Quality Engineering ›

Volume 17, 2004 - Issue 1

Original Articles

Evaluation of Nonnormal Process Capability Indices using Generalized Lambda Distribution

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Pages 77-85 | Published online: 15 Feb 2007

Cite this article https://doi.org/10.1081/QEN-200028709

Abstract

Process capability indices (PCIs) are used to describe a manufacturing process expressing its ability to produce items within the specified limits. These indices are developed under the assumption that the underlying process distribution is normal. In industries, there are many manufacturing processes where process distribution can not be described by a normal distribution. In such cases, those PCIs will give misleading results about the process. The most commonly used approach for analysing a nonnormal process data is to fit a standard nonnormal distribution (e.g., weibull, gamma) or a family of distribution curves (e.g., Pearson, Johnson) to the process data and then to estimate the percentile points from the fitted distribution that can be used to compute generalized PCIs. In this article, we outline the procedure using the generalized lambda distribution (GLD) curve for modeling a set of process data and for

estimating percentile points in order to compute generalized PCIs. The four-parameter GLD can assume a wide variety of curve shapes and hence it is very useful for the representation of data when the underlying model is unknown. Compared to the Pearson and Johnson family of distributions, the GLD is computationally simpler and more flexible. The article provides all necessary formulas for fitting a GLD curve, estimating its parameters, performing goodness-of-fit tests, and computing generalized PCIs. An example is used to illustrate the calculations that can be easily performed using spreadsheets.

Keywords:

generalized process capability indices | generalized lambda distribution | nonconformance | goodness-of-fit

Acknowledgment

The author heartily thanks the referee, Professor Fiorenzo Franceschini, for his valuable suggestions on this article.