

Development of a Smaller-the-better Process Capability Analysis Model under a Sampling Inspection Plan

Chang-Hsien Hsu

Asia University

Abstract

In practice, quality managers often employ sampling inspection to test and evaluate process performance or product quality instead of a 100% inspection, owing to cost and time considerations. Based on this factor, this article develops a smaller-the-better process capability analysis model (SBPCAM) to measure whether process capability of a product with multiple quality characteristics conforms to customer requirements, based on the process capability index (PCI) of smaller-the-better C_{pu} with the functions of the accuracy index (A) and the precision index (P). In the proposed method, a control chart with joint confidence blocks (JCB) is used to reduce sampling error and to improve the reliability of the point estimate of index C_{pu} . A numerical example is provided to illustrate the feasibility and effectiveness of the proposed method.

Keywords: Joint confidence blocks, process capability index, smaller-the-better quality characteristic.

1. Introduction

Due to the rapid advancement of manufacturing technology and economic globalization, producing high-quality products at a low price has become an extremely important issue underpinning success in a changing global marketplace. To satisfy the above requirements, a systematic and efficient approach is required. Process capability indices (PCIs) have been widely used to measure and improve process capability and performance in many manufacturing industries. By analyzing PCIs, a quality manager can trace and monitor whether a manufacturing process/product is capable of producing items within set specification limits.

Juran [7] first combined the process mean (μ), the process variance (σ^2), and the product specification to develop the concept of PCIs. Many statisticians and quality engineers have subsequently presented various PCIs and used these indices to develop analytical tools for measuring process capability and product quality (Chang et al. [1];