

Process Capability Indices With Student Mixture Models Applied to Aircraft Engines GD&T

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Auteurs : Mathieu Croquelois, Cyprien Ferraris, Mohamed Achibi, François Thiebaut

Abstract Usually, the process capability indices (PCIs) C_p and C_{pk} are used to quantify the production quality of Geometric Dimensioning & Tolerancing (GD&T). For the most popular PCIs, a strong assumption about normality is required. Many previous works provide information about misleading conclusions when we use usual PCIs without any verification of the dataset normality. In recent industrial developments, many processes increasingly complicate, and GD&T are mostly geometrical specifications. For that reason, most characteristics are not normally distributed. There are two issues when calculating PCIs with nonnormal distributions. First, we have to define PCIs that can deal with all distributions. Second, we need to determine the distribution of the dataset. To do so, we give a short review of the previous work about calculating PCIs with nonnormal distributions. Following that first part, we propose our method for nonnormal distributions. This method uses new PCIs based on the quantile of a standard normal distribution. Then, we consider an estimation method based on a Student mixture model. This allows handling nonnormal distributions, potentially with outliers, and mixture distributions, which are often treated as two different fields and are common in industrial datasets. Finally, we propose some use cases to benchmark our new PCIs and Student mixture model for aircraft engines GD&T applications.