Higher-Order Neural Network Based Root-Solving Controller For Adaptive Tracking Of Stable Nonlinear Plants

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Summary

The use of Intelligent control schemes in Nonlinear Model Based Control (NMBC) has gained widespread popularity. Neural Networks, in particular, have been used extensively to model the dynamics of nonlinear plants. However, in most cases, these models do not lend themselves to easy maneuvering for controller design. Therefore, a common need is being felt to develop intelligent control strategies that lead to computationally simple control laws. To achieve this objective, the present study combines the approximation power of Higher-Order Neural Networks (HONN) with the control-oriented nature of the recently developed U-model. By introducing the U-model equivalence of a Higher-Order Neural Unit (HONU), the control law synthesis part is reduced to a simple polynomial root-solving procedure. The proposed scheme is based on the robust Internal Model Control (IMC) structure and is suitable for stable nonlinear plants with uncertain dynamics. The main feature of the proposed structure is its ability to capture higher-order nonlinear properties of the input pattern space while allowing the synthesis of a simple control law. The scheme is therefore expected to prove extremely useful in the area of nonlinear adaptive control. The effectiveness of the proposed scheme is demonstrated through application to various nonlinear models.