ABSTRACT

On Adaptive Radial Basis Function Neural Networks for the
Forecasting of Time Series Processes. (December 1994)
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A feedforward neural model, the radial basis functions (RBF) network, was utilized to forecast process parameter values from a time series process. To demonstrate the forecasting capability, a predictive modeling system for the kappa number associated with a paper pulping manufacturing process was constructed by using RBF network (Chapter II). In the construction of the RBF network, two problems were found. First, the determination of the width of the kernel function during the training in the output layer has not been addressed completely yet. Also, the optimal design parameters, such as the number of neurons in the hidden layer and the initial values of the learning rate for connection weights, were not known. Because of these existing problems, the maximum prediction accuracy for the RBF network is hardly achieved. To overcome this difficulty, two simple approaches, the radius-modification (RM) and response surface methodology (RSM), are introduced (Chapter III and IV).

Furthermore, the decreased forecasting precision problem caused by the unknown optimal design parameters also exists in the other widely used feedforward neural model, the multi-layer perceptron (MLP) network. To solve this problem, RSM approach is applied in Chapter V to determine the optimal neural network setup. The results indicate that the adaptive neural network model using the proposed RM or RSM technique was

able to identify patterns from the manufacturing process data sets and to make precise predictions of future values of time series processes.