

# A Study of PID Controller Design Based on Artificial Neural Network

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## ABSTRACT

This research is based on the applications of neural network, including function approximation and parameter tuning of PID controller. This research first focuses the application of backpropagation neural network on the function approximation. The learning rules including steepest descent method, steepest descent with momentum method, resilient backpropagation, conjugate gradient method, BFGS quasi-Newton method and Levenberg-Marquardt method are employed to investigate the capability of function approximation. However, convergence and mean square error (MSE) are also carefully compared when they are used to train the neural network. In addition, the effects of neuron number in the hidden layer on the function approximation are also studied. This research also applies the neural network to the off-line parameter tuning of PID controller. The error output and tracing signals of the control system will be fed to the neural network as its new input and target signals, respectively. Moreover, the neural network can calculate the parameters of PID controller based on the input and target information. The parameters of PID controller, i.e.,  $K_p$ ,  $K_i$  and  $K_d$ , are tuned repeatedly based on the error output of control system until MSE

Keywords : Backpropagation neural network, function approximation, self-tuning PID controller

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