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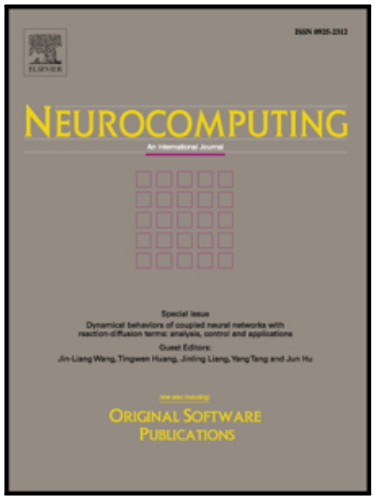

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Adaptive Neural Control of a 3-DOF Helicopter with Unknown time delay

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Abstract

In this paper, an adaptive neural network controller is designed for a three-degrees of freedom (3-DOF) helicopter using backstepping technique. As there is uncertain time delays in the system, appropriate Lyapunov-Krasovskii functions are used to compensate the delay and neural networks are introduced to deal with the uncertainty. The feasibility of neural network approximation of unknown system functions is guaranteed over practical compact sets. It is proved that all the signals are semiglobal uniformly ultimate bounded and the connections between the tracking error and the controller parameters are analyzed in detail. Simulation and practical experiment results are given to show that the proposed controller is practically effective when tracking the time-varying signals.

Keywords: Adaptive control, neural networks, time delays, 3-DOF Helicopters

1. Introduction

Recently, the small-sized aerospace vehicle is widely used due to its portability and low cost. The first unmanned aerial vehicles (UAVs) was born in the 1920s for warfare. Initially UAVs was merely used as unrecoverable bomb. With the development of technology, the performance of UAVs boosts [1]. The ap-

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