Design of affine controllers via convex optimization

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- affine_contr.pdf
- Matlab files (requires CVX to run)

We consider a discrete-time time-varying linear dynamical system, perturbed by process noise, with linear noise corrupted measurements, over a finite horizon. We address the problem of designing a general affine causal controller, in which the control input is an affine function of all previous measurements, in order to minimize a convex objective, in either a stochastic or worst-case setting. This controller design problem is not convex in its natural form, but can be transformed to an equivalent convex optimization problem by a nonlinear change of variables, which allows us to efficiently solve the problem. Our method is related to the classical Q-design procedure for time-invariant, infinite-horizon linear controller design, and the more recent purified output control method. We illustrate the method with applications to supply chain optimization and dynamic portfolio optimization, and show the method can be combined with model predictive control techniques when perfect state information is available.