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SOME NEW RESULTS ON LYAPUNOV-TYPE DIAGONAL STABILITY

[ABSTRACT]

In this talk, we present several recent developments regarding Lyapunov diagonal stability. This type of matrix stability plays an important role in various applied areas such as population dynamics, systems theory, complex networks, and mathematical economics. First, we establish a necessary and sufficient condition, based on the Schur complement, for determining Lyapunov diagonal stability of a matrix. This condition reduces the problem to common diagonal Lyapunov solutions on two matrices of order one less. We develop a number of extensions to this result, and formulate the range of feasible diagonal Lya-punov solutions. In particular, we derive explicit algebraic conditions for a set of 2×2 matrices to share a common diagonal Lyapunov solution. Second, the connection between Lyapunov diagonal stability and P -matrix property under Hadamard multiplication is extended. We present a new characterization involv-ing Hadamard multiplications for simultaneous Lyapunov diagonal stability on a set of matrices. This development is based upon a recent result concerning simultaneous Lyapunov diagonal stability and a new concept called P-sets, which is a generalization of P -matrices. Third, we consider various types of matrix sta-bility involving a partition α of $\{1, \ldots, n\}$. We introduce the notions of additive $H(\alpha)$-stability and $P0(\alpha)$-matrices, extending those of additive D-stability and nonsingular P0-matrices. Several new results are developed, connecting additive $H(\alpha)$-stability and the $P0(\alpha)$-matrix property to the existing results on matrix stability involving α. The extensions of results related to Lyapunov diagonal stability, D-stability, and additive D-stability are discussed.

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