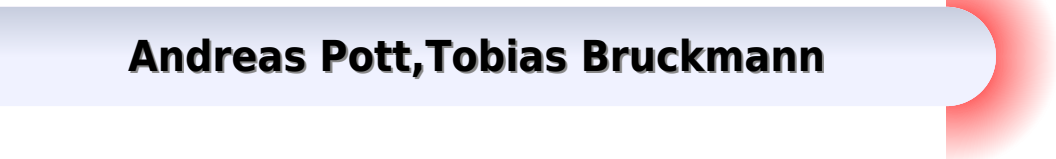




Parallel Robots

Andreas Pott, Tobias Bruckmann



Parallel Robots:

Parallel Robots Hamid D. Taghirad, 2013-02-20 Parallel structures are more effective than serial ones for industrial automation applications that require high precision and stiffness or a high load capacity relative to robot weight Although many industrial applications have adopted parallel structures for their design few textbooks introduce the analysis of such robots in terms of dynamics

Parallel Robots J.P. Merlet, 2005-12-27 Parallel robots are closed loop mechanisms presenting very good performances in terms of accuracy velocity rigidity and ability to manipulate large loads They have been used in a large number of applications ranging from astronomy to flight simulators and are becoming increasingly popular in the field of machine tool industry This book presents a complete synthesis of the latest results on the possible mechanical architectures analysis and synthesis of this type of mechanism It is intended to be used by students with over 150 exercises and numerous internet addresses researchers with over 650 references and anonymous ftp access to the code of some algorithms presented in this book and engineers for which practical results mistakes to avoid and applications are presented Since the publication of the first edition 2000 there has been an impressive increase in terms of study and use of this kind of structure that are reported in this book This second edition has been completely overhauled The initial chapter on kinematics has been split into Inverse Kinematics and Direct Kinematics A new chapter on calibration was added The other chapters have also been rewritten to a large extent The reference section has been updated to include around 45% new works that appeared after the first edition

Structural Synthesis of Parallel Robots Grigore Gogu, 2009-05-01 This is the first book of robotics presenting solutions of uncoupled and fully isotropic parallel robotic manipulators and a method for their structural synthesis Part 1 presents the methodology proposed for structural synthesis Part 2 presents the various topologies of parallel robots generated by this systematic approach Many solutions are presented here for the first time The book will contribute to a widespread implementation of these solutions in industrial products

Dynamics of Parallel Robots Sébastien Briot, Wisama Khalil, 2015-06-22 This book starts with a short recapitulation on basic concepts common to any types of robots serial tree structure parallel etc that are also necessary for computation of the dynamic models of parallel robots Then as dynamics requires the use of geometry and kinematics the general equations of geometric and kinematic models of parallel robots are given After it is explained that parallel robot dynamic models can be obtained by decomposing the real robot into two virtual systems a tree structure robot equivalent to the robot legs for which all joints would be actuated plus a free body corresponding to the platform Thus the dynamics of rigid tree structure robots is analyzed and algorithms to obtain their dynamic models in the most compact form are given The dynamic model of the real rigid parallel robot is obtained by closing the loops through the use of the Lagrange multipliers The problem of the dynamic model degeneracy near singularities is treated and optimal trajectory planning for crossing singularities is proposed Lastly the approach is extended to flexible parallel robots and the algorithms for computing their symbolic model in the most compact

form are given All theoretical developments are validated through experiments

Parallel Robots With Unconventional Joints Patrick Grosch,Federico Thomas,2019-03-20 This book shows how through certain geometric transformations some of the standard joints used in parallel robots can be replaced with lockable or non holonomic joints These substitutions allow for reducing the number of legs and hence the number of actuators needed to control the robot without losing the robot s ability to bring its mobile platform to the desired configuration The kinematics of the most representative examples of these new designs are analyzed and their theoretical features verified through simulations and practical implementations

Cable-Driven Parallel Robots Tobias Bruckmann,Andreas Pott,2012-09-13 This publication presents the outcome of the First International Conference on Cable Driven Parallel Robots in 2012 This is the first conference to bring together the cable robot community and dedicate a forum for the international experts of this field It contains the Know how ideas and experiences of active researchers developing cable driven robots The book presents the state of the art including summarizing contributions and latest research results and where relevant the future outlook The book covers the essential topics for cable driven robots classification and definition kinematics workspace analysis cable modeling control and calibration design methodology hardware prototype development experimental evaluation application reports and new application concepts

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

Dynamics of Parallel Robots Stefan Staicu,2018-09-14 This book establishes recursive relations concerning kinematics and dynamics of constrained robotic systems It uses matrix modeling to determine the connectivity conditions on the relative velocities and

accelerations in order to compare two efficient energetic ways in dynamics modeling the principle of virtual work and the formalism of Lagrange's equations. First a brief fundamental theory is presented on matrix mechanics of the rigid body which is then developed in the following five chapters treating matrix kinematics of the rigid body, matrix kinematics of the composed motion, kinetics of the rigid body, dynamics of the rigid body and analytical mechanics. By using a set of successive mobile frames the geometrical properties and the kinematics of the vector system of velocities and accelerations for each element of the robot are analysed. The dynamics problem is solved in two energetic ways using an approach based on the principle of virtual work and applying the formalism of Lagrange's equations of the second kind. These are shown to be useful for real time control of the robot's evolution. Then the recursive matrix method is applied to the kinematics and dynamics analysis of five distinct case studies: planar parallel manipulators, spatial parallel robots, planetary gear trains, mobile wheeled robots and finally two module hybrid parallel robots.

