H_∞ Control and Filtering for Systems with Jumps

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Gakio Wanyoike

Following the approach of Doyle *et al*, 1989, we consider the H_∞ control and filtering problems for linear systems with jumps. Jump systems are systems with mixed signals (both discrete and continuous time signals), thus they may be conceived as a generalization of continuous time and discrete time systems. In H_∞ control one wishes to find stabilizing controllers such that the effect of the exogenous inputs is minimized. More precisely, the H_∞ control problem is

(i) to find necessary and sufficient conditions for the existence of an internally stabilizing controller such that the H_∞ norm of the input-outlput operator is less than a prescribed number (say γ, $\gamma > 0$).

(i) to characterize all such controllers if they exist.

The filtering problem is to find an estimate of the state based on some given observation. Now, for a given γ, the H_∞ filtering problem is to find necessary and sufficient conditions for the existence of a causal filter such that the H_∞ norm of the input-output operator is less than γ.

We give necessary and sufficient conditions for the existence of suboptimal controllers and filters and characterize all such controllers and filters in terms of Riccati equations with jumps. We also show that the existing results for continuous time systems, with both continuous time and sampled observations and discreate time systems are special cases of jumps systems. We test the robustness of our controllers through the stabilization of an inverted pendulum system by computer simulation.