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OPTIMAL CONTROL BASED IN A MATHEMATICAL MODEL APPLIED TO ROBOTIC ARMS

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Abstract. *The major contributions of this paper are as follows: 1) The mathematical model of the cylindrical robotic arm is presented. This model is obtained by using the Euler Lagrange method. 2) The method to obtain the mathematical model of this paper is different to others because they use the Jacobians, the inertia tensors, or the Christoffel symbols, while in this paper, none of these methods is used. 3) It is proposed that the torque or the force used to move each link needs to compensate the initial value of the gravity to obtain the home position. 4) It is proposed that an optimal control is online applied to robotic arms for the regulation case. The proposed optimal control can be online applied to rigid robotic arms. The Riccati equation used in the proposed optimal control is online solved at the same time than the optimal control works. 5) The proposed optimal control is compared with a proportional control for the regulation case where the first is better than the second. 6) It is proposed that an optimal control is online applied to robotic arms for a reference point different of zero. The proposed optimal control can be online applied to any kind of rigid robotic arm. The Riccati equation of the proposed optimal control is online solved at the same time than the optimal control works.*
Keywords: Optimal control, Mathematical model, Robotic arm

1. Introduction.

There is some research about the control of robotic systems as in [11, 13, 16, 23, 27, 28, 29], but, to implement most of the controls for any system, it is necessary to know all the dynamic parameters, e.g., it is necessary to get a mathematical model of the system or get the measure of all the parameters of the system. It is less expensive to get a mathematical model of the system than to get the measure of all the parameters of the system.

The mathematical models of robotic arms describe the relationship between force or torque and motion. The equations of motion are important to consider in the design of robotic arms, in simulation and animation of robotic arm motion, and in the design of control algorithms avoiding the necessity to build a prototype of a real robotic arm.

There is some research in the mathematical model of robotic arms as is [6, 7, 10, 13, 15, 25, 26, 28], but none considers the mathematical model of the robotic arm of this paper.

The mathematical model of this paper is obtained by using the Euler Lagrange method. The method to obtain the mathematical model of this paper is different to others because they use the Jacobians, the inertia tensors, or the Christoffel symbols while in this paper none of these methods is used.