On the Distributed Stable Full Information H^∞ Minimax Problem

Olof J. Staffans
Åbo Akademi University
Department of Mathematics
FIN-20500 Åbo, Finland
Olof.Staffans@abo.fi
http://www.abo.fi/~staffans/

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We study the distributed parameter suboptimal full information H^∞ problem for a stable well-posed linear system with control u, disturbance w, state x, and output y. Here u, w, and y are L^2-signals on $(0,\infty)$ with values in the Hilbert spaces U, W, and Y, and the state x is a continuous function of time with values in the Hilbert space H. The problem is to determine if there exists a (dynamic) γ-suboptimal feedforward compensator, i.e., a compensator U such that the choice $u = Uw$ makes the norm of the input/output map from w to y less than a given constant γ. A sufficient condition for the existence of a γ-suboptimal compensator is that an appropriately extended input/output map of the system has a (J,S)-inner-outer factorization of a special type, and if the control and disturbance spaces are finite-dimensional and the system has an L^1 impulse response, then this condition is also necessary. Moreover, in this case there exists a central state feedback/feedforward controller, which can be used to give a simple parameterization of the set of all γ-suboptimal compensators. Our proofs use a game theory approach.