TRUDY INSTITUTA MATEMATIKI I MEKHANIKI UrO RAN

Vol. 23 No. 1 **2017**

DOI: 10.21538/0134-4889-2017-23-1-20-26

MSC: 93C41, 93C05

CONTROL OF A PLATFORM WITH OSCILLATORS UNDER THE ACTION OF DRY FRICTION

Received October 31, 2016

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We study a local control problem for a system consisting of a solid carrier and several linear dissipative oscillators attached to it. The carrier moves along a horizontal straight line under a horizontal steering force. The system is a simple approximation of a model describing controlled motions of a vessel with a viscous fluid. Since the state of the fluid in the vessel is unknown at any specific time, the physical parameters of the oscillators and their phase states are also considered unknown. It is assumed that a dry fiction force acts between the carrier and the straight line, and the parameters of the dry friction are unknown and varying. It is required to bring the carrier to a stop at a given terminal position and to keep it at that position; no constraints are imposed on the behavior of the oscillators after the carrier stops. We propose a feedback control law with bounded absolute value that brings the carrier from a neighborhood of the terminal position to this position in a finite time. The control is given by a function that is smooth (analytic) everywhere except for the terminal position. This function can be interpreted as a linear feedback with coefficients depending on the state variables. Although the coefficients grow unboundedly as the carrier approaches the terminal position, the control remains bounded. The efficiency of the control is illustrated by means of numerical modelling.

Keywords: linear control system, system of oscillators, feedback, dry friction.

REFERENCES

1. Borisov A.E., Levtov V.L., Romanov V.V., Tarasenko N.V. A set of technical means to ensure the controlled dynamic conditions for investigation of the gravity-sensing system research. *Kosmonavtika i raketostroenie*, 2007, vol. 4, no. 49, pp. 168–173 (in Russian).
2. Akulenko L.D., Bolotnik N.N., Borisov A.E., Gavrikov A.A. Quasi-optimal control of rotation of a rigid body about a fixed axis taking friction into account. *J. Comput. Sys. Sci. Int.*, 2015, vol. 54, no. 3, pp. 331–348. doi:10.1134/S1064230715030028 .
3. Anan'evskii I.M., Ishkhanyan T.A. Control of a turntable on a mobile base in the presence of perturbations. *J. Comput. Sys. Sci. Int.*, 2016, vol. 55, no. 3, pp. 483–491. doi: 10.1134/S1064230716030047 .
4. Ananievskii I.M., Anokhin I.M., Ovseevich A.I. Bounded feedback controls for linear dynamic systems by using common Lyapunov function. *Dokl. Math.* 2010, vol. 82, no. 2, pp. 831–834. doi: 10.1134/S106456241005039X .
5. Ovseevich A. A local feedback control bringing a linear system to equilibrium. *J. Optim. Theory Appl.*, 2015, vol. 165, no. 2, pp. 532–544. doi:10.1007/s10957-014-0636-1 .

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I. M. Anan'evskii, T. A. Ishkhanyan, Control of a platform with oscillators under the action of dry friction, *Trudy Inst. Mat. Mekh. UrO RAN*, 2017, vol. 23, no. 1, pp. 20–26 .