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Contents

Fuel-Time Optimal Control of the Electromechanical System

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An electromechanical system of the second order is considered, which approximately describes the dynamics of an individual link of the arm of a multi-link manipulator, if each link is controlled by the voltage supplied by an independent drive motor, and the dynamic interference of various degrees of freedom is sufficiently small [1]. For the manipulator model under consideration, in [1] the problems of constructing optimal control under different quality criteria (travel time, consumed energy, positioning accuracy) were studied, which ensures the movement of the system from an arbitrary initial state to a given final state of rest, including under additional constraints. In [2, 3], various systems were considered that represent models of mechanical and electromechanical systems containing an electric motor, with various restrictions on control, including mixed ones. There, problems of constructing a limited control that lead the system from an arbitrary initial state to the given terminal state, including a state of rest, in a finite time, has been investigated. In this article, as a criterion of optimality, is considered a functional that takes into account both the momentum transferred to the mechanical part of the system by the control voltage by means of the electric drive reducer and the time of the control process. The problem of optimal control with such a functional is related to the class of problems of minimizing fuel consumption or resources [4, 5]. Using the method of the maximum principle of the Pontryagin [6], an optimal control in the form of a synthesis is constructed which provides the movement of the considered system from an arbitrary initial state to a given final state of rest and minimizes the value of the combined functional. At the same time, two curves of switching of optimal control are constructed, which in the phase plane of the considered system form the disjoint domains. Depending on which domain the initial state is in, the movement of the system to the final state of rest - to the origin - occurs in the optimal control mode of different structure: with one or with two moments or without moments of switching. Formulas are obtained for calculating the moments of switching of optimal control and the optimal time of the control process.

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