Robust $\mathcal{H}_\infty$ Fuzzy Control Design for Time Delay Nonlinear Markovian Jump Systems: An LMI Approach

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Abstract: This paper considers the problem of designing a robust $\mathcal{H}_\infty$ fuzzy state-feedback controller for a class of time delay nonlinear Markovian jump systems. The proposed controller guarantees the $L_2$-gain of the mapping from the exogenous input noise to the regulated output to be less than some prescribed value. Solutions to the problem are provided in terms of linear matrix inequalities. To illustrate the effectiveness of the design developed in this paper, a numerical example is also provided.

Keywords: $\mathcal{H}_\infty$ fuzzy control; Takagi–Sugeno (TS) fuzzy model; linear matrix inequalities (LMIs); Markovian jump parameters; time-varying delay.

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1 Introduction

Markovian jump systems are also called hybrid systems, that is, the state space of a system contains both continuous (differential equation) and discrete states (Markov process). The Markovian jump system has been widely used to describe a physical system that changes abruptly from one mode to another mode. These abrupt changes may be caused by environmental disturbances, component and interconnection failures, parameters shifting, tracking, and fast variations in the operating point of the system. Over the past few decades, the Markovian jump system has been extensively studied by many researchers (see [1 – 7]).

It is a well known fact that engineering processes frequently contain time delays. Stability and control synthesis for time delay systems have been one of the most significant...