ABSTRACT

The use of statistical quality control has increased rapidly in recent years due to stiff competition and consumer awareness about the market. Now, the consumers look for more than one quality characteristics in the products. Therefore, the overall quality of a product is usually determined by several quality characteristics. In a production process, several correlated quality characteristics are to be simultaneously monitored. This is referred as Multivariate Statistical Process Control (MSPC) method. A *good* MSPC chart should have three important properties, namely, (i) control of overall type-I error α, (ii) easy identification of errant variable(s), and (iii) easy quantification of the change in the mean of the variables. Along with these properties, the chart should be sensitive to any change in the quality levels and should operate at minimum quality cost.

A new MSPC chart is developed with EWMA setting, which is named as Mx-EWMA chart. It is designed to satisfy all the required properties of a *good* MSPC chart including better ARL performance and also meeting the minimum quality cost requirement. The optimal selection procedure is studied to determine the EWMA smoothing constant r, based on the minimum out-of-control ARL.

One of the major problems that arise in using a multivariate quality control chart is the interpretation of the out-of-control signal and detection of errant quality variable. The reliability of detection of errant variable is found to be improving as the EWMA constant decreases.

Economic design of MxEWMA chart based on Duncan model and Knappenberger and Grandage model are studied. It is observed that the optimal cost is not effected by the direction of shift and the correlation matrix. The magnitude of the shift effects the cost most significantly. Other significant factors are the fixed cost of sampling, the cost of searching for assignable causes, the penalty cost of producing defective items, and the occurrence rates of assignable causes. Statistically constrained economic design of MxEWMA chart is suggested for use in industry for better ARL performance than pure economic design.

An application of the proposed control scheme to a continuous casting plant is studied. Five important elements in the chemical composition of the casting are monitored with this chart. The chart is able to detect the shift in the process mean.