

Quantifying Effect of Uncertainty Sources on Optimum in Tolerance Optimization

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1. Abstract

In cost based manufacturing tolerance optimization, multiple sources of uncertainty are present in the cost model inputs that leads to uncertainty in the outputs. The main output of interest is the cost associated with the optimal tolerance value. The cost model used in this paper combines the multiple objectives of manufacturing, quality and performance (reflected in value of weight savings). Combining these costs allows finding a tolerance value that balances the value of weight saving and production cost objectives. Sensitivity analysis showed that main sources of uncertainty are manufacturing error data, cost of useful load (hence value of weight savings) and mean cost of quality review. We propagated uncertainties present in the input variables by Monte Carlo simulation and explored uncertainty reduction strategies that would lead to maximum uncertainty reduction in the output i.e. total cost. It was found that uncertainty reduction in the cost of useful load leads to significant reduction in the total cost uncertainty, and uncertainty reduction in the manufacturing error data has the least effect.

2. **Keywords:** Tolerance optimization, uncertainty reduction, aircraft tolerance.