

## Multivariate Control Charts for Monitoring Process Variability

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The problem under consideration is constructing multivariate control charts for detecting changes in multivariate process variability as characterized by the covariance matrix of the process. I will discuss some of the developments in the last 15 years with a focus on multivariate normal processes.

There are three important considerations based on which a control chart is constructed. The first consideration deals with the methodology the control chart uses for combining sampled information. Three such methodologies are Shewhart, CUSUM and EWMA based statistics. The second consideration is the amount of data that are available for constructing the control chart. Three such possibilities exist: (i) the subgroup size ( $n$ ) is larger than the total number ( $p$ ) of quality characteristics of interest; (ii) only individual observations ( $n = 1$ ) are available; and (iii)  $1 < n < p$ . The third consideration relates to the types of changes in the covariance matrix the control chart is designed to detect. It could be changes in the generalized variance (the determinant), or in the total variation (the trace) of the covariance matrix, or in some of the  $p(p + 1)/2$  parameters of the covariance matrix. Examining existing works through these considerations allows us to have a better understanding of what has been accomplished so far and provides a clearer picture of what lies ahead.

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