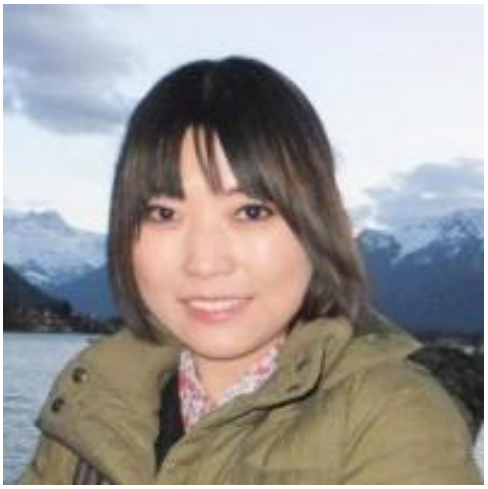
Remote Sensing for Diagnostics



Research at the University of Lincoln's School of Engineering is currently being carried out into new techniques of machine fault detection. The project, entitled 'Remote Sensing for Diagnostics and Prognostics on Industrial Gas Turbines', has been undertaken by Dr. Yu Zhang, a Research Fellow in the School of Engineering, with the support of Siemens Industrial Turbomachinery, Lincoln.

Machine fault detection has been an essential part in industrial control systems to assure operational reliability, quality and safety. Electronic equipment now supports almost every technical device and appliance to help a user or operator, with sensors taking the role of localized 'eyes and ears', which are of special importance for industrial application. Sensor fault detection has therefore also attracted considerable recent attention, due to the benefits of reducing down-time and loss of productivity. This project aims to work on machine- and sensor-fault detection for industrial gas turbine systems based on signal processing techniques.

Here, two readily implementable approaches for sensor fault detection are proposed through hierarchical clustering and self-organizing map neural networks. The proposed methodologies are capable of detecting sensor faults from a large group of sensors measuring different physical quantities and achieve sensor fault detection and identification in a single stage.

A new methodology of machine fault detection for industrial gas turbine systems has also been proposed. The integrated use of empirical mode decomposition, principal component analysis and Savitzky–Golay adaptive filtering are applied to extract noise from underlying measurements. Through analysis of the resulting noise, emerging component faults can be readily detected and localised.

The efficacy of the proposed approaches is demonstrated using experimental trials of industrial gas turbines. The presented techniques are now fully operational and monitoring a fleet of sub 15-MW industrial gas turbines in real-time.