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ALGORITHMIZATION AND MODELING OF MULTICOORDINATE MECHATRONIC SYSTEMS

A large quantity of mechatronic systems is based on trajectory constructing on topological manifolds (particularly on curves and surfaces) with given accuracy [1]. For automated control of these systems it is preferable for trajectory planning to be given in the form of finite equation or system of equations. These systems with the behavior which is established with exactness up to variety intersection are related to the class of mechatronic systems [2].

In the paper the problem of algorithmization and modeling of mechatronic systems presupposes the synthesis of differential analyzer in the form of differential equations for which the solution is the reproducible program of movement is considered.

Common formulation of a task of the algorithmization programming motions of the multi-coordinate mechatronic systems of different technological devices and space mechanisms, including robots, manipulators and mechatronic systems has the next describing. It is known that the motion of the multicoordinate devices describes by the system of differential equations of 2 degree with the help of mechanics, for example, of Lagrange [3, 4]. Equations of the motions can be reduced to the following form, considering the features, of the multicoordinate systems, which have autonomously-controlled coordinate modules, that count is determined by the need to realize a required number of degrees of freedom in three-dimensional space:

$$\dot{x}_i = p_i(x_1, \ldots, x_n) + b_i(x_1, \ldots, x_n)u_i, \quad i = \overline{1, n},$$

where $x = (x_1, \ldots, x_n)$ – generalized phase coordinates of the system; $u = (u_1, \ldots, u_n)$ – control vector; $b_i(x_1, \ldots, x_n)$ – variable coefficients.

The algorithmization and modeling of the programming motions on the base of solving reverse dynamics problem, where mathematical models have took on the base common method of creating differential equations by a given integral manifold of the proposed N.P. Yerugin [5], proposed in the current work. The realization of a such approach allows to define the controlling for different cases of the programming motions for the multicoordinate displacement systems.

Thus, on the base of algorithimization and modeling results, it is possible to analyze the following applied tasks:

– simplification of control algorithm and automatic control system structure;

– possibility to control the speed of affix movement without considerable complication of structure of automatic control system;

– possibility of change-over of control system parameters for reproduction of affix movement on different topological manifold without considerable complication of control system structure;

– possibility of optimal curves programming, i.e. such control design that provides maximum performance of drive while surface handling.

References

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