New structural - parametric method for assessing the geometrical accuracy of machine tools

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Abstract

Accuracy requirements for nano and micro product cause a steady increased accuracy of metal cutting machines themselves, systems and control methods.

This paper proposes an assessment of the geometrical accuracy of the machine tool according to geometrical images (GI), formed by the same set of simultaneous interrelated relative movements of the working bodies of the machine, as when performing the physical process of shaping. The structural - parametric method and methods for the accuracy assessment consider physical phenomena with deterministic and probabilistic properties. It is based on a point, line, plane, the whole pattern, the surface of the pattern, the point on the pattern, the centre of gravity, the centre of inertia. Geometric images are presented in the form of a set of single geometrical images (SGI) formed by the machine in its workspace. Geometrical errors of the machine tool will distort the GI, the properties of which determine the accuracy of the machine. Relations for assessing distortions and deformations of the GI properties are developed.

The structural - parametric method for assessing the geometrical accuracy of a machine tool applies for the thermal stiffness of a motor spindle and their thermal accuracy tested under no-load conditions. Experimental validation did approve the new structural - parametric method for assessing the thermal accuracy of a motor spindle for a machine tool and the control potential for an increased accuracy. Further investigations are planned on the accuracy of machine tool structures with kinematic chains.

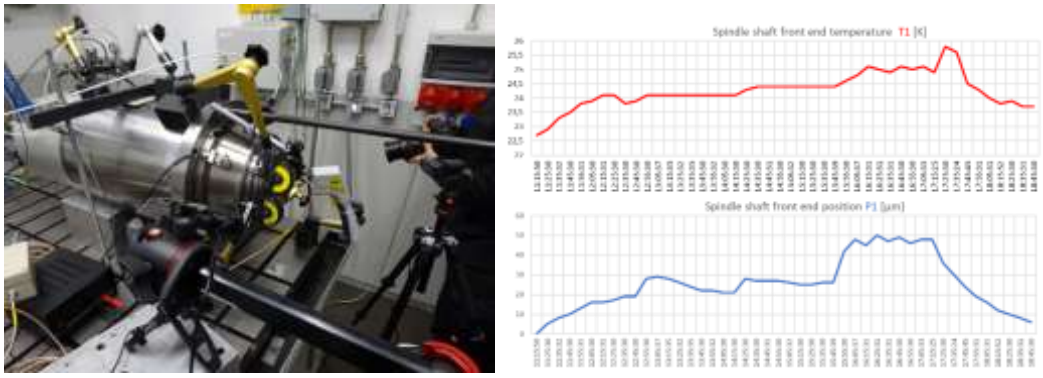

Figure 1: Thermal stiffness test of a motor spindle