Stabilization of Persistently Excited Linear Systems by Delayed Feedback Laws

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This talk will consider the problem of stabilization by a linear feedback law of a linear system submitted to an intermittent control satisfying a condition of persistence of excitation, i.e., a system of the form

$$\dot{x} = Ax + \alpha(t)Bu$$

where α is a persistently exciting signal and u is taken under the form $u = -Kx$. The goal is to choose a matrix K such that the closed-loop system is asymptotically stable, uniformly with respect to a given class of persistently exciting signals.

We will first recall some existing results concerning this problem, mainly those presented in [1], before turning to the main question we consider: can we still obtain a stabilization result for this system if the linear feedback is not applied instantaneously, but only after a certain delay $\tau > 0$? We thus consider the feedback $u(t) = -Kx(t-\tau)$, and we are able to prove in this case that stabilization is indeed possible under certain assumptions on (A,B), which are the same as those for the non-delayed case presented in [1]. We shall explain the technique of the proof, which relies on a time-contraction argument and the study of a non-delayed limit system as the parameter of time contraction tends to infinity.

References

[1] Y. Chitour and M. Sigalotti. On the stabilization of persistently excited linear systems. *SIAM J. Control Optim.*, 48(6):4032–4055, 2010.

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