

An Investigation of Some Characteristics of Univariate and Multivariate Control Charts

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Abstract

Control charts are a valuable tool of Statistical Process Control. These charts give a graphical representation of any process. Their wide use and popularity is a result of many reasons. First of all, control charts provide a useful tool for monitoring a process thus helping in keeping it under control. They can also be used as a measure for improving productivity, by reducing scrap and rework. Their effective prevention of defect items results in a decrease in cost. Finally, the diagnostic information contained in control charts is of significance as it allows for changes in the process by experienced operators or engineers.

This thesis aims at investigating some of the characteristics of control charts such as the effect of estimation, of non-normality, of the presence of a signal in a multivariate chart and of measurement error. In particular, following a review of the most known and commonly used univariate and multivariate control charts, the effect of estimation on control charts is investigated and some new results on its impact on univariate control charts for dispersion are obtained. A second problem considered is the issue of non-normality in control charts. New results are given in the case of the EWMA control charts for process dispersion under the presence of non-normality. The interpretation of a signal on a multivariate control chart is also examined. A new proposal for a chart that addresses this problem is given that is shown to lead to promising results. Furthermore, the implication of a measurement error on control charts is studied. Its effect is examined thoroughly in the EWMA case under the assumption of a specific model. Finally, some thoughts and discussion for possible future research and generalizations are given, for the issues that have been addressed in this thesis.