

Volumetric Measurement of Five-axis Machine Tool Thermal Deformation Using an MT-Check Probe

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Abstract

This paper focuses on volumetric measurement of five-axis machine tool thermal deformation. A new method was developed including a measuring apparatus and software for processing the results. Using this method, it is possible to measure the deviation of the relative position of the tool to the workpiece. This deviation is caused by temperature change during machine tool operation and in this case is given in the form of a space vector. Thermal deformations can be measured alternately in several points of the working space or along the trajectory generated by five-axis interpolation. Using an interpolation method, a time variant field of deviation vectors is reconstructed. Temperatures of the load-bearing structure near the machine's internal thermal sources as well as some machine parameters are recorded during the measurement tests for further analysis. A series of tests performed has clearly shown that the value of thermal deformation of a machine tool depends on the position of the machine tool's axes in the working space, the machine tool operating time and also on the machine tool topology. The results from the measurement tests clearly indicate that further research into this area is needed.



Figure 1: Measuring apparatus mounted on the tested five-axis machine tool.

Acknowledgement

The results have been obtained as part of the TE01020075 Competence Center – Manufacturing Technology project supported by the Technology Agency of the Czech Republic.