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ROBUST H_∞ FILTERING ON STOCHASTIC UNCERTAIN SYSTEMS

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Abstract. The robust H_∞ filtering problem is considered for stochastic uncertain systems subject to norm-bounded parameter uncertainties in both state matrix and output matrix of the state-space model. The aim is to design a filter by augmented systems, which ensures both the robustly stochastic stability and the prescribed level of H_∞ performance for the filtering dynamics error for all admissible uncertainties. The sufficient conditions for the existence of the filter are derived. The problem of robust H_∞ filtering is extended by auxiliary systems in order to obtain the sufficient and necessary conditions. An LMI method for designing filter is given by various matrix transformations, this makes it convenient to obtain the expression of filter. Finally, a numerical example shows that the method is effective and feasible.

Keywords. stochastic uncertain system; auxiliary system; robustly stochastic stability; robust H_∞ filtering; linear matrix inequality

AMS (MOS) subject classification: TP 13

1 Introduction

Kalman filtering is an important method to estimate signals, and has obtained widespread applications in many fields. The last three decades have witnessed significant advances in the celebrated Kalman filtering which seems to be the most effective estimation approach. However, it usually needs exact model and spectral densities of noise processes. In most practical problems, an exact model of the system may not be available and the robust performance of the filter in the face of system parameter uncertainties becomes an important issue. Considering this, another estimation method based on H_∞ filtering technique has been proposed recently, which is concerned with the design of estimators in which the estimation error is below a prescribed level from the noise signals to the estimation error. One of the main advantages of H_∞ filtering in comparison with Kalman filtering is that no statistical assumptions on the exogenous signals are needed which makes this technique useful in certain practical applications[1]. Therefore, the research subject of robust estimation and H_∞ estimation has drawn much attention in the past