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New Mathematical Model for Geometric Tolerances

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Background

Understanding the causes and effects of dimensional and geometrical variations that result during the manufacture of mechanical products provides a major concern for designers and manufactures. Designers must carefully account for these variations so that parts assemble and function properly; otherwise, designers and manufacturers risk producing unusable products. Consequently, designers specify an acceptable range or tolerance of imperfections in size and shape for each part designed. Parts falling outside of the permissible range receive rejection. Unfortunately, designers currently lack effective tools with which to adequately allocate tolerances and identify trade-offs during the design process.

Invention Description

Researchers at Arizona State University have responded to this deficiency by devising a method employing a mathematical to analyze geometrical tolerances. This method empowers designers and manufacturers by providing a tool by which to identify design and operation trade-offs, to analyze these considerations, and to optimize the allocation of tolerances.

Potential Applications

This new model is easily adaptable for incorporation into existing CAD/CAM software packages or for utilization in standalone applications. Meanwhile, the need for increasingly complicated machinery of increasingly reduced dimensions as well as the emergence of Just in Time Inventory Management and increase in globalization and sourcing of manufacturing poises the market for computer managed design and manufacturing for rapid growth.

Benefits and Advantages

- **Improves integration between CAD/CAM systems and tolerance analysis software.**
- **Permits designers to identify trade-offs and optimize the allocation of tolerances.**
- **Consistent with the ASME Y14.5 (1994) standard on tolerances.**
- **Shorter design times with fewer iterations in prototyping.**
- **Less scrap in manufacturing.**
- **Lowers costs.**