THREE - DEGREE - OF - FREEDOM MANIPULATOR's MODEL

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Abstract

In this work dynamical manipulator's model as a "heart" of a control algorithm is given and analysed. As it will be shown in the paper, that dynamical model predicts optimal control of the manipulator's elements in order to reduce usually complicated and harmful effects of d'Alembert's forces, centrifugal forces, Coriolis' forces as well as gravitation and friction forces during robot's movement. In other words, the manipulator traces a required trajectory with a small error and even the robot moves quicker keeping a good path of motion.

The aim of this paper is to control the manipulator "SCARA" with three - degree - of - freedom using "Matlab-Simulink" package. The following assumptions have been taken into account:

a) the manipulator is an open kinematic chain with revolute, prismatic as well as mixed joints;

b) the model is a chain composed of rigid bodies connected in series with free and fixed ends; there are no gaps in the constraints.

Although the obtained first differential equation is the linear one and independent of the other manipulator's degrees of freedom, the last two are strongly nonlinear and coupled. "Matlab-Simulink" package has been used to solve the equations.

The simulation results include examples of proper manipulator's motion examples of dynamic interaction and an analysis of influence of inertia moments.

The obtained results show that a building of complicated dynamical models of the robots is efficient. The first reason is the economical one. The simulation costs are extremely low even in comparison with only one robot. Second, the obtained results can be used by design engineers. The third reason is connected with a new design of controllers in order to build the robots more economically.