A Statistical Evaluation of Variance Estimation and Subgrouping in XBAR Control Charts

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Abstract

A statistical evaluation is provided for the estimation of unknown process standard deviation in XBAR control charts. Eight different biased and unbiased estimators, with and without subgrouping, based on the in-control sample standard deviation, sample variance and sample range are considered. The comparison is based on the degree of achieving a probability of false alarm comparable to that obtained in the known standard deviation case. It is shown that a simple modification in the charts, which includes the effect of uncertainty in the estimation of process mean, improves their efficiency significantly. The most successful estimator is shown to be the unbiased sample standard deviation without subgrouping. In most cases, subgrouping decreases the efficiency of estimation.

Keywords
Statistical Process Control, Control Charts, Variance Estimation, Subgrouping