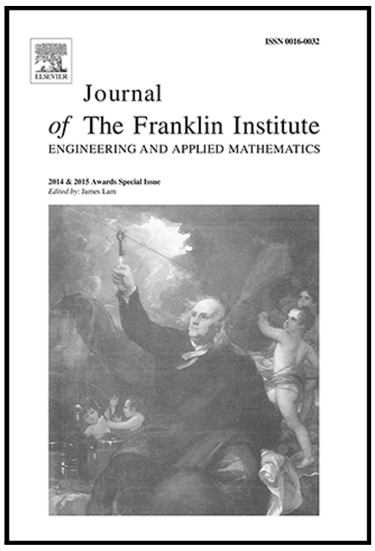

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Adaptive control of output feedback nonlinear systems with unmodeled dynamics and output constraint

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Abstract: This paper is concerned with the adaptive control problem of a class of output feedback nonlinear systems with unmodeled dynamics and output constraint. Two dynamic surface control design approaches based on integral barrier Lyapunov function are proposed to design controller ensuring both desired tracking performance and constraint satisfaction. The radial basis function neural networks are utilized to approximate unknown nonlinear continuous functions. K-filters and dynamic signal are introduced to estimate the unmeasured states and deal with the dynamic uncertainties, respectively. By theoretical analysis, the closed-loop control system is proved to be semi-globally uniformly ultimately bounded, while the output constraint is never violated. Simulation results demonstrate the effectiveness of the proposed approaches.

Keywords: unmodeled dynamics, output constraint, integral barrier Lyapunov function, dynamic surface control, K-filters.

1 Introduction

As we know, unmodeled dynamics exist in many practical nonlinear systems, they originate from various sources, such as measurement noises, modeling errors, external disturbances and modeling simplifications. Their existence significantly reduces the close-loop system performance and even makes the system unstable. Realizing the restraint and offset of unmodeled dynamics is a key to improve the performance of control system. Unmodeled dynamics in nonlinear systems can be classified as input unmodeled dynamics and state unmodeled dynamics. The control problem of a class of nonlinear systems with state unmodeled dynamics is considered in this paper.

Based on backstepping design and dynamic surface control (DSC) method, several adaptive control schemes were proposed for nonlinear systems with state unmodeled dynamics

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