Parallel PnP Robots Guanglei Wu, 2025-03-24. This book provides the design and application of multiple control algorithms and motion planning to a family of parallel robots which can be generalized to other robot counterparts. The book covers the fundamentals of dynamic models for control design as well as a comparison of the control effects from the classical to advanced control algorithms step by step which can help the researcher to understand the design procedure of control algorithms. It also includes different trajectory planning algorithms to ensure optimal robot performances. Furthermore, the research results previously scattered in many prestigious journals and conferences worldwide are methodically edited and presented in a unified form. The book is likely to be of interest to university researchers, R D engineers and graduate students in industrial parallel robotics who wish to learn the core principles, methods, algorithms and applications.

Cable-Driven Parallel Robots Andreas Pott, Tobias Bruckmann, 2014-08-14. This volume presents the outcome of the second forum to cable driven parallel robots bringing the cable robot community together. It shows the new ideas of the active researchers developing cable driven robots. The book presents the state of the art including both summarizing contributions as well as latest research and future options. The book covers all topics which are essential for cable driven robots: Classification, Kinematics, Workspace and Singularity Analysis, Statics and Dynamics, Cable Modeling, Control and Calibration, Design Methodology, Hardware Development, Experimental Evaluation, Prototypes, Application Reports and new Application concepts.

Cable-Driven Parallel Robots Clément Gosselin, Philippe Cardou, Tobias Bruckmann, Andreas Pott, 2017-07-05. This book presents proceedings of the third international conference in this field continuing the success of the previous events. The peer reviewed and the selected papers are arranged to make the proposed book the most recent and complete overview on the State of the Art in Cable Driven Parallel Robots. The conference took place 2017 in Quebec, QC, Canada.

Serial and Parallel Robot Manipulators Serdar Küçük, 2012-03-30. Robotics is an important part of modern engineering and is related to a group of branches such as electric.

Parallel Manipulators Cecilia Norton, 2016. Robots are a key element in current industrial processes as they

can be applied to a number of tasks increasing both quality and productivity. Traditionally serial robots have been installed in factories as their wide operating space allowed them to fulfill a number of tasks. However, due to their high moving mass and single kinematic chain structure, these robots present some disadvantages when high speed accuracy or heavy load handling tasks have to be executed. Parallel robots provide an interesting alternative to these application fields as their multiple kinematic chain structure offers increased stiffness, allowing reduced positioning errors, lighter mechanisms, and increased load weight ratios. In this book, Chapter One addresses a new control strategy for parallel manipulators based on L1 adaptive control. This latter is known for its decoupled control and estimation loops, enabling fast adaptation and guaranteed robustness. Chapter Two focuses on the control of parallel robots. Chapter Three reviews structure synthesis of fully isotropic two rotational and two translational parallel robotic manipulators. Chapter Four reviews the new prototype of the two legged parallel kinematic walking robot CENTAUROB developed at Hamburg University of Technology. Chapter Five analyzes and robustly controls the 6 DOF 3 legged Wide Open parallel manipulator using a Lyapunov analysis approach.

Cable-Driven Parallel Robots Marc Gouttefarde, Tobias Bruckmann, Andreas Pott, 2021-05-31 This volume gathers the latest advances, innovations, and applications in the field of cable robots as presented by leading international researchers and engineers at the 5th International Conference on Cable Driven Parallel Robots CableCon 2021 held as a virtual event on July 7-9, 2021. It covers the theory and applications of cable driven parallel robots, including their classification, kinematics, and singularity analysis, workspace, statics, and dynamics, cable modeling, and technologies, control, and calibration, design methodologies, hardware development, experimental evaluation, and prototypes, as well as application reports and new application concepts. The contributions, which were selected through a rigorous international peer review process, share exciting ideas that will spur novel research directions and foster new multidisciplinary collaborations.

Design, Analysis and Control of Cable-Suspended Parallel Robots and Its Applications Bin Zi, Sen Qian, 2017-02-18 This book provides an essential overview of the authors' work in the field of cable suspended parallel robots, focusing on innovative design, mechanics, control, development, and applications. It presents and analyzes several typical mechanical architectures of cable suspended parallel robots in practical applications, including the feed cable suspended structure for super antennae, hybrid driven based cable suspended parallel robots, and cooperative cable parallel manipulators for multiple mobile cranes. It also addresses the fundamental mechanics of cable suspended parallel robots on the basis of their typical applications, including the kinematics, dynamics, and trajectory tracking control of the feed cable suspended structure for super antennae. In addition, it proposes a novel hybrid driven based cable suspended parallel robot that uses integrated mechanism design methods to improve the performance of traditional cable suspended parallel robots. A comparative study on error and performance indices of hybrid driven based and traditional cable suspended parallel robots rounds out the coverage. This book addresses the needs of researchers, engineers, and post graduates in the field of cable suspended parallel robots and related areas.

