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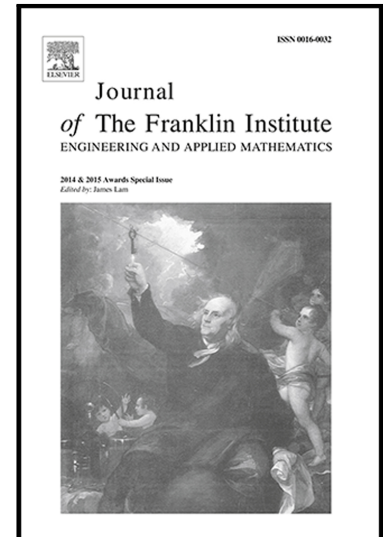
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Stabilizing two-dimensional stochastic systems through sliding mode control [☆]

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Abstract

This paper presents a stabilizing control for two-dimensional stochastic differential equations. The stability concept in this study is the stability in probability. To ensure such a stability, the control is designed based on the sliding mode technique, and applied to account stochastic systems. This finding has a practical implication—the proposed control can be used to stabilize a real-time automotive electronic throttle valve. The proposed approach is verified by data collected from experiments.

Keywords: stochastic systems, stability in probability, sliding mode control, control applications, automotive applications.

1. Introduction

Stability of stochastic differential equations has been investigated intensively during the past decades, showing a rich literature, see [2, 10, 17, 28, 29] for a brief account. Despite the progress made, stability results rely on general conditions based on n -dimensional systems, having n as either finite [17] or infinite [12]. That general conditions, though, do not apply in some practical circumstances—the case in which real-time control devices are modeled as two-dimensional systems (see an example in Section 3).

This paper contributes towards the stability of two-dimensional stochastic systems.

To clarify the contribution, some notations are now introduced. Given a complete filtered probability space $(\Omega, \mathcal{F}, \{\mathcal{F}_t\}_{t \geq 0}, \mathbb{P})$, consider the next two-dimensional stochastic

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