Singularity of optimal control in the problem of stabilizing a nonlinear inverted spherical pendulum

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Abstract

Models of inverted pendulum systems are widely used to study the dynamics of different real complex nonlinear objects. There are many papers in which computer modeling and simulation are used for controlling and stabilizing the inverted pendulum systems. Analytical results of the present talk can be useful in developing effective algorithms for computer modeling. We study an optimal synthesis in the minimization problem of the mean square deviation of a spherical inverted pendulum from the upper equilibrium position over an infinite time interval. We assume that the pendulum is attached by a hinge to a moving support point which can moves in a horizontal plane under the influence of a bounded control force. For the linearized model we found [1-2] optimal solutions in the form of logarithmic spirals that hit the origin in a finite time T. The corresponding optimal controls perform an infinite number of rotations along the circle S^1. We generalize the results obtained for the linear model to the nonlinear case.

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