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A FAULT DETECTION SYSTEM FOR AN AUTOCORRELATED PROCESS USING SPC/EPC/ANN AND SPC/EPC/SVM SCHEMES

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Abstract. *The statistical process control (SPC) chart is effective in detecting process faults. One important assumption for using the traditional SPC charts requires that the plotted observations are independent to each other. However, the assumption of independent observations is not typically applicable in practice. When the observations are autocorrelated, the false alarms are increased, and these improper signals can result in a misinterpretation. Therefore, the use of engineering process control (EPC) has been proposed to overcome this difficulty. Although EPC is able to compensate for the effects of faults, it decreases the monitoring capability of SPC. This study proposes the combination of SPC, EPC and artificial neural network (SPC/EPC/ANN) and SPC, EPC and support vector machine (SPC/EPC/SVM) mechanisms to solve this problem. Using the proposed schemes, this study introduces a useful technique to detect the starting time of process faults based on the execution of the binomial random experiments. The effectiveness and the beneficial results of the proposed schemes are demonstrated through the use of series simulations.*

Keywords: Fault detection, SPC, EPC, Artificial neural networks, Support vector machine

1. **Introduction.** Statistical process control (SPC) charts have been continuously developed and implemented in practice for more than 80 years. The primary function of SPC charts is to detect the presence of faults as soon as they intrude in the process. One important assumption for using the traditional SPC charts requires that the monitored observations are independent from each other. Otherwise, the false alarms are increased, and these improper signals result in misinterpretation and decrease capability of SPC charts.

However, autocorrelation commonly exists in real-life processes. The typical reasons include a shorter sampling interval, higher frequency of sampling time (i.e., they may be due to the use of automatic measuring systems or sensors), or the dynamic response time of the chemical materials. Consequently, autocorrelation occurs most frequently in the continuous and chemical processes [1-4]. The process personnel need to pay more attention while using traditional SPC charts on those autocorrelated processes.