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DESIGN OF A PERFORMANCE-ADAPTIVE PID CONTROLLER WITH A MODEL PREDICTION STRUCTURE

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Abstract. *PID controllers have been widely used for a number of process control systems represented by chemical processes. Recently, productivity improvement and cost reduction initiatives have created a demand for PID controllers that can retain a desirable performance over time in steady-state operation in spite of changes in the system properties. In this paper, a new design of a performance-adaptive PID controller with model prediction structure is proposed, which automatically adjusts the user-specified parameter within the GPC-PID controller based on the control performance assessment. According to the proposed algorithm, the PID controller is re-tuned in order to obtain desirable system performance only if the practical performance indices to assess the control loop exceed user-defined regions. The effectiveness of the proposed control scheme is evaluated by computer simulation examples.*
Keywords: PID control, Control performance assessment, Generalized predictive control

1. **Introduction.** With the rapid progress of computer technology, relatively complicated control algorithms [1, 2, 3] are easily employed in existing systems. For various process control systems such as refinery processes and chemical processes, PID controllers have been very widely used due to the fact that the controller structure is so plain and simple[4]. Recently, though, because of the rapid progress in computer technology and/or the influence of system nonlinearity, high control technologies such as Generalized Predictive Control (GPC) law[5] have begun to be applied mainly in process industries. Research focusing on GPC-based PID (GPC-PID) controllers concerned with self-tuning[6] and auto-tuning[7] have been proposed. Although control performance is greatly affect by the user-specified parameters contained in GPC law, the method of adjusting those parameters has been less researched. Until now, the parameters with desirable performance have been decided after repeated trial and error.

On the other hand, from the viewpoint of both productivity improvement and cost reduction, control performance assessment (CPA) has been widely studied[8, 9, 10] in which the performance of the control loop in steady-state is assessed and monitored regularly