THE CONTROL OF LINEAR SYSTEMS UNDER FEEDBACK DELAYS[1]

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The problems of measurement feedback control are at the heart of control theory [2, 6, 3, 1]. These problems were mostly treated in a stochastic setting. In this paper we consider problems of feedback control under delayed measurement output feedback and set-membership noise. The delays considered here may be due to errors in communication channels as well as to the processing time in the observers and controllers.

The suggested solutions are based on a combination of Hamiltonian techniques with methods of set-valued analysis. They rely on ellipsoidal approximations of information and solvability sets which describe the solution strategies [4]. These approaches allow to solve problems of realistically high dimensions. Their practical implementation may be based on the Ellipsoidal Toolbox [5].

We first consider the situation with feedback noise but no delay. This problem is dealt with by reduction to one in the metric space of information sets. The key point is that the problem further reduces to a standard one in finite-dimensional space.

After that we consider bounded noise in the delayed output measurement. A control strategy for the related problem of control is indicated. (Everything is exact.)

We finally present the results of numerical modelling for oscillating systems (of dimension up to 20). We show the realized control inputs, and how the quality of solution depends on delay time.

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