Radius of Approximate Controllability in the Function State Space of Retarded Systems Described by Linear Functional Differential Equations

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Abstract: In this paper we study the robustness of controllability in the state space $M_p = \mathbb{C}^n \times L_p(-h, 0, \mathbb{C}^n), 1 < p < \infty$, for dynamical systems described by linear functional differential equations (FDE) of the form

$$\dot{x}(t) = A_0 x(t) + \int_{-h}^{0} d[\eta(\theta)] x(t+\theta) + B_0 u(t),\ t \geq 0,\ x \in \mathbb{C}^n, \tag{12}$$

where $\eta(\cdot)$ is a $\mathbb{C}^{n\times n}$-function of bounded variation on $[-h, 0]$. Some computable estimates and formulas for the controllability radius of a controllable FDE system (12) are obtained under the assumption that the system's matrices A_0, η, B_0 are subjected to structured perturbations of the form

$$[A_0, B_0] \to [\widetilde{A}_0, \widetilde{B}_0] = [A_0, B_0] + D_0 \Delta_0 E_0,$$

$$\eta \to \widetilde{\eta} = \eta + D_1 \delta E_1,$$

where $D_i, E_i, i = 0, 1$ are given matrices, Δ_0 is unknown matrix, $\delta(\cdot)$ is unknown matrix function with bounded variation. Examples are provided to illustrate the obtained results.

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