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Exponential and Strong Stabilization for Inhomogeneous Semilinear Control Systems by Decomposition Method

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Abstract: In this work, we study, in a Hilbert state space, the stabilization problem of inhomogeneous semilinear control systems; the existence and uniqueness of solutions of the system are proved by the semigroup theory. The paper also gives a feedback control and sufficient conditions for exponential and strong stabilization using the decomposition method. Finally, an application to the heat equations is provided.

Keywords: *stability of control systems; stabilization of systems by feedback; heat equation.*

Mathematics Subject Classification (2010): 93-XX; 34-XX.

1 Introduction

Semilinear systems are special types of nonlinear systems. They are a transition class between linear and nonlinear systems and thus represent a wide range for modeling the dynamic behavior of various real-world phenomena. Stability is one of the most important concepts in dynamical systems theory, particularly semi-linear systems. This problem remains a major concern in the work of mathematicians and engineers. In this work, we study the stabilization of the inhomogeneous semi-linear system described by the equation

$$\begin{cases} \frac{dy(t)}{dt} = Ay(t) + v(t)(Ny(t) + c), \\ y(0) = y_0, \in H, \end{cases} \tag{1}$$

where

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