The Application of Neural Networks to Process Control

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ABSTRACT

More often than not many controllers are required to manipulate a chemicalplant smoothly. To tune a traditional PID controller is difficult, sincethree parameters, K_c, τ_I and τ_D, are interacted each other. In the past,experience still plays an important role for an appropriate tuning of a PIDcontroller.In this study, an on-line learning neural controller is proposed to replace atraditional PID controller. This neural controller needs only a start-uptraining datum, and uses an optimal dynamic learning rate to accelerate thesearch of the minimum of the error function. This controller may choose amoving-window learning rule to train the neural network on-line. In thismode of training, the previous output from the neural controller is used asone of the training data for the next output. In general, a neural controllerrequires a huge amount of data to train the network before it can functionproperly.Here, the on- line learning neural controller has been used to regulate theflux ratio of an activated sludge aerator in a wastewater treatment plant.When it encounters many disturbances such as a sudden change of feedconcentration, set point change, ..., etc., the on-line learning neuralcontroller also can make a correct decision to make the system back to the setpoint. The on-line learning control also has the characteristics of anadaptive control for an unsteady and non-linear system. Several examples showthe superiority of this on-line learning neural controller.

Keywords : Neural Networks ; On-line Learning Neural Controller ; Moving Window Learning Rule ; Optimal Dynamic Learning Rate

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