorimotor relationships. The theoretical part of the thesis starts with a close view on sensorimotor processing. The cognitivist approach and the embodied approach to sensorimotor processing are contrasted with each other, providing evidence from psychological and neurophysiological studies in favor of the latter. It is outlined how the application of robots fits into the embodied approach as research method. Furthermore, internal models are defined in a formal way, and an overview of their role in models of perception and cognition is provided, with a special emphasis on anticipation and predictive forward models. Afterwards, a thorough overview of internal models in adaptive motor control (covering both kinematics and dynamics) and a novel learning strategy for kinematic control problems ("learning by averaging") are presented. The experimental work comprises four different studies. First, a detailed comparison study of various motor learning strategies for kinematic problems is presented. The performance of "feedback error learning" (Kawato et al., 1987), "distal supervised learning" (Jordan and Rumelhart, 1992), and "direct inverse modeling" (e.g., Kuperstein, 1987) is directly compared on several learning tasks from the domain of eye and arm control (on simulated setups). Moreover, an improved version of direct inverse modeling on the basis of abstract recurrent networks and learning by averaging are included in the comparison. The second study is dedicated to the learning of a visual forward model for a robot camera head. This forward model predicts the visual consequences of camera movements for all pixels of the camera image. The presented learning algorithm is able to overcome the two main difficulties of visual prediction: first, the high dimensionality of the input and output space, and second, the need to detect which part of the visual output is non-predictable. To demonstrate the robustness of the presented learning algorithm, the work is not carried out on plain camera images, but on distorted "retinal images" with a decreasing resolution towards the corners. In the third experimental chapter, a model for grasping to extrafoveal (non-fixated) targets is presented. It is implemented on a robot setup, consisting of a camera head and a robot arm. This model is based on the premotor theory of attention (Rizzolatti et al., 1994) and adds one specific hypothesis: Attention shifts caused by saccade programming imply a prediction of the retinal foveal images after the saccade. For this purpose, the visual forward model from the preceding study is used. Based on this model, several grasping modes are compared; the obtained results are qualitatively congruent with the performance that can be expected from human subjects. The fourth study is based on the theory that visual perception of space and shape is based on an internal simulation process which relies on forward models (Moeller, 1999). This theory is tested by synthetic modeling in the task domain of block pushing with a robot arm.

Modelling and Simulation of Robot Manipulators-Albert Y Zomaya 1993-01-29 This book aims to describe how parallel computer architectures can be used to enhance the performance of robots, and their great impact on future generations of robots. It provides an in-depth, consistent and rigorous treatment of the topic. A clear definition of tools with results is given which can be applied to parallel processing for robot kinematics and dynamics. Another advantageous feature is that the algorithms presented have been implemented using a parallel processing system, unlike many publications in the field which have presented results in only theoretical terms. This book also includes “benchmark” results that can be used for the development of future work, or can serve as a basis for comparison with other work. In addition, it surveys useful material to aid readers in pursuing further research. Contents:IntroductionThe Parallel Processing ApproachRobot KinematicsComputing the JacobianInverse Jacobian ComputationRobot DynamicsParallel Computations of Robot DynamicsTuning of Robot DynamicsConcluding RemarksAppendix AAppendix BAppendix CAppendix D Readership: Engineers and computer scientists.

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.

Parallel Manipulators-Jee-Hwan Ryu 2008-04-01 Parallel manipulators are characterized as having closed-loop kinematic chains. Compared to serial manipulators, which have open-ended structure, parallel manipulators have many advantages in terms of accuracy, rigidity and ability to manipulate heavy loads. Therefore, they have been getting many attentions in astronomy to flight simulators and especially in machine-tool industries.The aim of this book is to provide an overview of the state-of-art, to present new ideas, original results and practical experiences in parallel manipulators. This book mainly introduces advanced kinematic and dynamic analysis methods and cutting edge control technologies for parallel manipulators. Even though this book only contains several samples of research activities on parallel manipulators, I believe this book can give an idea to the reader about what has been done in the field recently, and what kind of open problems are in this area.

