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ACARP MATTERS

DR MINGFEI LUO

Over the course of his career, Mingfei has focused on two key areas – condition monitoring and vibration/dynamic investigations. He has more than 10 years' experience in the detection, diagnosis and prognosis of machine condition.

"I carry out condition monitoring of pumps, compressors, fans, gearbox, extruders and chillers in all industries using vibration techniques. Collection, evaluation, liaison, and reporting are required year round," he said.

"I am one of only two project engineers at VIPAC who consult on the dynamic behavior of machines in situ. This job involves the regular application of vibration measurement analysers and equipment, impact testing techniques, modal analysis techniques, root cause analysis, torsional vibration estimation and isolation design. I have undertaken more than a hundred of these investigations in a range of industries."

This work led to the development of Smart, Cheap

Growing up in a remote, rural village in north eastern China, Mingfei Luo had never considered a career in mechanical engineering or the coal industry. However, a change in government education policy in 1976 gave him the opportunity to attend university. Now firmly established in Australia as Principal Engineer with VIPAC's Machine Monitoring Group in Melbourne, Mingfei has passed his passion for engineering onto his 24 year old daughter Ying, who has just completed double degrees in science and mechanical engineering at Monash University.

"She studied exactly the same fields as me because she loves my work," he said proudly.

Mingfei completed his PhD in mechanical engineering at Monash University in 1994. He also holds a Master of Mechanical Engineering degree and Bachelor of Mechanical Engineering degree, both from Northeastern University in China. He has worked for VIPAC Engineers and Scientists – a research, development and engineering consultancy that specialises in a broad range of acoustic, vibration, computer-based engineering, environmental testing, component manufacturing, electronics and instrumentation – for 15 years. Currently he is responsible for the overall technical coordination and market development of VIPAC's condition monitoring and maintenance services for the Melbourne and Hong Kong offices. He is also responsible for budgeting and target achievements for two condition monitoring groups.

It is hard to believe that when the young country boy enrolled at university he was ambivalent about his course of study.

"I did not care what I was studying as long as I was a university student, because this gave me the opportunity to enter city life," he said. It was also where he met his wife Rong Sheng Wang.

"My home town is a small farming village of around 5,000 households, about 1,000km northeast of Beijing. It is very cold in winter, sometimes -30oC. All the families plant crops and their food supply is dependent on the natural climate."

Mingfei and Rong Sheng arrived in Australia with three year old Ying in 1988. Life in Australia is very different from China. The Luos have a comfortable home. They own property (and cars) which would not be possible in China.

"But I do miss my family. My father was a primary school teacher and my mother was a housewife who looked after the children and planted crops on the land around our

Autonomous Monitoring Sensor System for Variable Speed Machinery (ACARP project C16007).

This device has been tested on a dragline at Ravensworth and is seen as another important step to improved maintenance for our industry.

house. I am the second oldest child and I have two brothers and a sister. I visit China at least every two years," he said.

The Research
A smart wireless condition monitoring system trialed at Xstrata Coal's Ravensworth Operations in New South Wales will reduce unscheduled maintenance and significantly reduce maintenance costs.

Developed by VIPAC under an ACARP research grant (C16007 Development of a Smart Condition Monitoring Sensor System for Variable Speed Machinery), the system for variable speed machinery extends condition-based maintenance of constant speed rotating machines, including:

- Unsafe areas such as dangerous mechanical systems and chemical processes;
- Inaccessible areas such as tall equipment, equipment on towers, ceiling, roofs, and holding ponds;
- Mobile equipment or moving parts such as overhead cranes and lifts;
- Areas where wiring is problematic such as between rooms and floors, and over long runs; and
- On a temporary basis for newly installed equipment, equipment with suspected problems and recently repaired equipment.

Project manager and principal researcher Mingfei said, ultimately, this cheap system would replace the offline and online condition monitoring system currently being used.

"Field testing on Dragline 1570 at Ravensworth Operations in May and June 2008 proved that the smart sensor system was working properly," he said.

"The system was set up on the motor and gearbox. All measured vibration data from the motor and gearbox had been within the warning envelope since the initial setup on 14 May. The results indicate that the motor and gearbox are in steady condition."

This two-stage project consisted of four elements:

- The smart sensor is a completely self-contained wireless machinery analyser that can carry signal processing and detect a machine conditions using comprehensive alarm 'Mask' methodology. If necessary, the pre-processed measurements from the smart sensor can be transmitted regularly to a transceiver without cabling. The transmitting interval is dependent on the machine process;
- The multi-channel transceiver supports up to 50 smart sensors within a 50m radius and provides instruction and communication with the smart sensors. The transceiver will be AC-powered for permanent mounting;
- The analysis results, such as alarms, spectra and 'sensor status', will be downloaded to a control centre with a PC from the transceiver. The control centre will hold the machine database with a special condition monitoring system. The system uses advanced, state-of the-art software, which will be required for accurate fault diagnosis and prognosis of machine faults. When the alarm parameters are exceeded, then the fault classification and fault severity ranking will be conducted in the centre. In addition, the control centre will be used to manage a comprehensive database incorporating details of all the equipment being monitored, update the measured data, graph and trend data, readjust the sensor set up and so on; and
- The subsequent dissemination of the fault message is through the control centre by modem to the internet, for access via network or mobile technologies. The enunciated fault 'message' will include a fault identifier/description, the fault severity, and the machine identifier (or IP address).

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