TRUDY INSTITUTA MATEMATIKI I MEKHANIKI UrO RAN

Vol. 23 No. 1 **2017**

DOI: 10.21538/0134-4889-2017-23-1-195-205

MSC: 37C75

ON A CONTROL PROBLEM FOR A LINEAR SYSTEM WITH MEASUREMENTS OF A PART OF PHASE COORDINATES

Received October 28, 2016

V. I. Maksimov

We consider a control problem for a system of linear ordinary differential equations. It is required to design a feedback control procedure under which the velocity of a part of the phase coordinates of the system would track the velocity of a part of the phase coordinates of another system, which is subject to an unknown perturbation. It is assumed that a part of phase coordinates of each of the systems is measured with error at discrete times. We propose a solution algorithm that is stable to informational disturbances and computation errors. The algorithm is based on the extremal shift method known in the theory of guaranteed control. Since it is impossible to apply the "classical" extremal shift due to the incompleteness of the information on the phase coordinates, we propose a modification of this method that employs elements of the dynamic inversion theory. The latter is based on constructions from the theory of ill-posed problems. In the concluding section of the paper, we specify a class of systems nonlinear in the phase coordinates for which the algorithm is applicable.

Keywords: control, incomplete information, linear systems.

REFERENCES

1. Krasovskii N.N., Subbotin A.I. *Game-theoretical control problems*. New York: Springer, 1987. 517 p. This book is substantially revised version of the monograph *Pozitsionnye differentsial'nye igry*, Moscow, Nauka Publ., 1974, 456 p.
2. Krasovskii N.N. *Upravlenie dinamicheskoi sistemoi* [Control of a dynamic system]. Moscow: Nauka Publ., 1985, 516 p.
3. *Izbrannye trudy Yu.S. Osipova* [Selected Works by Yu.S. Osipov]. Moscow: MSU Publ. 2009, 656 p.
4. Subbotin A.I., Chentsov A.G. *Optimizatsiya garantii v zadachakh upravleniya* [Optimization of a guarantee in control problems]. Moscow: Nauka Publ., 1981. 288 p.
5. Ushakov V.N. On the problem of stable bridges construction in the differential game of pursuit-evasion. *Izv. Akad. Nauk SSSR, Tekhn. Kibernet.*, 1980, no. 4, pp. 29–36 (in Russian).
6. Barabanova N.N. Subbotin A.I. On classes of strategies in differential games of evasion of contact. *J. Appl. Math. Mech.*, 1972, vol. 35, no. 3, pp. 349–356.
7. Patsko V.S. *Poverhnosti pereklјuchenija v linejnyh differencial'nyh igra* [Switching surfaces in linear differential games]. Preprint, Institute of Mathematics and Mechanics, Ural Branch of the Russian Academy of Sciences, Ekaterinburg, 2004. 80 p.
8. Maksimov V.I. The tracking of the trajectory of a dynamical system. *J. Appl. Math. Mech.*, 2011, vol. 75, no. 6, pp. 667–674. doi: 10.1016/j.jappmathmech.2012.01.007 .
9. Kryazhimskiy A.V., Maksimov V.I. Resource-saving tracking problem with infinite time horizon. *Diff. Equat.*, 2011, vol. 47, no. 7. pp. 1004–1013. doi: 10.1134/S001226611107010X .

10. Maksimov V.I. Compensation of disturbances in non-linear control systems. *J. of Computer and Systems Sciences International*, 2003, vol. 42, no. 2, pp. 220–226.
11. Fagnani F., Maksimov V., Pandolfi L. A recursive deconvolution approach to disturbance reduction. *IEEE Trans. Aut. Contr.*, 2004, vol. 49, no. 6, pp. 907–921. doi: 10.1109/TAC.2004.829596 .
12. Maksimov V.I. On tracking solutions of parabolic equations. *Russ. Math.*, 2012, vol. 56, no. 1, pp. 35–42. doi: 10.3103/S1066369X12010057 .
13. Maksimov V.I. Algorithm for shadowing the solution of a parabolic equation on an infinite time interval. *Diff. Equat.*, 2014, vol. 50, no. 3, pp. 362–371. doi:10.1134/S0012266114030100 .
14. Maksimov V.I. On a control algorithm for a linear system with measurements of a part of coordinates of the phase vector. *Proc. Steklov Inst. Math.*, 2016, vol. 292, suppl. 1, pp. 197–210. doi: 10.1134/S0081543816020164 .
15. Maksimov V.I. Tracking a given solution of a nonlinear distributed second-order equation. *Diff. Equat.*, 2016, vol. 52, no. 1, pp. 128–132. doi:10.1134/S0012266116010110 .
16. Maksimov V.I. Calculation of the derivative of an inaccurately defined function by means of feedback laws. *Proc. Steklov Inst. Math.*, 2015, vol. 291, pp. 219–231. doi: 10.1134/S0081543815080179 .

Viacheslav Ivanovich Maksimov, Dr. Phys.-Math. Sci., Prof., Krasovskii Institute of Mathematics and Mechanics, Ural Branch of the Russian Academy of Sciences, Yekaterinburg, 620990 Russia; Ural Federal University, Yekaterinburg, 620002 Russia, e-mail: maksimov@imm.uran.ru .

Cite this article as:
V. I. Maksimov, On a control problem for a linear system with measurements of a part of phase coordinates, *Trudy Inst. Mat. Mekh. UrO RAN*, 2017, vol. 23, no. 1, pp. 195–205 .