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Self Recurrent Wavelet Neural Network Based Direct Adaptive Backstepping Control for a Class of Uncertain Non-Affine Nonlinear Systems

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Abstract: This paper proposes an adaptive backstepping control strategy for a class of uncertain non affine systems using self recurrent neural networks. To assure the stable tracking of nonlinear non affine system, it is first converted to an affine like form and subsequently a wavelet based adaptive backstepping controller is developed. Self recurrent wavelet neural network (SRWNN) is used to approximate the uncertainties present in the system as well as to compensate the highly dynamic nonlinearities inserted by these uncertainties in the control terms. In addition robust control terms are also designed to attenuate the approximation error due to SRWNN. Based on the Lyapunov theory, the online adaptation laws and stability of the closed loop system are verified. A numerical example is provided to verify the effectiveness of theoretical development.

Keywords: *non-affine systems; self recurrent wavelet networks; backstepping control; adaptive control; Lyapunov analysis.*

Mathematics Subject Classification (2000): 49J35, 34A34, 92C20.

1 Introduction

Over last few years, several efforts on the development of adaptive control strategies for uncertain nonlinear systems have been cited in the literature. In these cases the common assumption was that the system is affine in input [1, 2]. However the development of control strategies is still an active area of research.

To deal with the non affine systems, two control strategies are cited in the literature. One is based on the dynamic inversion satisfying the assumptions of Tikhonov theorem

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