Picking the right Condition Monitoring

Seminar 07 September 2023 10:00 - 16:00

This Process Industries Division in-person Seminar has been organised by the Process Industries Community which consists of the Process Industries Division Centres in the North West and Yorkshire Regions, the Aberdeen Area and the Division Board.

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Prof. Jyoti Sinha, BSc (Mech), MTech (Aero), PhD, CEng, FIMechE

Prof. Jyoti K. Sinha is Programme Director of Reliability Engineering and Asset Management (REAM) MSc course and Head, Dynamics Laboratory, School of Engineering, The University of Manchester, Manchester, UK

Prof. Sinha is internationally well-known experts in **Vibration-based Condition Monitoring and Maintenance of Machines and Structures**. He is involved in and solved several industrial vibration problems of machines, piping and structures by *in-situ* vibration measurements and analysis in many plants in last 33 years. He is the author of more than 250 publications (Journals, conferences, books, edited book/conference proceedings and technical reports) and gave several keynote/invited lectures. He is author of two well-received book "*Vibration Analysis, Instruments and Signal Processing*" and "*Industrial Approaches in Vibration-based Condition Monitoring"* He is also co-author of two books.

Prof. Sinha has started a series of an **International Conference of Maintenance Engineering (IncoME)** from August 2016. Prof. Sinha is also associated with several international journals, conferences and IFTOMM Rotordynamics. He is also acting as the consultant and visiting professor to the industry and the educational institutes.

https://www.research.manchester.ac.uk/portal/Jyoti.Sinha.html

Title 1: Why Condition Monitoring is important in Industries?

There are several tools are available and used in the industries to manage and maintain their assets. However, there are many critical machines within any industry that need to be maintained to maximize the availability by reducing the downtime. This can be achieved through the appropriate and effective condition monitoring of machines. The presentation is targeting to provide the overview and the importance of the condition monitoring in industries.

Title 2: Industrial Case Studies

Following 3 industrial case studies (Sinha, 2020) will be presented.

(1) Gearbox fault detection by vibration measurements.
(2) Vibration measurements during the machine installation and commissioning
(3) Avoiding frequent failures of an old pump through vibration measurements

Sinha, Jyoti K. *Industrial Approaches in Vibration-Based Condition Monitoring*, 1st ed.; Taylor & Francis, CRC Press, Boca Raton, FL, USA, 2020.

Richard Hellebrand

Richard Hellebrand gained a BSc(Hons) in Mechanical Engineering from Brunel University. He has worked as a Chartered Mechanical Engineer in the process industries for more than 30 years. He was the Responsible Engineer at multi-plant sites manufacturing smokeless fuels, chemicals and polymers.

Richard has extensive experience of asset reliability, from initial design to decommissioning. Richard is Process Safety Management Superintendent for the Westlake Chemicals group, where he is also a Subject Matter Expert in the global Reliability & Maintenance Excellence Team.

He is a Fellow of the IMechE and a Fellow of the Energy Institute. He is also a member of IMechE's Bulk Materials Handling Committee and the Process Safety Management Competence Board.

Title 1: Using Condition Monitoring to reduce Downtime and Safety Risks

In the first of two presentations, Richard will give an overview of how to set up a condition monitoring programme, starting by compiling an Asset Life Plan, then assessing criticality and choosing appropriate maintenance techniques, including condition monitoring.

Title 2: Justifying the right condition monitoring

In the second presentation, he will discuss monitoring options from simple portable and fixed analysers up to cloud networked systems. He will also propose some ways to justify the necessary expenditure.

Dr Simon Lewis

Dr Lewis is a chartered engineer with particular expertise in structural integrity and a PhD background in fracture mechanics and statistic. He is a Principal Consultant at Element Digital Engineering with a focus on safety critical industries and has experience in design and management of high-pressure systems ranging from Aerospace and Nuclear Power to Subsea.

He has a particular interest in making the benefits of engineering simulation more accessible to non-experts and those making operational decisions about complex systems. He's still not sure what a digital twin is,but hopes to get there one day!

Title: The case for Simulation in Condition Monitoring - Why and When?

Condition monitoring of engineering systems has traditionally been based on interpreting measured data taken from operating assets. The accuracy of these approaches is often limited by the practicalities of what can be measured and where. Although instrumentation is becoming ever cheaper and easier, there are still cases where access, cost or feasibility mean we cannot measure what we would like (for example local stresses).

Advances in engineering simulation have made physics based predictions ever more accessible, allowing robust predictions to be made based on measured data. Combined with advances in real time or near real time simulation approaches.

Bernard Meir

As a research assistant and during his Diploma Thesis at the Technical University of Munich, Bernhard studied the influence of blender parameters on dampening of federate fluctuations. He later joined Gericke as a Project Engineer, gathering wide knowledge and experience in powder handling. He now leads the department for continuous manufacturing at Gericke. With 125 years history in powder handling, Gericke is one of the leading suppliers for feeding blending equipment for continuous manufacturing of oral solid dosage forms.

Title: Rapid Development of a Pharmaceutical Continuous Manufacturing Process using a Digital Twin

Continuous Manufacturing of Oral Solid Dosage forms has gained a lot of momentum in the pharmaceutical industry.

The talk will give insights into Continuous Manufacturing and how a digital twin can reduce development and time to market.

