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ROBUST $\mathcal{H}_\infty$ FILTERING FOR A CLASS OF LINEAR JUMPING DISCRETE-TIME DELAY SYSTEMS

M. S. Mahmoud[1] , P. Shi[2] and A. Ismail [1]

[1]Electrical Engineering Department
UAE University, Al-Ain, PO Pox 17555, United Arab Emirates
[2] Land Operations Division
Defense Science and Technology Organization
PO Box 1500, Salisbury SA 5108,Australia

Abstract. In this paper, we examine the robust $\mathcal{H}_\infty$ filtering problem for a class of linear, uncertain discrete delay systems with Markovian jump parameters. The uncertainties are time-varying and norm-bounded parametric uncertainties and the delay factor is arbitrary constant. We provide initially a robust stochastic stability result with a prescribed performance measure. Then we design a linear causal filter using algebraic inequality procedure which ensures a prescribed disturbance attenuation level from the disturbance signal to the filtering error.
Keywords. Discrete delay systems, Markovian jump parameters, Robust $\mathcal{H}_\infty$ filtering, Norm-bounded parametric uncertainties, Linear causal filter.

1 Introduction

Filtering is perhaps one of the oldest problems studied in systems theory [1]. In recent years, robust filtering arose out of the desire to determine estimates of unmeasurable state variables for dynamical systems with uncertain parameters. From this perspective, robust filtering can be viewed as an extension of the celebrated Kalman filter [1] to uncertain dynamical systems. The past decade has witnessed major developments in robust filtering problem using various approaches [2,5-7,10,11,16,22]. Of particular interest to our work is the $\mathcal{H}_\infty$ filtering in which the design is based on minimizing the $\mathcal{H}_\infty$-norm of the system. This design reflects a worst-case gain of the transfer function from the disturbance inputs to the estimation error output. In addition, $\mathcal{H}_\infty$ filtering is superior to standard $\mathcal{H}_2$ filtering since no statistical assumption is made on the input signals.

On another front of research, state-space modeling of industrial and engineering systems frequently encounter delay effects in processing state, input or related variables. In connection with system measurements and/or information flow amongst different parts of dynamical systems, time-delay arise quite naturally [9,12,21]. Thus, the class of dynamical systems with time-delay has