Sampled-Data Distributed $H_\infty$ Control of a Class of Parabolic Systems

Abstract:

We develop, for the first time, sampled-data $H_\infty$ control for a class of parabolic systems. These systems are governed by semilinear transport reaction equations with additive disturbances and with distributed control on a finite interval. We suggest a sampled-data controller design, where the sampling intervals in time and in space are bounded. The network of $N$ stationary sensing devices provide spatially averaged state measurements over the sampling spatial intervals. Our sampled-data static output feedback enters the equation through $N$ shape functions (which are localized in the space) multiplied by the corresponding state measurements. Sufficient conditions for the internal exponential stability and for $L_2$-gain analysis of the closed-loop system are derived via direct Lyapunov method in terms of Linear Matrix Inequalities (LMIs). By solving these LMIs, upper bounds on the sampling intervals that preserve the internal stability and the resulting $L_2$-gain can be found. Numerical examples illustrate the efficiency of the method.