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Approximation Approach in State Estimation Problems for Dynamical Control Systems Under Uncertainty

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Abstract

The control problems for set-valued trajectories of a nonlinear dynamic system described by differential equations with nonlinearity and uncertainty are studied. It is assumed that only the bounding sets for uncertain variables are known and any additional statistical information is not available. Approaches are described for solving the optimal control problem for such systems, including the problem of the fastest transfer of the system state inside a given terminal set.

The research develops previously proposed theoretical schemes and improves basic approaches considered earlier in [1, 2]. Numerical simulations related to the proposed techniques and based on new state estimation ideas and on new algorithms are included to illustrate the main results.

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Keywords: Nonlinear dynamics, uncertainty, ellipsoidal calculus.

References:

[1] T. F. Filippova, On two approaches to the solution of set-valued state estimation problem for control systems under uncertainty. J. Math. Sci. (N.Y.) 295 (2025), no. 3, 316–324.

[2] T. F. Filippova, HJB-Inequalities in estimating reachable sets of a control system under uncertainty. Ural Math. J. 8 (2022), no. 1, 34–42.