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# DESIGN OF A SLIDING MODE CONTROLLER FOR A WATER TANK LIQUID LEVEL CONTROL SYSTEM

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Abstract. *In this paper, a new sliding mode control scheme based on the sliding surface design is proposed to improve the tracking performance of a water tank liquid level control system, which can be found in many industrial works. The key feature of this control scheme is the introduction of extra adjustable free parameters into the design of sliding surface so that a new sliding mode controller can be constructed to improve the tracking performance. The validity of the proposed control scheme is verified by means of a practical testing on an experimental liquid level control device. For the cases of single-step, multi-step, and sinusoidal level position command inputs, the experimental results strongly suggest that the proposed control scheme is capable of improving the tracking precision effectively. In addition, the new control scheme seems to be very robust against various set point conditions.*

**Keywords:** Sliding mode control, Sliding surface, Liquid level control system

1. **Introduction.** Owing to the requirement of industrial manufacturing processes, the liquid tank level control system is applied to many processing fields. For example, the raw materials stock of chemical works [1], the mixture raw materials of lithification process [1], the mould casting process [2,3], and the steam generator of nuclear power plants [4,5] etc., involve liquid level control to a certain extent. Conventionally, the linear PID control schemes are employed to have control of the liquid level for a number of liquid tank systems. However, as regards the high-precision control, it is insufficient to use linear PID controllers. Typically, there are some challenges in the design of liquid tank level control systems such as system parameter variations, and the inherent highly nonlinear relationship between the flow resistance and the flow-level [1-5]. Therefore, it is believed to be difficult, if not impossible, to perform a high-precision servo control by using linear control methods. To reach a better performance and good tracking precision in the presence of system nonlinearities and parameter uncertainties, various control strategies have been proposed in literature. For instance, Dussud et al. [2] and Na [5] design fuzzy logic controllers for the casting model level and the nuclear steam water level control systems, repectively. Irving and Bihoreaux [9] design an adaptive controller for the P.W.R. steam generator water level control; Bedi et al. [3] and Zhong et al. [16] design sliding mode control schemes in casting process and uncertain stochastic systems, respectively. Kim [4] and Tani et al. [7] design neural-fuzzy hybrid control strategies to the nuclear steam water level and the tank level control problems, respectively. Fan et al. [6] and