

## Capability Prediction of Machining Processes Based on Uncertainty Analysis

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**Abstract :** Prediction of machining process capability in the design stage plays a key role to reach the precision design and manufacturing of mechanical products. Inaccuracies in machining process lead to errors in position and orientation of machined features on the part, and strongly affect the process capability in the final quality of the product. In this paper, an efficient systematic approach is given to investigate the machining errors to predict the manufacturing errors of the parts and capability prediction of corresponding machining processes. A mathematical formulation of fixture locators modeling is presented to establish the relationship between the part errors and the related sources. Based on this method, the final machining errors of the part can be accurately estimated by relating them to the combined dimensional and geometric tolerances of the workpiece &ndash; fixture system. This method is developed for uncertainty analysis based on the Worst Case and statistical approaches. The application of the presented method is illustrated through presenting an example and the computational results are compared with the Monte Carlo simulation results.

**Keywords :** process capability, machining error, dimensional and geometrical tolerances, uncertainty analysis

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