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Robust $\mathcal{H}_\infty$ Filtering for Discrete Stochastic Time-Delay Systems with Nonlinear Disturbances*

Huijun Gao[1], James Lam[2] and Changhong Wang[1]

[1] *Space Control and Inertial Technology Research Center, P.O.Box 1230, Harbin Institute of Technology, Xidazhi Street 92, Harbin, 150001, P. R. China*
[2] *Department of Mechanical Engineering, The University of Hong Kong, Pokfulam Road, Hong Kong*

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Abstract: This paper deals with the problem of robust $\mathcal{H}_\infty$ filtering for discrete time-delay systems with stochastic perturbation and nonlinear disturbance. It is assumed that the state-dependent noises and the nonlinearities satisfying global Lipschitz conditions enter into both the state and measurement equations, and the system matrices also contain parameter uncertainties residing in a polytope. Attention is focused on the design of robust full-order and reduced-order filters guaranteeing a prescribed noise attenuation level in an $\mathcal{H}_\infty$ sense with respect to all energy-bounded noise inputs for all admissible uncertainties and time delays. Sufficient conditions for the existence of such filters are formulated in terms of a set of linear matrix inequalities, upon which admissible filters can be obtained from the solution of a convex optimization problem. A numerical example is provided to illustrate the applicability of the developed filter design procedure.

Keywords: *Filter design; linear matrix inequality; robust filtering; state-delay systems; stochastic systems; nonlinearity.*

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