Introduction of Robust Multivariate Process Capability Indices

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Abstract : Process capability indices (PCIs) are important concepts of statistical quality control and measure the capability of processes and how much processes are meeting certain specifications. An important issue in statistical quality control is parameter estimation. Under the assumption of multivariate normality, the distribution parameters, mean vector and variance-covariance matrix must be estimated, when they are unknown. Classic estimation methods like method of moment estimation (MME) or maximum likelihood estimation (MLE) makes good estimation of the population parameters when data are not contaminated. But when outliers exist in the data, MME and MLE make weak estimators of the population parameters. So we need some estimators which have good estimation in the presence of outliers. In this work robust M-estimators for estimating these parameters are used and based on robust parameter estimators, robust process capability indices are introduced. The performances of these robust estimators in the presence of outliers and their effects on process capability indices are evaluated by real and simulated multivariate data. The results indicate that the proposed robust capability indices perform much better than the existing process capability indices.

Keywords : multivariate process capability indices, robust M-estimator, outlier, multivariate quality control, statistical quality control

Conference Title : ICIEA 2018 : International Conference on Industrial Engineering and Applications

Conference Location : Paris, France

Conference Dates : April 19-20, 2018