Nonlinear Q-Design for Convex Stochastic Control

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- nonlin_Q_param.pdf

- Matlab files (requires CVX to run)

In this note we describe a version of the Q-design method that can be used to design nonlinear dynamic controllers for a discrete-time linear time-varying plant, with convex cost and constraint functions and arbitrary disturbance distribution. Choosing a basis for the nonlinear Q-parameter yields a convex stochastic optimization problem, which can be solved by standard methods such as sampling. In principle (for a large enough basis, and enough sampling) this method can solve the controller design problem to any degree of accuracy; in any case it can be used to find a suboptimal controller, using convex optimization methods. We illustrate the method with a numerical example, comparing a nonlinear controller found using our method with the optimal linear controller, the certainty-equivalent model predictive controller, and a lower bound on achievable performance obtained by ignoring the causality constraint.