Wei, Kehui

Quadratic stabilizability of linear systems with structural independent time varying uncertainties. (English) Zbl 0735.93066

Robust control of linear systems and nonlinear control, Proc. Int. Symp. Math. Theory Networks Syst., MTNS, Vol. II, Amsterdam/Neth. 1989, Prog. Syst. Control Theory 4, 229-237 (1990).

Summary: [For the entire collection see Zbl 0723.00047.]

This paper investigates the problem of designing a linear state feedback control to stabilize a class of single-input uncertain linear dynamical systems. The systems under consideration contain time-varying uncertain parameters whose values are unknown but bounded in given compact sets. The method used to establish asymptotical stability of the closed loop system (obtained when the feedback control is applied) involves the use of a quadratic Lyapunov function. Under the assumption that each entry of system matrices independently varies in a sufficient large range we first show that to insure a system stabilizable some entries of the system matrices must be sign invariant, more precisely, the number of the least required sign invariant entries is equal to the system order. Then, for a class of systems containing both the least required sign invariant entries and sign varying structural uncertainties we provide the necessary and sufficient conditions under which the system can be quadratically stabilized by a linear control for all admissible variations of uncertainties. The conditions show that all uncertainties can only enter the system matrices in a way to form a particular geometrical pattern called “anti-symmetry stepwise configuration”.

MSC:

93D15 Stabilization of systems by feedback
93D09 Robust stability
93C05 Linear systems in control theory

Keywords:

linear state feedback control; quadratic Lyapunov function; anti-symmetry stepwise configuration