International Journal of Innovative Computing, Information and Control
Volume **6**, Number **8**, August **2010**

 ISSN 1349-4198
pp. 3751–3762

SELF-TUNING PID CONTROLLER BASED ON CONTROL PERFORMANCE EVALUATIONS

Makoto Tokuda[1] and Toru Yamamoto[2]

[1]Department of Information Engineering
Yuge National College of Maritime Technology
1000 Shimo-Yuge, Yuge, Kamijima, Ehime, 794-2593, Japan
tokuda@info.yuge.ac.jp

[2]Department of Technology and Information Education
Graduate School of Education
Hiroshima University
1-1-1 Kagamiyama, Higashi-Hiroshima, Hiroshima, 739-8524, Japan
yama@hiroshima-u.ac.jp

Received May 2009; revised December 2009

Abstract. *In steady state of process systems, reductions in cost and advances in quality are continuously pursued. Some process systems are considered time-variant systems with system characteristics that change according to the conditions and environments of the system operations. Previously, one of the authors proposed a design scheme of a self-tuning PID control system, in which a user-specified parameter is tuned to maintain two control performances (variance of the control error and variance of the control input difference) based on the modeling performance assessment. As a result, efficient control is expected in the steady state. However, the transient state requires readiness and stability of the control systems. In this paper, the self-tuning control scheme is improved by adding a function to maintain two other control performances (overshoot and rise time) in the transient state. The tuning scheme of PID parameters is switched based on the steady state or the transient state. Finally, the effectiveness of the proposed control scheme is evaluated by simulation examples.*

Keywords: Process control, PID control, Self-tuning control, Generalized minimum variance control, Control performance assessment

1. **Introduction.** In process systems such as chemical plants, evaluations of control performances primarily focus on steady state conditions. On the other hands, system readiness of the transient state generally remains slow in order to avoid continuous fluctuation of system outputs. Also, most process systems are considered time-variant systems, which means the system characteristics change according to variations of the operation environment and/or the components in raw materials. In recent years, many studies on time-variant systems have been actively carried out to maintain or improve control performance [1-9]. Typically, user-specified parameters are automatically adjusted as needed by continual monitoring of the operation data. In most of these studies, control performances of the steady state are assessed.

In the area of process industries, control schemes are in need of improvements in efficiency and performance of system operations because of the economic downturn, escalation of global competition, and so on. To realize this, control performances should be improved by focusing not only on the steady state as before, but also on the transient state. Here, the required control performance depends on the control state. For example, in the transient state, system readiness strongly affects productivity. It is also important