The Control in Nonlinear Dynamical Systems with Triggers of a Coupled Singularities.

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Abstract: This paper analyses the controllability of motion of dynamical systems in which exist or appear triggers of coupled singularities. It is shown that the phase plane method is useful for the analysis of nonlinear dynamics of systems with one degree of freedom control strategies and also shoes the way it can be used for controlling the relative motion in rheonomic systems having equivalent scleronomic conservative or nonconservative system

The differential equation of the nonlinear dynamics of a system with trigger of the coupled singularities is in the form of:

$$\ddot{x} + g[k, F(x)]f(x) = 0$$

where x is generalized coordinate and in the special cases in same time relative coordinate. For that case when in the system existed a trigger of the coupled singularities, than the functions $f(x)$, $F(x)$ and $g[k, F(x)]$ must be satisfy some conditions defined by *a Theorem on the existence of a trigger of the coupled singularities and the separatrix in the form of number eight*

Task of the defined dynamical system optimal control is: By using controlling force $\tilde{u}(t)$ acting to the system, transfer initial state of the nonlinear dynamics of the system defined by $x_1(0) = \alpha$ and $x_2(0) = \beta$ into the final state of the nonlinear dynamics defined by $x_1(T) = \gamma$ and $x_2(T) = \chi$, where T is minimal time for that optimal control task. Than we can write two new nonlinear differential equations first order for optimal control task in the following form:

$$\dot{x}_1 = x_2$$
$$\dot{x}_2 = -2\delta x_2 |x_2| - g[k, F(x_1)]f(x_1) \pm \tilde{u}(t)$$

with previously defined initial conditions state.

Examples of engineering systems with coupled rotational motions in the nonlinear dynamics of which there are triggers of couples singularities which are the cause of chaos dynamics and the system response to periodic excitation are given.

Possibilities for application for control of motion within an active construction are also shown.

Key words: Control, nonlinear dynamical system, phase portrait, triggers of coupled singularities.

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