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REAL-TIME DECENTRALIZED NEURAL BACKSTEPPING CONTROL: APPLICATION TO A TWO DOF ROBOT MANIPULATOR

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Abstract. *This paper presents a discrete-time decentralized control scheme for trajectory tracking of a two degrees of freedom (DOF) robot manipulator. A high order neural network (HONN) is used to approximate a decentralized control law designed by the backstepping technique as applied to a block strict feedback form (BSFF). The neural network learning is performed on-line by Kalman filtering. The controllers are designed for each joint using only local angular position and velocity measurements. These simple local joint controllers allow trajectory tracking with reduced computations. The proposed scheme is implemented in real-time to control a two DOF robot manipulator.*
Keywords: Decentralized control, High-order neural networks, Extended Kalman filter, Backstepping

1. **Introduction.** Recently, control of robot manipulators has become a significant research area for different applications due to the relevancy that they have acquired in performing tasks classified as dangerous, or which require higher accuracy.

In this context, different control schemes have been proposed to guarantee efficient trajectory tracking and stability [1,2]. Fast advances in computational technology offer different possibilities for implementing control algorithms within the approach of a centralized control design [3]. However, there is a great challenge to obtain an efficient control for these systems, due to their highly nonlinear complex dynamics, with strong interconnections, parameters difficult to be measured and unmodeled dynamics. Considering only the most important terms on the mathematical model, control algorithms with great number of mathematical operations are required, which affect real-time implementation feasibility.

In [4], the authors presented a control approach based on open-loop optimization using a genealogical decision tree (GDT), which can be used for solving both tracking and regulation. A novel task-space robust control approach with suitable tracking performance under imperfect transformation was presented in [5]; the proposed control law is