Joint design of alarm deadbands and delay timers to reduce the number of nuisance alarms

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Abstract. Alarm deadbands and delay timers are widely used in practice to reduce the number of nuisance alarms. This paper proposes a method to jointly design alarm deadbands and delay timers that are connected in a serial or parallel manner. Serial and parallel alarm systems are effective for removing nuisance alarms with different types of nuisance alarms, while alarm deadbands or delay timers alone are suitable only for one type of false alarms. The principle idea is that nuisance alarms with alarm deviations or alarm durations less than a certain threshold can be effectively removed by an alarm deadband or a delay timer. A minimization problem is formulated to design optimal values of the alarm deadband width and delay timer factor. Bayesian estimation approach is exploited to achieve reliable estimates of joint probabilities of alarm deviations and alarm durations. Existing methods are limited to the design of either alarm deadbands or delay timers based on probability density functions of process variables, and to a restrictive assumption that process variables are independent and identically distributed. The proposed method is for the joint design of serially/parallelly-connected alarm deadbands and delay timers; it is based on joint probabilities of alarm deviations and alarm durations, and does not require the restrictive assumption. Numerical and industrial examples are presented to illustrate the proposed method and compare with existing ones.

Keywords: Industrial alarm systems, Nuisance alarms, Alarm deadbands, Delay timers