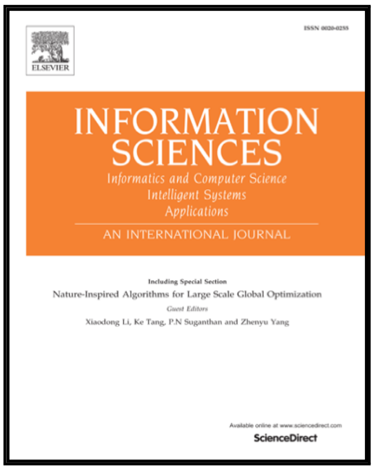
Accepted Manuscript



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PII: S0020-0255(18)30261-5
DOI: 10.1016/j.ins.2018.04.006
Reference: INS 13549

To appear in: *Information Sciences*

Received date: 4 December 2017
Revised date: 14 February 2018
Accepted date: 2 April 2018

Please cite this article as: Xiaoli Luan, Peng Shi, Fei Liu, Given-time multiple frequency control for Markov jump systems based on derandomization, *Information Sciences* (2018), doi: 10.1016/j.ins.2018.04.006

Given-time multiple frequency control for Markov jump systems based on derandomization

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Abstract This paper investigates the multiple frequency performance of Markov jump linear systems (MJLSs) in a given time interval and different frequency ranges. To improve the transient performance of MJLSs, derandomization approach is proposed to combine the stochastic jumping rule among different modes into controller design by transforming the original MJLSs into augmented deterministic systems. Then from two scales including time and frequency domains, the multiple frequency stabilization problem is dealt with over a given time interval. Finally, we use a numerical example to discuss and verify the effectiveness and advantages of the presented theoretical algorithm.

Keywords Discrete-time Markov jump systems, Derandomization, Multiple frequency control, Given-time control

1 Introduction

In practical industry applications, such as bioengineering, networked control systems, etc., more attention has been paid to the dynamic performance of the system in a given time interval rather than the asymptotical steady-state characteristics in infinite-time domain. To deal with this, Kamenkov put forward the idea of finite-time stability (FTS) in 1950s [9]. Differ from the asymptotic stability in infinite-time domain, FTS only requires the states of the system stay within the specific boundary under given time. In 1961, FTS was applied to the stability study for time-varying linear systems by Dorato and aroused wide attention of scholars [4]. However, the high demand of calculation limits its further development. Until 1997, linear matrix inequality theory was firstly applied to finite-time controller design for linear systems by Dorato, Abdallah and Famularo [5]. Benefit from this method, theory of FTS was generalized rapidly to finite-time boundedness, finite-time stabilization and finite-time filtering for linear time invariant systems [10], fuzzy systems [14, 19, 20], multi-agent systems [26, 27], hybrid systems [12, 13], etc. Especially for Markov jump linear systems (MJLSs) [6, 15, 16], or nonlinear Markov jump systems [24, 26], one of the typical hybrid systems, the finite-time performance has been widely researched for its less conservativeness in the time domain and significant applications in industrial fields.