A New Variable-type Skip-lot Sampling Plan Based on the Process Capability Index

I-Ting Wei
Department of Industrial Engineering and Engineering Management,
National Tsing Hua University, Hsinchu, Taiwan
No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan
wei40626@gmail.com

Chien-Wei Wu
Department of Industrial Engineering and Engineering Management,
National Tsing Hua University, Hsinchu, Taiwan
No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan
cweiwu@ie.nthu.edu.tw

Abstract

As technologies develop rapidly nowadays, managing and improving the quality of products have become important issues in manufacturing industries. Acceptance sampling plan is a quality management tool which has been commonly used in practice to provide reliable decision rules in lot sentencing. Owing to the availability and efficiency of acceptance sampling plan, various acceptance sampling plans are proposed to handle different situations. Skip-lot sampling plan (SKSP) has been used extensively in the manufacturing industries for inspecting a successive series of lots or bulk materials. It takes the quality history into consideration and inspects only a fraction of the submitted lot. On the other hand, repetitive group sampling plan (RGSP) gives the submitted lots the chance of resampling which is helpful for maintaining long-term cooperation between the producer and the consumer. Compared with single sampling plan (SSP), both SKSP and RGSP can obtain a smaller average sample number (ASN) in inspection.

Process capability indices (PCIs) is another common tool in the field of quality management that has been used to measure the performance of manufacturing process. The advantage of PCIs is that it is a dimensionless tool and is useful to quantify the process capability. Among PCIs, C_{pk} is the most popular one in manufacturing industries because it not only considers both precision and accuracy of the process but also gives the estimation of the process yield. In recent years, scholars have applied PCIs in acceptance sampling plans. The PCI-based sampling plan can improve accuracy of inspection by using the exact sampling distribution. To consolidate the advantage of SKSP, RGSP and PCIs, this study develops a modified version of SKSP based on C_{pk} where RGSP is used as the reference plan. The optimization model of the proposed plan is constructed to minimize the average sample number and fulfill the quality and risk requirements by both producers and consumers. Moreover, the performance of the proposed plan are compared with the conventional SSP and SKSP.

Keywords

Acceptance sampling plan, skip-lot sampling plan, repetitive group sampling plan, process capability index and average sample number

Biographies

I-Ting Wei is a graduate student in the Department of Industrial Engineering and Engineering Management at National Tsing Hua University (NTHU), Taiwan. And now she is also a member of quality management lab at school. She holds a Bachelor's degree in Industrial Engineering and Engineering Management from Tsing Hua in 2018. In the same year, she received the Research Creativity Award from the Ministry of Science and Technology in Taiwan. Her present research interests are quality management and quality control, such as process capability analysis, data analysis and application of acceptance sampling strategies.

Chien-Wei Wu is currently a Professor in the Department of Industrial Engineering and Engineering Management at National Tsing Hua University (NTHU), Taiwan. Dr. Wu received his Ph.D. degree in Industrial Engineering and Management with Outstanding Ph.D. Student Award from National Chiao Tung University in 2004 and the M.S. degree in Statistics from NTHU in 2002. He is serving as one of Editors-in-Chief of Quality Technology and Quantitative Management (QTQM) and editorial board members for various international journals. His research interests include quality engineering and management, statistical process control, process capability analysis and data analysis.