Transactions of the Institute of Measurement and Control
35(8) 1152

DOI: 10.1177/0142331212466670
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A new control system design for a small hydro-power plant based on particle swarm optimization-fuzzy sliding mode controller with Kalman estimator: a comment

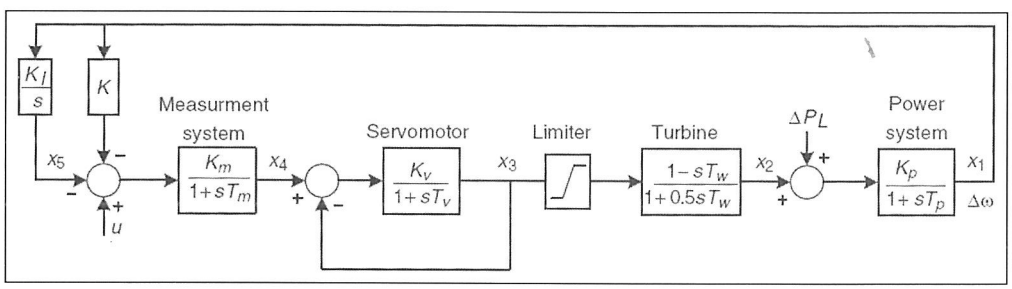

Figure 1. Block diagram of a hydro-power plant in Iran.

Comments

The purpose of this letter is to point out and rectify a mistake in the considered paper. Furthermore, a correct model in the form of a state space equation is addressed for control design. For simplicity, all the symbols in this comment are the same as those in the paper under consideration.

The design of a fuzzy sliding mode controller with a Kalman estimator on the basis of particle swarm optimization has been tackled in Zargari et al. (2012). Zargari and his colleagues showed a block diagram of a hydro-power plant in Iran as in Figure 1 (labelled Figure 3 in the considered paper), and claimed that a series of state equations as in (1) (labelled Equation 7 in the considered paper) are acquired by considering the state variables from the block diagram in Figure 1.

$$\begin{aligned} \dot{x}_1 &= -\frac{1}{T_p}x_1 + \frac{K_p}{T_p}x_2 - \frac{2K_p}{T_p}x_3 - \frac{K_p}{T_p}\Delta P_L \\ \dot{x}_2 &= \frac{2}{T_w}x_2 + \frac{6}{T_w}x_3 \quad \dot{x}_3 = -\frac{(1+K_v)}{T_v}x_3 + \frac{K_v}{T_v}x_4 \\ \dot{x}_4 &= -\frac{1}{T_m}x_4 - \frac{K_m}{T_m}x_5 - \frac{K_m}{T_m R}x_1 + \frac{K_m}{T_m}u \quad \dot{x}_5 = K_I x_1 \end{aligned} \tag{1}$$

In fact, it is not possible to obtain (1) according to Figure 1. A correct expression from Figure 1 in the form of the state equation for control design should be

$$\begin{aligned} \dot{x}_1 &= -\frac{1}{T_p}x_1 + \frac{K_p}{T_p}x_2 + \frac{K_p}{T_p}\Delta P_L \quad \dot{x}_2 = -\frac{2}{T_w}x_2 + 2\left(\frac{1}{T_w} + \frac{1+K_v}{T_v}\right) \\ & x_3 - \frac{2K_v}{T_v}x_4 \quad \dot{x}_3 = -\frac{1+K_v}{T_v}x_3 + \frac{K_v}{T_v}x_4 \\ \dot{x}_4 &= -\frac{1}{T_m}x_4 - \frac{K_m}{T_m}x_5 - \frac{K_m}{RT_m}x_1 + \frac{K_m}{T_m}u \quad \dot{x}_5 = K_I x_1 \end{aligned} \tag{2}$$

Acknowledgements

This work was supported by the NSFC Projects under grant Nos. 60904008, 60975060, the Natural Science Foundation of Hebei Province under grant No. F2012502023, and the Fundamental Research Funds for the Central Universities under grant No. 12TD02.

Reference

Zargari A, Hooshmand R and Ataei M (2012) A new control system design for a small hydro-power plant based on particle swarm optimization fuzzy sliding mode controller with Kalman estimator. *Transactions of the Institute of Measurement and Control* 34(4): 388–400.

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