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Discussion

Comments on "Synthesis of PID controller for unstable and integrating processes"—Chemical Engineering Science 64 (2009) 2807–2816 ☆

Yin-Ya Li *, Guo-Qing Qi, An-Dong Sheng

School of Automation, Nanjing University of Science and Technology, Nanjing 210014, China

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ABSTRACT

In the above-mentioned paper [Chemical Engineering Science 64 (2009) 2807–2816], the problem of synthesis of PID controller for unstable and integrating processes is considered. Analytical PID controller tuning rules are proposed by a correct approximation function using desired closed-loop response technique. However, we find that there exist some mistakes and misprints in this paper. This note points out the flaw of the commented paper.

Dear Sirs,

We have read the paper by Panda (CES, vol.64, pp. 2807–2816, 2009) with great interest. This present communication is intended to point out some mistakes and misprints in this paper.

In the mentioned paper (Panda, 2009), the author presented the details to illustrate the approach of PID controller tuning rules for unstable and integrating processes, such as first-order dead time unstable process (FODUP), second-order dead time unstable process (SODUP) and second-order dead time unstable process with two unstable poles (SODPTUP). For a FODUP with the transfer function

$$G_P(s)=\frac{K_P e^{-D_P s}}{\tau_P s-1}$$

The PID controller parameters of K_C and τ_D, respectively, should be

$$K_C=\frac{(\gamma+\beta-\tau_P)-\dfrac{\lambda^2+\gamma D_P-D_P^2/2}{2\lambda+D_P-\gamma}}{-K_P(2\lambda+D_P-\gamma)}=\frac{\tau_I}{-K_P(2\lambda+D_P-\gamma)}$$

and

$$\tau_D=\frac{(\beta\gamma-\beta\tau_P-\gamma\tau_P)(2\lambda+D_P-\gamma)-\left(\dfrac{D_P^3}{6}-\dfrac{\gamma D_P^2}{2}\right)-\left(\lambda^2+\gamma D_P-\dfrac{D_P^2}{2}\right)\tau_I}{\tau_I(2\lambda+D_P-\gamma)}$$

The PID controller parameters of K_C and τ_D for SODUP type of process with the transfer function

$$G_P(s)=\frac{K_P e^{-D_P s}}{(\tau_P s-1)(as+1)}$$

respectively, should be

$$K_C=\frac{(-\tau_P+a+\gamma+\beta)-\dfrac{\lambda^2+\gamma D_P-D_P^2/2}{2\lambda+D_P-\gamma}}{-K_P(2\lambda+D_P-\gamma)}=\frac{\tau_I}{-K_P(2\lambda+D_P-\gamma)}$$

and

$$\tau_D=\frac{(2\lambda+D_P-\gamma)[(a+\gamma)(\beta-\tau_P)+a\gamma-\beta\tau_P]-\left(\dfrac{D_P^3}{6}-\dfrac{\gamma D_P^2}{2}\right)-\left(\lambda^2+\gamma D_P-\dfrac{D_P^2}{2}\right)\tau_I}{\tau_I(2\lambda+D_P-\gamma)}$$

For a SODPTUP with the transfer function

$$G_P(s)=\frac{K_P e^{-D_P s}}{(\tau_{P1}s-1)(\tau_{P2}s-1)}$$

The parameters of γ_1 and γ_2 in the filter transfer function

$$F(s)=\frac{\gamma_2 s^2+\gamma_1 s+1}{(\lambda s+1)^4}$$

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* Corresponding author. Tel./fax: +86 25 84315309.
E-mail address: liyinya@mail.njust.edu.cn (Y.-Y. Li).

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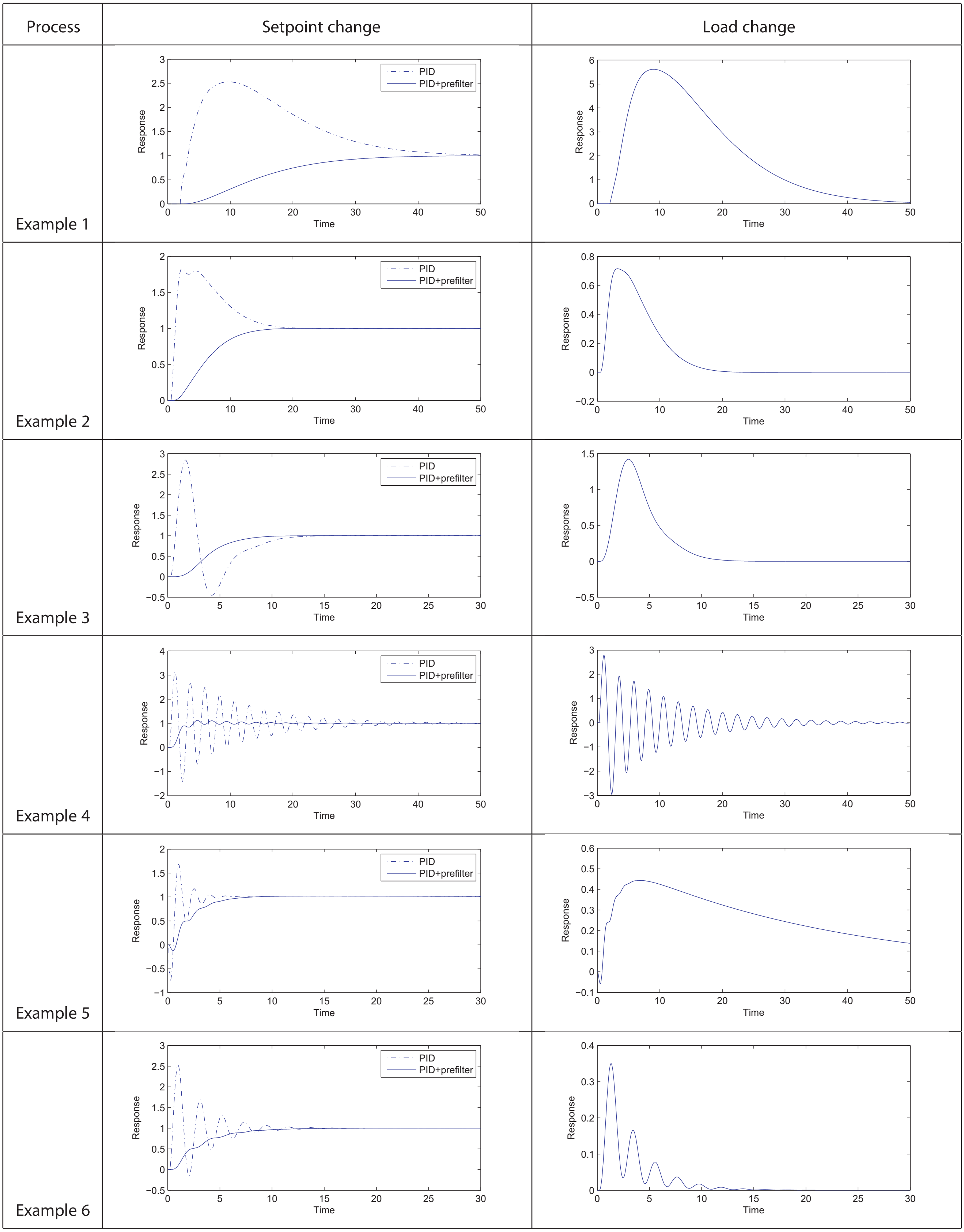

Fig. 1. Closed-loop responses of different open-loop unstable examples.