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Stabilization of Controllable Linear Systems

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Abstract: The work consists of two parts. The first part is devoted to linear continuous-time systems and the second one to linear discrete-time systems. In the first part stationary and nonstationary stabilization of linear time-invariant continuous-time systems is considered. A simple and direct proof of Zubov's and Wonham's Theorem on pole assignment in controllable linear systems by means of a suitable static time-invariant output feedback of the state is given. Brockett's problem of stabilization by means of a static time-varying output feedback of linear system is considered. To solve this problem two approaches are considered. Sufficient conditions of low- and high-frequency stabilization of controllable linear systems are given. Also examples of possibility of nonstationary low-frequency and high-frequency stabilization of two-dimensional and three-dimensional linear systems are given. In the second part the discrete-time version of Brockett's problem for linear control systems is considered. It is shown that under mild conditions stabilization for linear time-invariant discrete-time systems is possible by means of piecewise-constant periodic with a sufficiently large period static output feedback control. Sufficient conditions of low-frequency stabilization are given. For second-order systems a necessary and sufficient condition of stabilizability by periodic output feedback is given. Also pole assignment problem for linear time-invariant discrete-time systems by static periodic output feedback is considered.

Keywords: *stabilization, time-invariant system, Brockett problem, pole assignment, time-invariant/time-varying static output feedback.*

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