

## Statistical Design of Synthetic VP X-bar Control Chart Using Markov Chain Approach

**Authors :** Ali Akbar Heydari

**Abstract :** Control charts are an important tool of statistical quality control. These charts are used to detect and eliminate unwanted special causes of variation that occurred during a period of time. The design and operation of control charts require the determination of three design parameters: the sample size ( $n$ ), the sampling interval ( $h$ ), and the width coefficient of control limits ( $k$ ). The variable parameters (VP) x-bar control chart is the x-bar chart in which all the design parameters vary between two values. These values are a function of the most recent process information. In fact, in the VP x-bar chart, the position of each sample point on the chart establishes the size of the next sample and the time of its sampling. The synthetic x-bar control chart which integrates the x-bar chart and the conforming run length (CRL) chart, provides significant improvement in terms of detection power over the basic x-bar chart for all levels of mean shifts. In this paper, we introduce the synthetic VP x-bar control chart for monitoring changes in the process mean. To determine the design parameters, we used a statistical design based on the minimum out of control average run length (ARL) criteria. The optimal chart parameters of the proposed chart are obtained using the Markov chain approach. A numerical example is also done to show the performance of the proposed chart and comparing it with the other control charts. The results show that our proposed synthetic VP x-bar control chart perform better than the synthetic x-bar control chart for all shift parameter values. Also, the synthetic VP x-bar control chart perform better than the VP x-bar control chart for the moderate or large shift parameter values.

**Keywords :** control chart, markov chain approach, statistical design, synthetic, variable parameter

**Conference Title :** ICASDA 2022 : International Conference on Applied Statistics and Data Analytics

**Conference Location :** Venice, Italy

**Conference Dates :** August 16-17, 2022