Fully Funded EPSRC PhD Case studentship.

Project Title: Self-calibration of embedded strain sensors for traceable measurement of structural distortion

Digitalisation of manufacturing machinery is essential for future development in condition monitoring, advanced prognostics and performance improvements. The growth in the number and complexity of sensors being installed by OEMs on Machine Tools and the growth in IoT systems from providers like Siemens means that more and more data will be captured. Typically, standard temperature sensors or accelerometers are used to monitor the machine, but these provide limited capability for advanced capabilities such as error compensation for finite stiffness effects in the machine structure due to, for example, thermal and mass variation effects.

In this research a newly developed sensor, which uses phase resolved interferometry to measure the elongation of an optical fibre, will be used to measure the structural distortion of mechanical systems such as the main elements of advanced machinery. This could include CNC machine tools, precision artefacts and coordinate measuring systems. Since the system will be embedded onto the machine, possibly for its lifetime, there will be no possibility of performing calibration to ensure the readings continue to be accurate. This is essential if the data is to be used for calculating structural distortion so that the resulting errors can be compensated to improve the accuracy of the machine or measuring system. A detailed uncertainty evaluation of the measuring system will be performed, with areas of uncertainty identified and then solutions for tracking or compensating these uncertainties created. Concepts such as reversal techniques, material constants, controlled self-excitation and differential systems will be explored, simulated and then the novel solution implemented into the prototype measurement system which will then be used for monitoring and improving the performance of precision machinery.

Eligibility: The student must have a high-grade qualification, at least the equivalent of a UK 1st or 2:1 class degree or MSc with distinction in Physics, Engineering or related disciplines. The student must be proficient in both written and spoken English, and possess excellent presentation and communication skills.

Salary: £15,285 (2020/21 EPSRC Standard)

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