Signal processing technique ready for commercial testing

Earlier in 2015, a doctoral degree candidate at the University of Pretoria's Centre for Asset Integrity Management (C-AIM) developed a new signal processing technique for the vibration monitoring and testing of turbomachinery. Now, C-AIM aims to create industry partnerships to develop this technique to maturity and commercialisation.

Over the last two years, Dawie Diamond, who conducts research in mechanical engineering, developed the new statistical signal processing technique for blade-tip timing measurements. He uses the blade-timing approach in the analysis of the synchronous vibration of turbine blades during a constant turbine shaft speed.

Blade-tip timing is used to monitor blade vibration and uses probes of various designs to detect the arrival time of individual rotor blades at a number of points around the rotor casing. The technique forms part of several online, non-intrusive condition monitoring techniques that focus on vibration signals or pressure fluctuations that are observed in turbine blade testing.

Diamond explains that this vibration is one of several vibration conditions of turbomachinery, which can include flutter that occurs when there is aerodynamic instability and synchronous vibration.

The technique was successfully used in the Sasol laboratory from July to November 2014, with several recorded and verified successes on a laboratory-scale turbomachine blade-vibration test setup. The technique was also tested against other published methods, with the results providing an error of only 0.2% – a significant increase in accuracy – whereas another testing method provided an error of about 5 to 6%.

Despite these favourable results, he acknowledges the challenges in testing practicalities, which can only be verified on industry-sized turbomachinery, hence the need for access to industry turbines to conduct active field research and complete the technique's methodologies.

Prof Stephan Heyns, Director of C-AIM, concludes that: "The research work developed to such an extent that we believe we have a solution, which, in collaboration with industry partners, can be brought to commercial feasibility." He believes that this will be a leap forward in understanding the conditions of turbomachinery.

Prof Heyns expects field testing to start within the next two years and stresses that, as turbomachinery (particularly turbines) lies at the heart of any power production process, it is crucial to ensure the integrity of these machines.