

An economic design of combined double sampling and variable sample size $\bar{X}$ control chart

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Abstract

In recent years several studies have shown that $\bar{X}$ control charts with adaptive schemes or double sampling plans detect both small and moderate shifts in the process mean more quickly than the traditional Shewhart $\bar{X}$ chart. In the classical double sampling $\bar{X}$ chart, the difference between two points were placed in the central region of first stage was not considered. In this study, a new control chart is proposed by combination of double sampling $\bar{X}$ chart and variable sample size $\bar{X}$ chart (called DSVSS chart), that can successfully reduce the detection time of small mean shift. Before a DSVSS $\bar{X}$ chart is used, its design parameters should be determined, hence economic design model of DSVSS $\bar{X}$ chart is constructed. Markov chain approach is used to compute the statistical properties of the chart that are essential to our cost function. Then, the Genetic Algorithms (GA) are used to solve the optimal designs of DSVSS $\bar{X}$ chart. Finally, a numerical example is provided to illustrate the use of this model.

Keywords; Quality control, Double sampling chart, Variable sample size chart, Markov chain, Genetic algorithms

1- Introduction

Control chart is a main statistical process control (SPC) tool to detect the occurrence of assignable causes so that a remedial action can be taken before many defective products are manufactured in a process. Dr. Shewhart created $\bar{X}$ control chart, which $\mu \pm 3\sigma_{\bar{X}}$ is used to set control limits for controlling process. It is easy for operators to understand how Shewhart's control chart works, so the chart is widely applied in industries. Static strategies have become less and less suitable for today's advanced industrial society, because of their low performance in detecting small process shifts quickly. Researchers have been trying to propose various adaptive schemes in control chart in order to respond to a shift in process immediately, when a control chart is used to monitor a process, three