Applications of an On-line Learning Neuro-Controller to Process Control

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ABSTRACT

A back-propagation (BP) neural network is a multi-layer feed- forwardneural network. The BP is typical and most frequently used in currentlearning models. An on-line learning neural network controller based on aback-propagation neural network has been used in this simulation. Thiscontroller can breakthrough the bottleneck of a traditionalneuro-controller, which can learn on-line and take a control action at thesame time. Furthermore, the controller can merge the learning process with areal control, eliminating the need to training it before use. The weights ofa neural network are obtained from a random number generator. Thus, settingweights is not a problem. In this study, the on-line learning neural network controller has beenapplied to a CSTR system. The effect of learning rates on controllability ofan on-line learning neuro-controller has been studied in this simulation.The computer simulation of a CSTR system with two control loops has beencarried out. The interaction between the two loops is also discussed.Simulation results show that the neuro-controller with fixed learning ratescannot control the CSTR at satisfactory standers. Therefore, a linearexpansion method and Newton likely method are then used to obtain optimal,dynamic learning rates. Simulation results show that good controlperformance is obtained if an on-line learning neuro-controllers combinedwith optimal, dynamic learning rates. A neural network needs to be trained before use. Training a neuralnetwork takes a lot of time, and therefore limits the application of theneural network. If a neural network can take training and perform a controlaction at the same time, then the application of a neural network becomesmore convenient. Today''''s personal computers have improved calculationability, which can be used to train neuro-controllers to predict a nearfuture process state. This ability is very important to a real-timesimulation. Actually, the neuro- controllers play two roles, includingfeed-froward (prediction) and feed-back (control).

Keywords : 神經網路 ; 程序控制 ; 最佳動態學習速率 ; 線上學習神經控制器

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