Dynamic Modeling for Machine Tool Thermal Error Compensation

Research Assistants/Staff

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Objectives

- To improve the accuracy and robustness of machine tool thermal error compensation through dynamic modeling
- To develop an innovative methodology for machine tool thermal error modeling based on system identification theory
- To develop a fast thermal error calibration methodology which is suitable for the dynamic thermal deformation system modeling

State-of-the-Art

- The thermal error estimation model is based on static modeling approach which only considers the instantaneous relationship between current temperature measurement and thermal deformation
- The process of extracting thermal error signature is long and costly in order to cover a large range of working conditions

Approaches

Part-oriented Machine Error Self-calibration System

Dynamic Modeling for Machine Tool Thermal Error Compensation

Accomplishments

- Non-stationary thermal-elastic process modeling using Integrate Output Error model
- Dynamic modeling for a three-axis horizontal machining center
- Development of the fast calibration procedure and software package for rapid machine error calibration through part error measurements

Future Work

- Development of the Model Adaptation strategy for machine tool thermal error estimation based on the Dynamic Modeling methodology
- Development of the fast calibration procedure and software package for rapid machine error calibration through part error measurements

Sponsors

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Thermal error modeling and compensation of five axis machine tools

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Objectives
• Development of 5DOF EDM machine station

State-of-the-Art
• Machine structure selection
• Rotary axes distribution
• System configuration

Objectives
• Robust thermal error compensation for adaptive, ultra precision control

State-of-the-Art
• Sensor placement on DMD 505
• Preliminary tests

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