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ON DESIGNING H_∞ FAULT DETECTION FILTER FOR MARKOVIAN JUMP LINEAR SYSTEMS WITH POLYTOPIC UNCERTAINTIES

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Abstract. *This paper deals with the problem of robust fault detection for Markovian jump linear systems with polytopic uncertainties. Using a generalized form of observer-based fault detection filter (FDF) as a residual generator, the design of robust FDF is formulated in the framework of stochastic H_∞ filtering. Based on analyzing the robust mean square stability and stochastic H_∞ performance of the FDF, sufficient conditions on the existence of both mode-dependent and mode-independent H_∞ FDFs are respectively derived and solutions to the H_∞ FDFs are given in terms of linear matrix inequalities. A numerical example is given to show the effectiveness of the proposed method.*
Keywords: Fault detection filter, Observer, Markovian jump system, Polytopic uncertainty

1. **Introduction.** During the past three decades, model-based fault detection and isolation (FDI) has been an active research topic and a lot of approaches have been developed, see [1, 2, 5, 6, 7, 10, 12, 13, 16, 17, 19, 21] and references therein. On the other hand, Markovian jump systems are appropriate to model plants subject to component failures, sudden environment disturbances, changes in subsystems interconnections, and so on. The problems of stability analysis and control have been investigated deeply [3, 4, 9, 14, 15, 18, 20]. With the increasing demands for system safety and reliability, it is of significance to study the problem of FDI for Markovian jump linear systems. For example, in [22], the observer-based residual generator was designed by solving two-objective optimization problem; in [23], the H_∞ filtering based approach in [2] was extended to handle the problem of robust FDI for Markovian jump linear systems, which focused on designing a mean square stable robust FDF (RFDF) such that the error between residual and fault (or weighted fault) achieves a prescribed unknown input attenuation level; in [11], a networked control system was modelled as a Markovian jump linear system and an observer-based H_∞ FDF was designed. However, the majority of the previous existing results of FDI for Markovian jump systems are developed without considering modelling errors. To authors' best knowledge, the problem of H_∞ fault detection for Markovian jump linear systems with polytopic uncertainties could not be handled by straight application of the existing results and the research remains significant and challenging, which motivates the present study.