Comprising materials and equipment databases, process workflows and modelling software, the digital twin will provide a deeper understanding of how active pharmaceutical ingredients and excipients will interact in the tablet manufacturing process, enabling optimization to occur in the digital space. This drives efficiency in pharmaceutical product development, as well as allowing for tailoring of medicines for specific patient groups, such as pediatric or geriatric. The speed and agility will also allow for shorter production runs, enabling pharma companies to more effectively respond to differing patient needs as well as reducing the development burden, costs, and associated carbon footprint.

David Smith

David Smith, Lifetime Solutions Engineer at Schaeffler UK, has worked as an engineer in manufacturing, with over 10 years of this being in the field of condition monitoring. He brings a wealth of experience with a blend of traditional and new methods of predictive and preventative maintenance for many industrial processes, including those of power generation, steel, aggregates, as well as food & beverage and pharmaceuticals.

Title: Moving into the new era of condition monitoring

How can we predict the lifetime if we don't know the condition of the machine? How is it possible to know the condition of the machine if we don't measure it?
Schaeffler will use its depth of knowledge as leading pioneers in the field of motion and mobility, specifically in the remit of bearing technology, to show how they use their own OPTIME Ecosystem within their plants cost effectively.

Dr Andrew Moffatt

Andrew is a Group Manager in the Condition Based Engineering Department at Solar Turbines Inc. Solar Turbines is one of the world's leading manufacturers of industrial gas turbines with more than 16,000 units in over 100 countries. Andrew is responsible for the development of methods to life high value components (hot section and compressor) within Solar Turbines fleet of operational gas turbines. He is also responsible for the development of software which utilizes engine data, along with the lifting methods, so that near-real-time damage assessments of individual units can be calculated and actioned. Andrew is a Chartered Physicist and obtained his PhD in Engineering Materials from the University of Southampton.

Title: Application of Simulation and Digital Asset Management to Gas Turbine Condition Monitoring.

Condition Monitoring, for example via vibration monitoring, has traditionally been used to identify degradation in physical assets, to pre-empt failure and schedule maintenance. Improvements in sensor technology allow a wide range of real time data to be captured from operating systems in a cost-effective manner. The much hyped 'Digital Twin' concept aims to combine this real time data with simulation tools to calculate parameters which are difficult to measure such as stress or damage, opening up a range of opportunities for better asset management. In this webinar, Andrew will give an overview of how Solar Turbines have combined data capture, with advanced engineering simulation and material modelling, to create 'Digital Assets' – digital representations of their operating fleet. Near-real-time damage prediction is allowing operators to improve maintenance planning, increase part re-use and optimise operating regimes to improve engine life and availability. This talk will cover the the Solar Turbines approach and the potential benefits, as well as some of the challenges encountered.

Martin Greenbank and Matthew Moore (Petrofac)

Martin is Senior Consultant in Condition Monitoring with Petrofac. He has over 15 years' experience in vibration and performance monitoring within the Oil & Gas and Power Generation industries. Martin holds a degree in Mechanical Engineering from Durham University, is a certified Mobius Institute ISO 18436-2 Category III vibration analyst and an Associate Member of the IMechE.

Matthew Moore BSc (Hons) is the Global Subject Matter Expert in Condition Monitoring for Petrofac. He has over 25 years of experience in the field of vibration and condition monitoring within the Oil & Gas industry and is a certified Mobius Institute ISO 18436-2 Category IV vibration analyst and training instructor. Matthew is a member of the Mobius Institute Board of Certification Vibration Technical Committee, Editorial Board member for CBM Connect and Reliability Connect, and is the Mobius Connect United Kingdom Community Leader.

Title: Evaluating MEMS Accelerometer Technology

With the advent of wireless vibration sensors for IIoT machine health applications, MEMS accelerometer technology has become increasing popular. There is however still some scepticism whether this technology can truly replace traditional accelerometers. Due to the lack of credible comparisons in the public domain, end users are either reliant on trusting the OEM's data sheets or performing their own trials. Within this presentation we discuss the results of our trials which include:

- Comparison of high quality wired MEMS ICP accelerometer with a traditional routine data collection accelerometer in an offshore oil & gas measurement environment
- Calibration testing of the frequency response of a wireless MEMS accelerometer
- Comparison of two very different wireless vibration sensor designs

Matthew Laskaj

Matthew Laskaj is a Chartered Mechanical Engineer, a Fellow and Chair of IMechE Scottish Region.

Originally from Australia, Matthew started his career working in a food manufacturing plant, where he was responsible for setting up a new reliability programme. The next five years were spent as a mechanical and reliability engineer within steel works and refineries across Australia.

He then moved to Scotland, working in manufacturing plants and refineries, before settling in Aberdeen as Engineering Manager of a drilling company. Matthew is now the Director of Project Engineering Management Ltd. Over the last 8 years, he has worked as a specialist engineering and maintenance trainer, whilst continuing his involvement in the management of projects

Title: Why RCM relies on condition monitoring

Reliability Centred Maintenance (RCM) is not intended to eliminate failures. The objective is to reduce or mitigate the consequences of a failure when one occurs. During this presentation, you will learn what the RCM process involves, how condition monitoring fits into an RCM review, and why it is so important to select the right monitoring method.