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RE-EVALUATION OF ADAPTIVE $\bar{X}$ CONTROL CHARTS: A COST-EFFECTIVENESS PERSPECTIVE

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Abstract. *Studies have considerably improved the statistical performance of the $\bar{X}$ control charts by varying the design parameters as a function of the data from the process. These design parameters include the sample size, length of sampling interval and control/warning limits of a control chart. Studies compare adaptive charts with standard $\bar{X}$ charts in terms of cost-effectiveness, where the former outperforms the latter. Traditionally, researchers analyze cost-effectiveness for certain input process/cost parameters, and the sensitivity to the input parameters examines each factor in turn. This analysis is requires little effort, however, its results depend on the initial input parameters. Therefore, to achieve an objective analysis, this paper develops a statistical procedure combining experimental design, regression analysis and covariance analysis to facilitate cost-effectiveness analysis better. This study presents a numerical example to demonstrate the use of this new approach in the cost-effectiveness analysis of adaptive charts.*
Keywords: Adaptive control chart, Economic design, Cost-effectiveness analysis, Genetic algorithms

1. **Introduction.** Industries use control charts to observe whether a process is in control. When there is one quality characteristic to control, process disturbances are typically monitored with Shewhart control charts [1]. The advantage of Shewhart charts is their simplicity, however, they may take a long time to detect small disturbances. Thus, researchers have proposed alternatives, such as the Shewhart control chart with supplementary run rules [2], EWMA charts [3] and CUSUM charts [4,5] to improve the performance of Shewhart charts.

Recently, adaptive sampling schemes that allow one, two or all of the three design parameters (i.e., sample size, sampling interval, coefficients of control limits) to be variable during production are applied to the standard Shewhart (SS) chart to improve the average time to detect small mean shifts. This chart with adaptive sampling schemes is referred to as an adaptive chart. Several studies have examined adaptive sampling schemes, including the variable sampling interval (VSI) [6-8], variable sample size (VSS) [9,10], variable sample size and sampling interval (VSSI) [11-13] and variable parameter (VP) [14,15].