International Journal of Innovative Computing, Information and Control
Volume **5**, Number **11(A)**, November **2009**

ICIC International ©2009 ISSN 1349-4198
pp. 3995–4005

PARAMETER SELF-TUNING BASED INDUSTRIAL BATCHING AND WEIGHTING CONTROL SYSTEM

Bailin Hang[1] and Lianming Sun[2]

[1]Qingdao University of Science and Technology
Qingdao, Shandong Province, P. R. China
hangbl@mesnac.com

[2]Department of Information and Media Engineering
Faculty of Environmental Engineering
The University of Kitakyushu
1-1 Hibikino, Wakamatsu-ku, Kitakyushu 808-0135, Japan
sun@env.kitakyu-u.ac.jp

Received September 2008; revised January 2009

Abstract. *Batching and weighting of chemical material is an intermittent process in a severe changing of industrial environment, and is difficult to be controlled by conventional control methods. In this work, a new mathematical reference model for controller parameter tuning and the parameter self-tuning approach are proposed, and a cascade control system is developed where the parameters are tuned automatically. The proposed system is operated easily, works well under various conditions, and improves the system performance significantly. It is shown that the proposed scheme can offer effective adaptive control techniques for the practical batching and weighting applications.*
Keywords: Parameter self-tuning, Batching and weighting process, Intermittent plant

1. **Introduction.** In many chemical plants, multi-variety materials are used in chemical production, and the batching processes regulate the quantity of every material to satisfy the technical requirement through electromagnetic equipment. Some essential materials are only in small quantities, whereas they play fundamental roles in production. Consequently, both the bathing accuracy and response speed will influence the production efficiency and product quality significantly [5, 12].

The control of feeding speed and guarantee of batching accuracy are important issues in the batching system; moreover, the simplicity of operation is expected strongly at the work-site. In the practical applications, however, the batching process has severe nonlinearity, intermittence, time delay and disturbances caused by measurement noise, homogeneity of mass density, humidity and conveying viscosity. Furthermore, the material varieties change with different products or technical requirement frequently, then the characteristics of materials also change in the batching process. As a result, the actual feeding speed of material often fluctuates even though it is regulated by the identical control operation with the same electromagnetic equipment. The circumvention to these problems is required in the practical batching system.

The conventional batching control systems use PLC or PID controller [9, 10] to regulate the material feeding speed. PLC switches the speed between dual levels only, i.e., the quick and slow levels, which are determined by weight measurement of the collected materials logically. The material feeding speed is not fed back into PLC for control directly due to the speed intermittence, so the system almost works in an open loop, where the final batching accuracy is only adjusted through shutting down the material feeding device