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Monoaxial Attitude Stabilization of a Rigid Body under Vanishing Restoring Torque

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Abstract: The paper deals with the problem of monoaxial attitude stabilization of a rigid body. The possibility of implementing such a control system in which the restoring torque tends to zero as time increases is studied. With the aid of the Lyapunov direct method and the differential inequalities theory, conditions under which an equilibrium position of the body is stable with respect to all variables as well as with respect to a part of variables are derived. The results of a numerical modeling are presented to demonstrate the effectiveness of the proposed approaches.

Keywords: *rigid body; monoaxial attitude stabilization; dissipation; asymptotic stability; Lyapunov function; differential inequality.*

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1 Introduction

In problems of a rigid body attitude control, restoring torques are usually the basis of control system functioning. However, attitude stabilization of a body is impossible without damping torques ensuring suppression of a body oscillations in a neighborhood of a stable equilibrium position. Therefore, the question how to create a damping torque and to design a specific damping mechanism is one of the main problems that should be solved for practical realization of attitude control systems [6, 7, 9, 14, 20, 24]. At the same time, due to limited resources of control systems based on jet propulsion, there arises a natural question on the possibility of implementing such a control system in which the restoring torque tends to zero as time increases.

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