

# Exponential stability of stochastic switched systems

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This paper proposes a method for exponential  $m$ -stability analysis of stochastic switched systems. The models, in a finite set of models, are non-linear stochastic models. It is assumed that there is no jump in the state at switching instants and there is no Zeno behaviour, ie, there is finite number of switches on every bounded interval. The stochastic hybrid systems have wide applications: transmission control protocol flows with congestion avoidance and slow-start modes; estimation in distributed networked systems; air traffic control; process control and communication networks for control systems. For analysis of stochastic switched system the multiple Lyapunov functions are used and exponential  $m$ -stability is proved. From the main result of the paper: 1) the exponential  $m_1$ -stability of stochastic switched systems whereby  $m_1 \in (0, m)$ ; 2) the stability in probability. The exponentially stable equilibrium of system is relevant for practice because such systems are robust to perturbations.

**Key words:** Exponential stability; family of models; multiple Lyapunov functions; stochastic switched systems.

## 1. Introduction

Hybrid systems are digital real-time systems, which are embedded in an analogue environment. The analogue part of the hybrid system is described with differential equations and a discrete part of the hybrid systems is the event-driven dynamics which can be described using concepts from discrete event systems (Cassandras and Lafortune, 2008). In this paper, switched systems, which can be viewed as higher-level abstraction of hybrid systems, will be considered (Liberzon, 2003). For such systems, we assume: 1) there is no jump in the state at the switching instants, 2) there is no Zeno behaviour, ie, there is a finite number of switches on every bounded interval of time.

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