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Tesis: **"COORDINATED CONTROL OF A 6-DOF ROBOTIC MANIPULATOR EMPLOYING VIRTUAL MODELS OF ITS ACTUATORS"**

Resumen:

Accurate motion control is required in mechatronic and robotic systems, and it is particularly important for the inverse kinematic (IK) control of robotic manipulators when using independent joint control (IJC) techniques. For this reason, it is necessary to improve the performance of the speed and position control strategies used in robotics.

This work presents an alternative IK solution for the UR5 manipulator, created by Universal Robots, and complete IK solutions that include algorithms to select a set of angles that can take the end-effector to a desired pose without resulting in singular configurations. These

methods are necessary to choose the angular position of each joint for the IJC scheme.

The proposed speed control strategy for direct current (DC) motors combines a model reference control (MRC) scheme with an internal model control-based proportional-integral (PI) controller; said scheme imposes a first-order behavior on the speed control system while compensating for disturbances caused by load torque variations and, together with the IK solution, it will allow doing the IJC of the robot. Performance indexes help to validate the strategy and compare three different MRC controllers to find the best control action.

A position control scheme that uses the proposed speed control strategy with the best control action, which is a PI, is also tested; the resulting scheme, which includes an outer loop with a proportional-derivative controller and an integrator, is later employed to control a virtual model of the DC motor to use it as a reference model for the physical one.