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The allure and the perils of summarizing process performance in a single index

Industrial statisticians are well acquainted with the temptation to simplify the analysis of process performance through summary statistics. One of the most prominent examples is process capability analysis, in which a process's ability to produce items within specification limits is expressed as the ratio between the specification range and the natural variability of the process. The latter is typically estimated from observed data so as to cover a specified proportion of the underlying distribution, resulting in point estimates of the "true" capability indices that are inherently subject to uncertainty. Furthermore, the calculation of these indices often relies on assumptions regarding the characteristics of the process data. In our collaborations with industry, we have found violations of the normality assumption to be among the most common challenges encountered in practice. In this presentation, we discuss several approaches to capability analysis for processes in which the data cannot reasonably be assumed to follow a normal distribution.

Over the years, we have also observed growing interest in multivariate capability indices as an increasing number of quality characteristics are collected and jointly used to assess process performance. We compare several multivariate capability indices proposed in the literature and discuss their differences and limitations using both simulated data and a case study drawn from industrial practice.

Special/ Invited session

JQT/QE/TECH session

Classification

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Primary author: Prof. KULAHCI, murat (DTU)

Co-author: KARAMAN, Mahmut Onur (Hacettepe University)

Presenter: Prof. KULAHCI, murat (DTU)

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