ABSTRACT

Today, as the demand for large parts increases, accordingly large machine tools have got greater importance; a clear example is the production of wind turbines, which are growing in size in each new model.

Thermal deformation is one of the principal factors among those that limit positioning accuracy in large machines. Internally generated heat on one hand, and environment temperature fluctuations on the other, expose machine tool to complex and variable temperature distributions. For this reason thermal deformations caused by temperature variation can be of a magnitude equivalent to geometric errors, severely affecting the accuracy of the machine. Therefore, measuring thermal deformations for subsequent compensation is one of the greatest challenges for the machine tool industry today.

To further minimize thermal effects, it is necessary to know first which the thermal behavior of the machine is. A method is presented here for the characterization of thermal deformations of large machine tools.

Large scale metrology equipment such as laser tracker devices provides great flexibility and long range which are useful for machine set up, but the uncertainty given by this kind of equipment is not low enough to perform thermal deformation measurements with the required accuracy. However, laser multilateration schemes performed with laser tracker or laser tracer devices improve greatly measurement accuracy.

For that reason a new method is under development which solves the difficulties associated with this kind of measurements. This way, large volumes up to several cubic meters can be measured with the required accuracy needed to identify thermal deformations in large machine tools. In addition, the automation of the measurements provides the adequate cadence of data acquisition to achieve the evolution of the thermal deformation over time as the machine heats up under different working conditions.