Countering spindle growth

A new, better solution to the monitoring of machine tool spindle thermal growth is now available. Dean Palmer, editor of Eureka, reports

Thermal expansion in machine tool spindles in the z axis is a common phenomenon. Systems exist for its compensation, but they have drawbacks. A new development offers a solution.

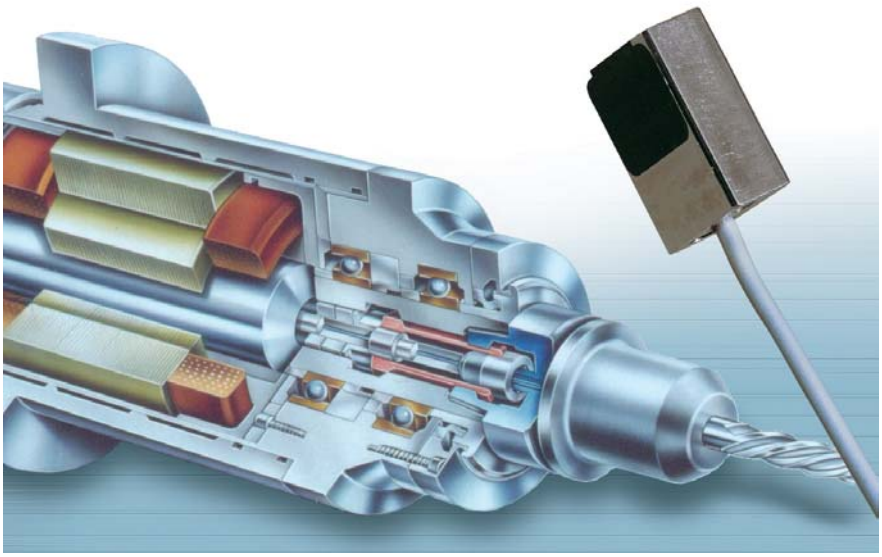
Up to now, any solution to counter to this problem has used sensors mounted outside the spindle. This is a compromise as the real thermal expansion error is inside the centre of the spindle. But mounting a traditional sensor inside the spindle presents a problem as a worn, discarded spindle will also include the sensor.

Furthermore, after buying a replacement spindle, engineers or maintenance staff must re-calibrate the displacement sensor with the electronics controller, which takes time – up to 15 minutes. And if the sensor was integral to the spindle, it would be impossible to perform this set-up procedure and so a lower accuracy external mount sensor has to be used.

Now one company has a solution to both location and replacement issues.

Micro-Epsilon has developed its SGS (Spindle Growth System) which also enables machine tool users to change a spindle without having to re-calibrate the sensor and electronics.The sensor, Micro-Epsilon's eddy current eddyNCDT sensor, is integrated into the spindle and accurately measures any z-axis expansion of the spindle.

The system supports the active compensation of the axial spindle via the CNC unit. "Other sensor manufacturers can provide similar accuracies to our solution, but where we have a technical advantage is in the interchangeability of the sensor system with the spindle. No re-calibration is necessary, which saves time and money for the customer," says Guenther Schallmoser, OEM sales manager at Micro-Epsilon in Germany.



An internal sensor solution that can be reused and requires no recalibration

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"Normally, customers have been using a number of externally-mounted temperature sensors along the spindle, perhaps three to five, to try to measure the temperature difference across it. They then try to compensate for the thermal expansion changes. But this is inaccurate and it is much better to use a displacement sensor to measure the precise thermal expansion of the spindle."

The SGS sensor system was originally developed for Steptec, a Swiss manufacturer of machine tool spindles (owned by Agie Charmilles and with users such as Cincinnati Machine UK).

The sensor is based on Micro-Epsilon's standard eddyNCDT sensor but has a special aluminium, more compact housing and is rectangular in shape rather than cylindrical.

Normally, with eddy current sensors, an engineer has to calibrate the spindle at fixed displacements, in order to 'teach' the sensor and electronics the shape of the displacement curve – 10- or 20-point calibration is usually required to get this kind of shape. Micro-Epsilon uses an embedded (EEPROM) chip that stores calibration data so that re-calibration of the sensor is unnecessary.

A simpler capacitive sensor has been selected by some machine builders as this system does not require such a lengthy set-up process. However, the limitation is that the sensor must always be in a clean environment – something that is very difficult to achieve on a milling or grinding machine.□