

MULTIVARIATE METHODS TO MONITOR SHORT RUN COMPLEX PROCESSES

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Abstract

Consider a manufacturing process that should produce short production runs of complex parts. For instance, we may have to produce only few units of a given part, and then reset the process (machine) for a different part, and so on. In this case it will be difficult to gather the data necessary to implement traditional Multivariate SPC techniques. Therefore special multivariate control charts that combine data from several short runs into a single analysis will be necessary.

The paper deals with this problem and the influence function is proposed to build up multivariate control charts to monitor short run complex processes. To monitor the process mean the influence function of mean is proposed, to investigate process variability control charts based on the influence functions of eigenvalues are suggested, and to describe process orientation control charts based on the influence functions of eigenvectors may be employed.

To define the operating level for all runs we assume that the manufacturing process is influenced by a common set of causes, regardless of the run.

Then in order to use a single control chart for all runs we standardize each observation based on the properties of its run. Moreover, in the case that the quality vectors of each run have not the same dimensions, it is also necessary to standardize the control limits.

The proposed techniques are general, and the influence functions may be used to build up short runs multivariate control charts for different process parameters and for the both stages of the manufacturing process.

The proposed methods will be illustrated with real applications from short run complex manufacturing systems.