$H_\infty$ Filtering for Uncertain Bilinear Stochastic Systems †

Huijun Gao 1*, James Lam 2, Xuerong Mao 3 and Peng Shi 4

1 Space Control and Inertial Technology Center, Harbin Institute of Technology, Harbin, China
2 Department of Mechanical Engineering, University of Hong Kong, Hong Kong
3 Department of Statistics and Modelling Science, University of Strathclyde, Livingstone Tower, 26 Richmond Street, Glasgow, G1 1XT, Scotland, U.K.
4 School of Technology, University of Glamorgan, Pontypridd, CF37 1DL, United Kingdom

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Abstract: This paper is concerned with the problem of $H_\infty$ filtering for continuous-time uncertain stochastic systems. The model under consideration contains both state-dependent stochastic noises and deterministic parameter uncertainties residing in a polytope. According to the online availability of the information on the uncertain parameters, we propose two approaches, namely robust stochastic $H_\infty$ filtering and parameter-dependent stochastic $H_\infty$ filtering. Both approaches solve the filtering problems based on a modified (improved) bounded real lemma for continuous-time stochastic systems, which decouples the product terms between the Lyapunov matrix and systems matrices and enables us to exploit parameter-dependent stability idea in the filter designs. Sufficient conditions for the existence of admissible robust stochastic $H_\infty$ filters and parameter-dependent stochastic $H_\infty$ filters are obtained in terms of linear matrix inequalities, upon which the filter designs are cast into convex optimization problems. Since the filter designs make full use of the parameter-dependent stability idea, the obtained results are less conservative than the existing one in the quadratic framework. A numerical example is provided to illustrate the effectiveness and advantage of the filter design methods proposed in this paper.

Keywords: Linear matrix inequality; $H_\infty$ filtering; parameter uncertainty; robust filtering; stochastic systems.

Mathematics Subject Classification (2000): 93E11.

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* Corresponding author: hjgao@hit.edu.cn

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