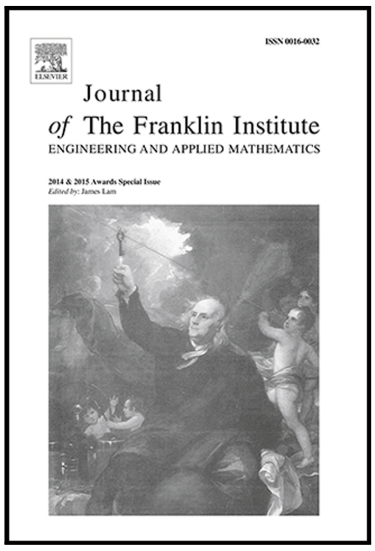


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Zhibao Song, Junyong Zhai

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# Finite-time adaptive control for a class of switched stochastic uncertain nonlinear systems

Zhibao Song and Junyong Zhai*
Key Laboratory of Measurement and Control of CSE, Ministry of Education
School of Automation, Southeast University, Nanjing, Jiangsu 210096, China

**Abstract** This paper addresses the problem of global finite-time adaptive control for a class of switched stochastic uncertain nonlinear systems under arbitrary switchings. By applying the delicate introduction of coordinate transformations and adding a power integrator technique, an adaptive controller is constructed to guarantee that the system state is regulated to the origin almost surely in a finite time while maintaining the boundedness of the resulting closed-loop systems in probability. Two examples are given to illustrate the effectiveness of the proposed control scheme.
**Key words**: Finite-time stability; Switched stochastic nonlinear systems; Adding a power integrator; Adaptive control.

## 1 Introduction

In this paper, we consider the problem of global finite-time adaptive control for a class of switched stochastic nonlinear systems

$$\begin{aligned}
\mathrm{d}x_1 &= x_2^{p_{1,\sigma(t)}}dt + f_{1,\sigma(t)}(\bar{x}_1,\theta)dt + g_{1,\sigma(t)}^T(\bar{x}_1,\theta)d\omega,\\
\mathrm{d}x_2 &= x_3^{p_{2,\sigma(t)}}dt + f_{2,\sigma(t)}(\bar{x}_2,\theta)dt + g_{2,\sigma(t)}^T(\bar{x}_2,\theta)d\omega,\\
&\vdots\\
\mathrm{d}x_n &= u^{p_{n,\sigma(t)}}dt + f_{n,\sigma(t)}(x,\theta)dt + g_{n,\sigma(t)}^T(x,\theta)d\omega
\end{aligned} \tag{1}$$

where $x = (x_1,\cdots,x_n)^T \in \mathbb{R}^n$ and $u \in \mathbb{R}$ are the system state and control input respectively. $\bar{x}_i = (x_1,\cdots,x_i)^T$, $i = 1,\cdots,n$. $\sigma(t)$ is the switching signal taking its values in a finite set $M = \{1,\cdots,m\}$ and $m$ is the number of subsystems. $\omega$ is an $r$-dimensional standard Wiener process defined on the complete probability space $(\Omega,\mathcal{F},P)$ with $\Omega$ being a sample space, $\mathcal{F}$ being a $\sigma$-field and $P$ being a probability measure. $\theta \in \mathbb{R}^s$ is a vector of uncertain parameters with integer

*Corresponding author: e-mail: jyzhai@seu.edu.cn