Fault Detection Filter for Linear Time-Delay Systems

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Abstract: By extension of a fault detection optimization approach to linear time invariant (LTI) systems, this short paper deals with the fault detection filter (FDF) problem for linear time-delay systems with $L_2$-norm bounded unknown inputs. The basic idea is first to introduce a new FDF as the residual generator; and then based on an objective function to formulate the FDF design as an optimization problem. Through appropriate choice of the filter gain matrix and a post-filter, the convergence of the residual generator and satisfactory FDF performance can be achieved. A numerical example is given to illustrate the effectiveness of the proposed method.

Keywords: Fault detection; filter; robustness; sensitivity; time delay.


1 Introduction

Many significant approaches to the problems of robust fault detection and isolation (FDI) have been developed during the past two decades, for instance unknown input observer (UIO), parity space, $H_\infty$ optimization, eigenstructure assignment, and $H_\infty$ filtering [1, 5, 6, 9, 12]. However, most of these aforementioned works are about delay-free systems. Time delay is an inherent characteristic of many physical systems, such as rolling mills, chemical processes, water resources, biological, economic and traffic control systems. To the best of our knowledge, only few researches on FDI have been carried out

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