Abstract:

The study aims to examine the performance of two control charts for Rayleigh distribution under time-truncated life testing for: Moving Average Cumulative Sum (MA-CUSUM) and Moving Average Exponentially Weighted Moving Average Cumulative Sum (MA-EWMA-CUSUM). Based on changes in the process mean, sample sizes, span (w), and weighted parameters (λ), the average run length (ARL), standard deviation of run length (SDRL), and median run length (MDRL) of both charts are evaluated. The results showed that, especially with higher sample numbers, the MA-CUSUM control chart may be used to identify small process changes. By integrating both MA and EWMA characteristics, the proposed MA-EWMA-CUSUM, on the other hand, gives an improved capability and a more thorough method of shift detection. Under various parameter settings, it works very well for both small and significant modifications. For example, the ARL for a tiny shift $\delta = 0.10$ drops from 17.03 for $n = 20$ to 13.00 for $n = 50$ with a span of $w = 3$ and a weighted parameter $\lambda = 0.1$, demonstrating its quick detection capability. On the other hand, it is demonstrated that greater spans ($w = 5$) and higher λ values are more stable for bigger changes but less sensitive to smaller ones. Overall, the comparison between the two charts suggests that while MA-CUSUM is highly effective for small to moderate shifts, the MA-EWMA-CUSUM chart provides better flexibility and adaptability for a wide range of shift sizes, especially when a balance between early detection and consistency is required. This research contributes to the understanding of control chart performance in process monitoring and offers practical insights into their application in industrial quality control.