

Assessing Nanofabrication Performance Based on the Estimated Taguchi Capability Index with Subsamples

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Abstract

The Taguchi capability index C_{pm} has been proposed to the manufacturing industry for measuring manufacturing capability. Investigations of the estimated Taguchi capability index based on subsamples have been proposed and arrested substantial research attention. In this paper, investigation based on subsamples is considered for normally distributed processes from the traditional distribution frequency approach. A reliable inferential procedure based on subsamples of the estimated Taguchi capability index is proposed. Computational programs using Matlab software are proposed to calculate p-values and critical values required to ensure the process reaching a certain desirable level of the time. A practical example is provided to demonstrate how the proposed procedure may be applied for judging whether the process runs under the desirable quality requirement.

Keywords: Nanofabrication, subsamples, Taguchi capability index.

1. Introduction

Process capability indices, whose purpose is to provide numerical measures on whether or not a manufacturing process is capable of reproducing items satisfying the quality requirements preset by the customers or the product designers, have received substantial research attention in the quality control and statistical literature [3, 4, 5, 6, 9, 11, 18, 20, 22]. The three essential capability indices C_p , C_a and C_{pk} , have been defined as [10, 14, 21]:

$$C_p = \frac{USL - LSL}{6\sigma} \quad (1.1)$$

$$C_a = 1 - \frac{|\mu - m|}{d} \quad (1.2)$$

$$C_{pk} = \min \left\{ \frac{USL - \mu}{3\sigma}, \frac{\mu - LSL}{3\sigma} \right\} \quad (1.3)$$

where USL and LSL are the upper and lower specification limits preset by the customers or the product designers, μ is the process mean, σ is the process standard deviation,