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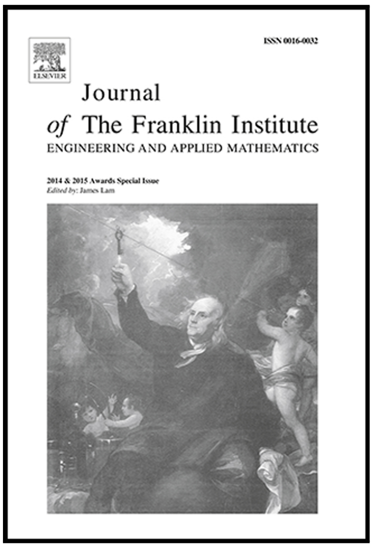

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Stabilizing a Class of Mixed States for Stochastic Quantum Systems via Switching Control

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Abstract

The global stabilization of a class of mixed states for finite dimensional stochastic quantum systems with degenerate measurement operator is investigated in this paper. We construct a measurement operator and control Hamiltonian that make the target state one of the system equilibria. Based on the proposed Lyapunov function, a control law is designed following Lyapunov's method to steer system state to the target mixed state from an initial state in the convergence domain, which is obtained through the analyses of invariant set based on LaSella's invariance principle. When the initial state isn't in the convergence domain, a constant control is used to steer the system state so that it enters the convergence domain in finite time. The constant control and the control designed by Lyapunov method compose a switching control strategy, which can steer system state to the target mixed state from any arbitrary state in the state space, i.e. the target mixed state is globally stable under the switching control. The convergence of the switching control is proved based on state sample trajectories. Moreover, the numerical experiments on a three dimensional stochastic quantum system are performed to demonstrate the effectiveness of switching control.

Keywords: stochastic quantum systems, mixed states, global stabilization, switching control

1. Introduction

The state transfer of quantum systems is important for the applications in quantum chemistry and atomic physics [1, 2]. In order to steer system state to the desired target state, a number of classical control strategies have been applied to quantum systems, e.g. optimal control [3, 4, 5, 6], sliding mode control [7, 8], H-∞ control [9, 10], Lyapunov control [11, 12, 13, 14, 15], etc., in which

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