Analysis and Synthesis of State-Feedback Controllers with Timing Jitter

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We consider a continuous-time linear system with sampled constant linear state-feedback control and a convex quadratic performance measure. The sample times, however, are subject to variation within some known interval. We use linear matrix inequality (LMI) methods to derive a Lyapunov function that establishes an upper bound on performance degradation due to the timing jitter. The same Lyapunov function can be used in a heuristic for finding a bad timing jitter sequence, which gives a lower bound on the possible performance degradation. Numerical experiments show that these two bounds are often close, which means that our bound is tight. We show how LMI methods can be used to synthesize a constant state-feedback controller that minimizes the performance bound, for a given level of timing jitter.