Advances in Robot Kinematics: Motion in Man and Machine-Jadran Lenarčič 2010-07-20 The ?rst International Meeting of Advances in Robot Kinematics, ARK, occurred in September 1988, by invitation to Ljubljana, Slovenia, of a group of 20 int- nationally recognized researchers, representing six different countries from three continents. There were 22 lectures and approximately 150 attendees. This success of bringing together excellent research and the international community, led to the formation of a Scienti?c Committee and the decision to repeat the event biannually. The meeting was made open to all individuals with a critical peer review process of submitted papers. The meetings have since been continuously supported by the Jozef ? Stefan Institute and since 1992 have come under patronage of the Inter- tionalFederationforthePromotionofMechanismandMachineScience(IFToMM). Springer published the ?rst book of the series in 1991 and since 1994 Kluwer and Springer have published a book of the presented papers every two years. The papers in this book present the latest topics and methods in the kinem- ics, control and design of robotic manipulators. They consider the full range of - botic systems, including serial, parallel and cable driven manipulators, both planar and spatial. The systems range from being less than fully mobile to kinematically redundant to overconstrained. The meeting included recent advances in emerging areas such as the design and control of humanoids and humanoid subsystems, the analysis, modeling and simulation of human body motion, the mobility analysis of protein molecules and the development of systems which integrate man and - chine.

Space Based Robot Manipulators-Liang-Boon Wee 1993

Southeastcon '95-IEEE Region 7 1995-03

Inverse Kinematics Problem in Robotics Using Neural Networks-National Aeronautics and Space Administration (NASA) 2018-07-05 In this paper, Multilayer Feedforward Networks are applied to the robot inverse kinematic problem. The networks are trained with endeffector position and joint angles. After training, performance is measured by having the network generate joint angles for arbitrary endeffector trajectories. A 3-degree-of-freedom (DOF) spatial manipulator is used for the study. It is found that neural networks provide a simple and effective way to both model the manipulator inverse kinematics and circumvent the problems associated with algorithmic solution methods. Choi, Benjamin B. and Lawrence, Charles Glenn Research Center RTOP 506-43-41...

Optimized Forward Kinematics for the MBA Exoskeleton and Partitioned Kinematics for the Merlin

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Robot-Michael S. Branicky 1990 This paper describes a systems approach to improving the performance of a telerobotic testbed. The testbed is the Force-Reflecting Interfaces to Telemanipulators Testing Systems (FITTS), at the Harry G. Armstrong Aerospace Medical Research Laboratory. First, the testbed hardware is described, along with an overview of the system's communications paths. Next, the previously-determined forward kinematics for the MBA exoskeleton are outlined. Then the optimization of these kinematic equations is given. The paper also details efficient forward and inverse kinematic solutions for the Merlin industrial robots, using the method of wrist partitioning. The utility of these solutions in toto is that the interfacing of the two systems, given sufficient communications bandwidth between the MBA exoskeleton and the control computer, can now achieve the 4 ms compute time attainable by the Merlin hardware. This optimization puts the FITTS hardware at a milestone stage of completion, as the system is now capable of operating at its peak as a unilateral telerobotic testbed. Finally, future steps to extend FITTS for force reflection research are specified. Teleoperation, Robotics, Remote Control, Human Factors, Force Reflection.

Comparison of Inverse Kinematic Methods for a Redundant Robot-Colin Bennett 2015 Inverse kinematics is the process by which joint angles are solved for a given end position and research is being done to find new methods that are more efficient. The purpose of this thesis is to compare two new inverse kinematic methods with an older method for a redundant robot with seven degrees of freedom to determine each method’s strengths and weaknesses. Metrics used for this comparison will include total angle change, maximum single angle change, and computation time. Inverse kinematics methods displayed in this paper are Triangulation, Forward and Backward Reaching Inverse Kinematics (FABRIK), and dual quaternion.

A Geometric Algebra Invitation to Space-Time Physics, Robotics and Molecular Geometry-Carlile Lavor 2018-07-12 This book offers a gentle introduction to key elements of Geometric Algebra, along with their applications in Physics, Robotics and Molecular Geometry. Major applications covered are the physics of space-time, including Maxwell electromagnetism and the Dirac equation; robotics, including formulations for the forward and inverse kinematics and an overview of the singularity problem for serial robots; and molecular geometry, with 3D-protein structure calculations using NMR data. The book is primarily intended for graduate students and advanced undergraduates in related fields, but can also benefit professionals in search of a pedagogical presentation of these subjects.

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