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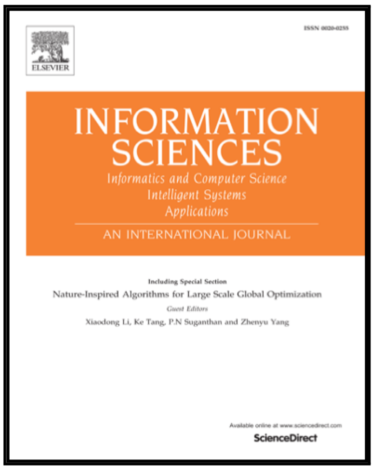

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Adaptive Neural Network-Based Visual Servoing Control for Manipulator With Unknown Output Nonlinearities

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Abstract

In this paper, the problem of neural network control for visual servoing robotic system is addressed, where the unmodeled dynamics and output nonlinearity are taken into account simultaneously. An adaptive neural network module is constructed to approach the unknown dynamics, upon which, the robot dynamics are not required to be linearly decomposable and structurally known. The major superiority of this module lies in its conciseness and the computational-reduction operation. Moreover, the output nonlinearity is considered, and its undesirable effect is subsequently tackled without a prior knowledge of the model parameters in output mechanism. It is proven by the Lyapunov method that the image-space tracking error is driven to an adjustable neighborhood of origin. Numerical simulations and experiments under various situations are used to validate the performance of the proposed adaptive neural network based scheme.

Keywords: Neural network-based control, adaptive control, unknown output nonlinearities, robotic manipulator, unknown dynamics

1. Introduction

Visual servoing(VS) robotic systems have many potential applications such as industry, agriculture, military and life service field due to its high accuracy of accomplishing sophisticated tasks, see, e.g., [1, 39, 20, 36, 37, 38, 26, 35, 45, 41]. Via exploiting the *linearity-in-parameters* feature, the recent studies in [20, 39, 36, 37, 38] systematically investigated image-based visual servoing(IBVS) controllers for performing adaptive tracking/regulation tasks under eye-to-hand(ETH) [39, 36, 37] and eye-in-hand(EIH) configurations [38]. However, the *linearity-in-parameters* condition assumes that the exact knowledge of the physical robot-architecture can be

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