On Simultaneous Lyapunov Diagonal Stability

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Abstract

The problem of simultaneous Lyapunov diagonal stability (viz. the existence of a common diagonal Lyapunov solution for systems of Lyapunov matrix inequalities) on a matrix set $\mathcal{A}$ arises from the study of Lyapunov diagonal stability on a single matrix and from the area of interconnected time-varying and switched systems. In this talk, we present two characterizations for simultaneous Lyapunov diagonal stability, one through a theorem of the alternative for linear maps on inner product spaces and the other through Hadamard products of the matrices in $\mathcal{A}$ and a new notion called $\mathcal{P}$-sets. Applications of these results are also provided.