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Introduction to Robotics Mechanics and Control John J. Craig Contents 1 Introduction 1.1 Background 1.2 the Mechanics and Control of Mechanical Manipulators 1.3 Notation Spatial Descriptions and Transformations 2.1 Introduction 2.2 Descriptions: Positions, Orientations, and Frames 2.3 Mappings: Changing Descriptions From Frame to Frame 2.4 Operators: Translations, Rotations, Transformations 2.5 Summary of Interpretations 2.6 Transformation Arithmetic . 2.7 Transform Equations 2.8 More on Representation of Orientation 2.9 Transformation of Free Vectors 2.10 Computational Considerations Manipulator Kinematics 3.1 Introduction 3.2 Link Description 3.3 Link Connection Description 3.4 Convention for Affixing Frames to Links 3.5 Manipulator Kinematics 3.6 Actuator Space, Joint Space, and Cartesian Space 3.7 Examples: Kinematics of Two Industrial Robots 3.8 Frames With Standard Names 3.9 Where is the Tool? 3.10 Computational Considerations 4 Inverse Manipulator Kinematics 4.1 Introduction 4.2 Solvability 4.3 the Notion of Manipulator Subspace When $N < 6$ 4.4 Algebraic Vs. Geometric . 4.5 Algebraic Solution by Reduction to Polynomial 4.6 Pieper's Solution When Three Axes Intersect 4.7 Examples of Inverse Manipulator Kinematics 4.8 the Standard Frames 4.9 Solve-ing a Manipulator 4.10 Repeatability and Accuracy 4.11 Computational Considerations 5 Jacobians: Velocities and Static Forces 5.1 Introduction 5.2 Notation for Time-varying Position and Orientation 5.3 Linear and Rotational Velocity of Rigid Bodies 5.4 More on Angular Velocity 5.5 Motion of the Links of a Robot 5.6 Velocity "Propagation" From Link to Link 5.7 Jacobians 5.8 Singularities . 5.9 Static Forces in Manipulators 5.10 Jacobians in the Force Domain 5.11 Cartesian Transformation of Velocities and Static Forces 6 Manipulator Dynamics 6.1 Introduction 6.2 Acceleration of a Rigid Body Mass Distribution Newton's Equation, Euler's Equation Iterative Newton-euler Dynamic Formulation Iterative Vs. Closed Form An Example of Closed Form Dynamic Equations The Structure of the Manipulator Dynamic Equations Lagrangian Formulation of Manipulator Dynamics Formulating Manipulator Dynamics in Cartesian Space Inclusion of Nonrigid Body Effects Dynamic Simulation Computational Considerations Trajectory Generation 227 7.1 Introduction 227 7.2 General Considerations in Path Description and Generation 228 7.3 Joint Space Schemes 230 7.4 Cartesian Space Schemes 246 7.5 Geometric Problems With Cartesian Paths 249 7.6 Path Generation at Run Time 252 7.7 Description of Paths With a Robot Programming Language 255 7.8 Planning Paths Using the Dynamic Model 255 7.9 Collision-free Path Planning 256 8 Manipulator Mechanism Design 8.1 Introduction 8.2 Basing the Design on Task Requirements 8.3 Kinematic Configuration 8.4 Quantitative Measures of Workspace Attributes 8.5 Redundant and Closed Chain Structures 8.6 Actuation Schemes 8.7 Stiffness and Deflections 8.8 Position Sensing 8.9 Force Sensing 9 Linear Control of Manipulators 9.1 Introduction 9.2 Feedback and Closed Loop Control 9.3 Second-order Linear Systems 9.4 Control of Second-order Systems 9.5 Control Law Partitioning 9.6 Trajectory-following Control Disturbance Rejection Continuous Vs. Discrete Time Control Modeling and Control of a Single Joint Architecture of an Industrial Robot Controller 10 Nonlinear Control of Manipulators 10.1 Introduction 10.2 Nonlinear and Time-varying Systems 10.3 Multi-input, Multi-output Control Systems 10.4 the Control Problem for Manipulators 10.5 Practical Considerations 10.6 Present Industrial Robot Control Systems 10.7 Lyapunov Stability Analysis 10.8 Cartesian-based Control Systems 10.9 Adaptive Control 11 Force Control of Manipulators 11.1 Introduction 11.2 Application of Industrial Robots to Assembly Tasks 11.3 a Framework for Control in Partially Constrained Tasks 11.4 the Hybrid Position/force Control Problem 11.5 Force Control of a Mass-spring 11.6 the Hybrid Position/force Control Scheme 11.7 Present Industrial Robot Control Schemes 12 Robot Programming Languages and Systems 12.1 Introduction 12.2 the Three Levels of Robot Programming 12.3 a Sample Application 12.4 Requirements of a Robot Programming Language 12.5 an Example Application Coded in Three Rpls 12.6 Problems Peculiar to Robot Programming Languages 13 Off-line Programming Systems 13.1 Introduction 13.2 Central Issues in Olp Systems 13.3 Cimstation 13.4 Automating Subtasks in Olp Systems 13.5 Summary Index 447 Appendices A Trigonometric Identities 440 B the Twenty-four Angle Set Conventions 442 C Some Inverse Kinematic Formulas 445 **كلمة سر فك الصغط** : books-world.net The Unzip Password : books-world.net تسجيل الدخول | تسجيل تسجيل من الموقع لكي تتمكن من التحميل تسجيل | تسجيل الدخول

Provides readers with real-world practicality with underlying theory presented. With one half of the material from traditional mechanical engineering material, one fourth control theoretical material, and one fourth computer science, the book covers rigid-body transformations, forward and inverse positional kinematics, velocities and Jacobians of linkages, dynamics, linear control, non-linear control, force control methodologies, mechanical design aspects and programming of robots. For engineers. Robotics is concerned with the study of those machines that can replace human beings in the execution of a task, as regards both physical activity and decision making. The goal of the introductory chapter is to point out the problems related to the use of robots in industrial applications, as well as the perspectives offered by advanced robotics. A classification of the most common mechanical structures of robot manipulators and mobile robots is presented. Topics of modelling, planning and control are introduced which will be examined in the following chapters. The chapter ends with a list of references dealing with subjects both of specific interest and of related interest to those covered by this textbook. Mobile Robot Robot Manipulator Material Handling Kinematic Chain Industrial Robot These keywords were added by machine and not by the authors. This process is experimental and the keywords may be updated as the learning algorithm improves. This is a preview of subscription content, log in to check access. Unable to display preview. Download preview PDF.J. Angeles, Fundamentals of Robotic Mechanical Systems: Theory, Methods, and Algorithms, Springer-Verlag, New York, 1997.zbMATHGoogle ScholarH. Asada, J.-J.E. Slotine, Robot Analysis and Control, Wiley, New York, 1986.Google ScholarG.A. Bekey, Autonomous Robots, MIT Press, Cambridge, MA, 2005.Google ScholarC. Canudas de Wit, B. Siciliano, G. 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