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Stability of Stochastic Interval System with Distributed Delays

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Abstract: In this paper, we study the stability problem of a stochastic interval system with distributed delays. Firstly, we prove that the solution of such system exists and is unique, and then a sufficient criterion of exponential stability is obtained and such result can be generalized to the systems with multiple time delays. Finally, an example is given to illustrate the result.

Keywords: *exponential stability; stochastic interval system.*

Mathematics Subject Classification (2010): 65C30, 60H10.

1 Introduction

Stochastic modelling has come to play an important role in many branches of science and industry, such as neural network and automatic control of stochastic system and so on, see [1–9]. One of the most useful stochastic models which are often used in practice is stochastic differential delay equation [10–15]. However, in many practical models, it is difficult to determine the parameters with a fixed value and instead of obtaining some estimation – the parameters are changed in an interval. Such a system can be described by stochastic interval system.

In the past decades, a lot of work on stochastic differential interval systems could be found in [16–18] and the results are generalized to Markov switched system by [19, 20]. Motivated by these works, in this paper, we study stochastic interval system with distributed delays. Consider the following stochastic system

$$\begin{aligned} dx(t) &= [A_0x(t) + A_1x(t-\tau) + A_2\int_{-\tau}^{0} x(t+\theta)d\mu(\vartheta)]dt \\ &\quad +[B_0x(t) + B_1x(t-\tau) + B_2\int_{-\tau}^{0} x(t+\theta)d\nu(\vartheta)]dB_t, \end{aligned} \tag{1}$$

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