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SINGLE NEURON PREDICTIVE PID CONTROL

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Abstract. A single neuron controller based on predictive control is designed combining a single neuron with prediction model feedback correction mechanism to build an increment proportion integral differential (PID) controller and decrease the control signal delay. The weights and gain of the proposed controller are self-adjusted on-line to improve the control performance, and the future error signals are utilized to minimize control signal delay. Simulation studies on second order and third order non-minimum phase delay systems and a blending process, have verified its excellent learning capability, simplicity and robustness.

Keywords. Neuron controller, non-minimum phase delay system, predictive control, increment PID, self-adjusting.

1 Introduction

PID controllers are widely used in industrial process control because of their functional simplicity, which allows process engineers to operate them in a simple and straightforward manner. According to the survey of [1], more than 84% of the control loops were of the PID type, if its modified forms were included, the proportion was up to 90%. However, traditional PID controllers cannot obtain satisfactory control performance for the process with long time-delay and under different conditions [2].

Predictive Control (PC) is one of the most successful control strategies for long time-delay process, because there exist three basic characteristics: prediction model, moving horizon and feedback correction [3]. Since the predictive PID controller was proposed by Hagglund [4], it has been improved gradually and successfully applied in controlling some complicated systems. Combining the simplicity, practicability and robustness of PID controller with characteristics of PC, the predictive PID control algorithm possessed the virtues of above two algorithms, and its control performance was improved greatly. Recently, many researchers put forward various predictive PID controllers to improve their control performance and practicability. Kateb [5] developed a predictive PID controller with similar features to the model-based