

NETWORKED GUARANTEED COST CONTROL FOR UNCERTAIN DISCRETE-TIME MARKOVIAN JUMP LINEAR SYSTEMS

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Abstract. This paper addresses the networked guaranteed cost control for discrete-time jump linear systems governed by two different Markov chains which represent the uncertain transition probability of open-loop plant and the random network-induced effects respectively. A new sufficient condition for the existence of guaranteed cost controller and an upper bound of the cost function are presented by a stochastic Lyapunov-Krasovskii functional. The mode-dependent controller design problem for such system is then formulated as a convex optimization over a set of linear matrix inequalities (LMIs). As an example to verify the proposed method, a class of open-loop unstable plants in the networked setup is discussed. The simulation results demonstrate the effectiveness of the method.

Keywords. guaranteed cost control, networked control systems, Markovian jump linear system, linear matrix inequality

1 Introduction

Markovian Jump Linear Systems (MJLSs) may represent an important class of stochastic dynamic systems subject to abrupt variations in their structure. This is in part caused by phenomena such as component failures or repairs, changing subsystem interconnections, and abrupt environmental disturbances, see e.g. [10]. Recently, MJLSs have gained attention in their ability to model the so-called networked control systems (NCSs) wherein the control loops are closed via communication networks. There are many examples which motivate the analysis of NCSs within the frame of MJLSs. As one example, the network-induced effects, such as random time-delays and packet losses, which are introduced by the unreliable communication links between remote sensors, actuators and controllers can be modeled by a Markov chain. As another example, the communication channel can be modeled as a Markov model in which the various states correspond to different signal noise ratio (SNR) values [19]. For each SNR value, a different probability of error for