Cable-Driven

Parallel Robots Stéphane Caro, Andreas Pott, Tobias Bruckmann, 2023-07-04 This volume gathers the latest advances innovations and applications in the field of cable robots as presented by leading international researchers and engineers at the 6th International Conference on Cable Driven Parallel Robots CableCon held in Nantes France on June 25 28 2023 It covers the theory and applications of cable driven parallel robots including their classification kinematics and singularity analysis workspace statics and dynamics cable modeling and technologies control and calibration design methodologies hardware development experimental evaluation and prototypes as well as application reports and new application concepts The contributions which were selected through a rigorous international peer review process share exciting ideas that will spur novel research directions and foster new multidisciplinary collaborations Biologically Inspired Series-Parallel Hybrid Robots Shivesh Kumar, Andreas Mueller, Frank Kirchner, 2024-11-27 Biologically Inspired Series Parallel Hybrid Robots Design Analysis and Control provides an extensive review of the state of the art in series parallel hybrid robots covering all aspects of their mechatronic system design modelling and control This book highlights the modular and distributed aspects of their mechanical electronics and software design introducing various modern methods for modelling the kinematics and dynamics of complex robots These methods are also introduced in the form of algorithms or pseudo code which can be easily programmed with modern programming languages Presenting case studies on various popular series parallel hybrid robots which will inspire new robot developers this book will be especially useful for academic and industrial researchers in this exciting field as well as graduate level students to bring them closer to the latest technology in mechanical design and control aspects of the area Introduces clear definitions for all relevant terms and the foundational theories Provides in depth kinematics of various parallel mechanisms typically used in the design of series parallel hybrid robots Presents holistic methods for solving kinematics dynamics trajectory generation and control of series parallel hybrid robots considering large number of holonomic constraints Investigates case studies on the mechatronic system design of various series parallel hybrid robots for practitioners in the field *New Frontiers in Parallel Robots* Zhufeng Shao, Dan Zhang, Stéphane Caro, 2023-07-05 The parallel robot a kind of robot that utilizes multiple closed loop branch chains jointly connecting and driving the moving platform is an important part of modern robotics with outstanding advantages of high stiffness high precision and high speed Parallel robots can efficiently change performance through the configuration of synthesis and design The rich variety of configurations and the existence of a large number of passive joints also brought abundant challenges and research topics to the modeling optimization calibration and trajectory planning of parallel robots This book focuses on the research frontiers of parallel robots from fundamental theory to application technology Special attention is paid to kinematics dynamics modeling error modeling and calibration impedance control and the machining stability of parallel robots Notably a considerable portion of the book focuses on cable driven parallel robots CDPRs that integrate cable driven kinematic chains and parallel mechanism theory CDPRs inherit the high dynamics and heavy load capacities of parallel robots and significantly improve the

workspace cost and energy efficiency simultaneously following the cutting edge trend of rigid flexible fusion *Parallel Robots* J.P. Merlet, 2000-07-31 Parallel robots are closed loop mechanisms presenting very good performances in terms of accuracy rigidity and ability to manipulate large loads Parallel robots have been used in a large number of applications ranging from astronomy to flight simulators and are becoming increasingly popular in the field of machine tool industry This book presents a complete synthesis of the latest results on the possible mechanical architectures analysis and synthesis of this type of mechanism It is intended to be used by students with over 100 exercises and numerous Internet addresses researchers with over 500 references and anonymous ftp access to the code of some algorithms presented in this book and engineers for which practical results and applications are presented **Structural Synthesis of Parallel Robots** Grigore Gogu, 2010-09-08 In other words the invention of a mechanism will be to the scientific kinematist a synthetic problem which he can solve by the use of systematic if also difficult methods Reuleaux F Theoretische Kinematik Braunschweig Vieweg 1875 Reuleaux F The Kinematics of Machinery London Macmillan 1876 and New York Dover 1963 translated by A B W Kennedy This book represents the third part of a larger work dedicated to the structural synthesis of parallel robots Part 1 Gogu 2008a presented the methodology of structural synthesis and the systematisation of structural solutions of simple and complex limbs with two to six degrees of connectivity systematically generated by the structural synthesis approach Part 2 Gogu 2009a presented structural solutions of translational parallel robotic manipulators with two and three degrees of mobility This book focuses on various topologies of parallel robotic manipulators with planar motion of the moving platform systematically generated by using the structural synthesis approach proposed in Part 1 The originality of this work resides in the fact that it combines the new formulae for mobility connectivity redundancy and overconstraints and the evolutionary morphology in a unified approach of structural synthesis giving interesting innovative solutions for parallel mechanisms

Decoding **Parallel Robots**: Revealing the Captivating Potential of Verbal Expression

In a period characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its power to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Parallel Robots**," a mesmerizing literary creation penned by way of a celebrated wordsmith, readers embark on an enlightening odyssey, unraveling the intricate significance of language and its enduring affect our lives. In this appraisal, we shall explore the book's central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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