

Title: Wavelet neural network-based narma-l2 internal model control utilizing micro-artificial immune techniques to control nonlinear systems

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Abstract: This paper presents an intelligent control strategy based on internal model control (IMC) to control nonlinear systems. In particular, a wavelet neural network (WNN)-based nonlinear autoregressive moving average (NARMA-L2) network is used to acquire the forward dynamics of the controlled system. Subsequently, the control law can be directly derived. In this approach, a single NARMA-L2 with only one training phase is required. Hence, unlike other related works, this design approach does not require an additional training phase to find the model inversion. In the literature, gradient descent methods are the most widely applied training techniques for the neural network-based IMC. However, these methods are characterized by the slow convergence speed and the tendency to get trapped at local minima. To avoid these limitations, the newly developed modified micro-artificial immune system (modified Micro-AIS) is employed in this work to train the NARMA-L2. The simulation results have demonstrated the effectiveness of the proposed approach in terms of accurate control and robustness against external disturbances. In addition, a comparative study has shown the superiority of the WNN over the multilayer perceptron and the radial basis function based IMC. Moreover, compared with the genetic algorithm, the modified Micro-AIS has achieved better results as the training method in the IMC structure.