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RESEARCH PAPERS

基于小波网络的非线性动态过程建模和在环氧氯丙烷生产过程中的应用

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摘要 A type of wavelet neural network, in which the scale function is adopted only, is proposed in this paper for non-linear dynamic process modelling. Its network size is decreased significantly and the weight coefficients can be estimated by a linear algorithm. The wavelet neural network holds some advantages superior to other types of neural networks. First, its network structure is easy to specify based on its theoretical analysis and intuition. Secondly,network training does not rely on stochastic gradient type techniques and avoids the problem of poor convergence or undesirable local minima. The excellent statistic properties of the weight parameter estimations can be proven here. Both theoretical analysis and simulation study show that the identification method is robust and reliable.Furthermore, a hybrid network structure incorporating first-principle knowledge and wavelet network is developed to solve a commonly existing problem in chemical production processes. Applications of the hybrid network to a practical production process demonstrates that model generalisation capability is significantly improved.

关键词 wavelet neural network non-linear system identification hybrid neural network

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Non-linear Chemical Process Modelling and Application in Epichlorhydrine Production Plant Using Wavelet Networks

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Abstract A type of wavelet neural network, in which the scale function is adopted only, is proposed in this paper for non-linear dynamic process modelling. Its network size is decreased significantly and the weight coefficients can be estimated by a linear algorithm. The wavelet neural network holds some advantages superior to other types of neural networks. First, its network structure is easy to specify based on its theoretical analysis and intuition. Secondly,network training does not rely on stochastic gradient type techniques and avoids the problem of poor convergence or undesirable local minima. The excellent statistic properties of the weight parameter estimations can be proven here. Both theoretical analysis and simulation study show that the identification method is robust and reliable.Furthermore, a hybrid network structure incorporating first-principle knowledge and wavelet network is developed to solve a commonly existing problem in chemical production processes. Applications of the hybrid network to a practical production process demonstrates that model generalisation capability is significantly improved.

Key words wavelet; neural network; non-linear system identification; hybrid neural network

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