On the reliability of Shewhart-type control charts for multivariate process variability

ABSTRACT

We show that in the current practice of multivariate process variability monitoring, the reliability of Shewhart-type control charts cannot be measured except when the sub-group size n tends to infinity. However, the requirement of large n is meaningless not only in manufacturing industry where n is small but also in service industry where n is moderate. In this paper, we introduce a new definition of control limits in the two most appreciated control charts in the literature, i.e., the improved generalized variance chart (IGV-chart) and vector variance chart (VV-chart). With the new definition of control limits, the reliability of the control charts can be determined. Some important properties of new control limits will be derived and the computational technique of probability of false alarm will be delivered.