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Efficient Method for Testing the Batch-Processing Process Yield

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Abstract

Batch manufacturing processes have been widely used in various manufacturing processes, such as wafer fabrication, IC fabrication, and gridline printing process in the solar battery fabrication. In a batch manufacturing process, products are produced batch-by-batch. Thus, total process variations are generally divided into batch-by-batch variation and within-batch variation. The main purpose of this study is to provide an efficient method for testing the batch-processing process yield. Base on the one-way random effect model, the generalized pivotal quantity is utilized to establish the generalized confidence interval for assessing the process yield index. By simulations, the proposed method shows that its empirical coverage probability is not affected by the batch effect, and is still close the nominal coverage probability as the batch size increases.

Keywords: Generalized confidence interval, multiple batches, process yield.

1. Introduction

Quality is a critical concern for most manufacturers while purchasing materials. The need of high-quality suppliers has always been an important issue for many manufacturing organizations. Among various quality improvement activities, process capability analysis has always been considered one of the most important engineering decision tools [24]. Quantifying the relationship between the actual process performance and specification limits is the main objective in process capability analysis, and the process capability indices (PCIs) have been widely adopted to this end (The reader can see [3, 12, 13, 14, 15, 16, 19, 20, 21, 22] for more information about the PCIs). Among various PCIs, indices C_p, C_{pk} and C_{pm} are most well-known. As noted by the past research, the precision index C_p only considers the process variability, thus provides no sensitivity on process departure at all. The index C_{pk} takes the process mean into consideration but it fails to distinguish between on-target processes from off-target processes. Moreover, the index C_{pm} takes the proximity of process mean from the target value into account, and is more sensitive to process departure than C_p and C_{pk}.