Modeling and Analyzing Infrequent Failures: with implications for Process Monitoring Policies

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Abstract
Continues improvement of industrial systems require constant measuring process variation and eliminating extraneous variation whenever possible to push the target measures as close to the ideal value as possible. Statistical Processes Control (SPC) technique is a very efficient statistical technique for monitoring and controlling processes variation. In recent years an alternate Shewhart-type statistical quality control charts called g-chart has been developed for controlling process variation where failure is infrequent like hospital acquired infections.

Some statistics show the national costs of cardiac bypass infections, cathedral related infections and surgical site infections problems are staggering 770,000 to 2 million injured patients, 44,000 to 18,000 deaths and an estimated of $8.8 billion additional healthcare costs. Recent studies estimated that between 45,000 to 98,000 patients die each year in US hospitals from medical errors. The total national cost of this phenomenon is estimated between $17 billion to $29 billion.

However, g-chart, EWMA chart and probability based control charts, which are the main control charts used for monitoring infrequent failure processes fail to detect changes in the process quickly enough. As a solution it was proposed to inspect and follow-up on every failure that occurs in the process.

A mathematical model for the long-run cost of a quality control policy is developed. This model is used to compare the cost of following up on every failure policy with the cost of using statistical control chart for monitoring processes.

By comparing the total cost per hour of using statistical control chart method with the total cost per hour of following up on every failure, it is concluded that following up on every failure policy results in quick detection of changes in the process and it is also a more cost efficient method.

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