Abstract

The methods of statistical quality control are frequently employed to monitor and maintain the quality of a product. The goal of quality control is to find process defects and produce products without any intolerable defect. In any kind of industrial process control charts are widely used as a process monitoring tool of the statistical process control (SPC). In a production or manufacturing process they are usually used to monitor in-control and out-of-control situations. Natural and inherent variation is incorporated into the final product of every manufacturing process. In the process, there are two type of variation, one is natural, while the other is unnatural. The SPC is often used to address the non-natural or assignable causes of variation in a process. One of the tools that SPC can use to effectively identify assignable causes of variation is control chart. There are control charting schemes available in literature to effectively monitor process variability. The researchers designed different dispersion charts based on different robust dispersion estimators. The designed dispersion charts efficiently handled the process variability and timely detect any assignable cause in ongoing process. This study aims at designing different dispersion charts based on different ranked set sampling schemes. The existing structures of dispersion chart used simple random sampling (SRS) scheme, while it is well established that the control charts based ranked set sampling have superiority over existing counterparts. The ranked set based charts are superior due to the fact that sampled information are collected through rigorous methods that results in efficient estimated statistics compared to existing SRS. The goal of this research is to construct different robust control charts based on different robust dispersion estimators based ranked set sampling such as: ranked set sampling (RSS); median ranked set sampling (MRSS) and extreme ranked set sampling (ERSS) to monitor scale parameter of quality characteristic of interest. The designed structures of proposed robust dispersion charts and existing charts are compared based on simulation results. The comparison is based on different individual performance measures such as: average run length (ARL); median of run length (MDRL) and standard deviation of run length (SDRL). These performance measures are based on the run length distribution that means the number of faulty units occurred before it is detected by a control structure. The simulation results show that the performance of different dispersion charts improve with the increase in sample size (n=5, 10). The ranked set sampling schemes under perfect ranking (ρ=1.0) showed best performance for different dispersion charts (R, SD, IQR, MAD, MAD, VMR) compared to the performance under imperfect ranking (ρ=0.25, 0.5, 0.75). The results under MRSS for all dispersion charts are better than the dispersion charts under SRS, RSS and ERSS. Real life example of the proposed scheme is demonstrated by using a real data of heights and weights. The results based on real data study are also in accordance with the results of simulation study.