EWMA Control Charts for monitoring finite horizon processes

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Abstract

In manufacturing systems characterized by high degree of flexibility and a variety of produced items, the resource capacity is usually scheduled to manufacture small production runs. In these industrial scenarios, the production horizon of the same part code between two consecutive set-ups should be limited to a few hours or shifts.

Managing on-line quality monitoring in companies implementing lean production and Just in Time management principles is a challenging issue: processes should be frequently reconfigured to manufacture different part codes and maintain small inventory levels. When 100% sampling is not possible, on-line quality monitoring on a quality characteristic should be immediately started by means of a control chart.

Exponentially weighted moving average, ($EWMA$), control charts are an alternative to Shewhart control charts and are particularly effective in detecting small persistent processes shifts. The control limits of an $EWMA$ control chart should vary with time, approaching asymptotic values as time goes on.

In this study, we investigate the statistical performance of $EWMA$ control charts for monitoring the location of a quality characteristic in a production process with a finite horizon and a small number of scheduled inspections. An extensive numerical investigation is carried out to get the statistical performance of both the $EWMA$ t control chart for normal observations and the distribution-free $EWMA$ Sign (SN) control chart. The property to have varying control limits at each inspection allows these $EWMA$ control charts to be very sensitive to shifts in the location. A non-homogeneous Markov chain model is used to evaluate the statistical properties of the $EWMA$ control charts with varying control limits. An illustrative example shows the implementation of the $EWMA$ SN control chart on a real data set collected in a beverage company.