Kinematic Modeling and Control of the PUMA 560 Robot Arm using MATLAB

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***Abstract*—This report presents the comprehensive modeling and control of the PUMA 560 robot arm using MATLAB, focusing on both forward and inverse kinematics. The project utilizes the Robotics System Toolbox and Simscape to develop a detailed 3D model of the robot, enabling accurate simulations of the arm's kinematic behavior and control strategies. Forward kinematics were employed to determine the position and orientation of the robot's end-effector from given joint angles, while inverse kinematics were used to calculate necessary joint angles to achieve desired end-effector positions. The project successfully demonstrates the robot's capability to perform precise movements, crucial for applications in industries such as manufacturing and medical assistance. Through the integration of MATLAB's computational tools, this study not only enhances the understanding of robotic motion and control but also provides a valuable educational resource for advanced robotics research. The outcomes show significant potential for improving the efficiency and functionality of automated systems, emphasizing the importance of kinematic analyses in developing effective robotic solutions.**

***Index Terms*—Robotics, Kinematic Modeling, PUMA 560 Robot Arm, MATLAB Simulation, Forward Kinematics, Inverse Kinematics, Robotics System Toolbox, Control Systems, Engineering Education, Industrial Automation**

I. Introduction

The objective of this project is to model a PUMA 560 arm in MATLAB and calculate the necessary forward and inverse kinematics. The Robotics System Toolbox and Simscape [1] will allow for the creation of a PUMA 560 model by leveraging the Denavit-Hartenberg parameters; this model will be controlled by the forward and inverse kinematics and dynamics calculation functions designed specifically for this project.

II. Background

A. Maintaining the Integrity of the Specifications

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