

Thermofluids Group

EXPERIMENTAL METHODS FOR HEALTH MONITORING OF FLUID SYSTEMS

Institution of
**MECHANICAL
ENGINEERS**

22 April 2010
London

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Keynote Speakers: Rolls-Royce

Pete Loftus, Head of Measurement Capability

Charlie Dibsdale, Head of Global Equipment Health Management Capability

Improving the world through engineering

EXPERIMENTAL METHODS FOR HEALTH MONITORING OF FLUID SYSTEMS

Health monitoring is an area of emerging importance in engineering, which is vital for future competitiveness. There is currently a lack of proven and robust experimental methods for health monitoring in engineering situations, especially in the severe environments commonly present in thermo-fluid applications. Very few forums exist that promote the cross-fertilisation of ideas and techniques between different engineering domains.

This event will highlight the current technologies and challenges in a number of targeted industry sectors and provide an opportunity for cross-fertilisation of health monitoring measurement techniques and instrumentation between these sectors.

THIS EVENT WILL ATTRACT:

- Technical project leaders of OEMs
- Technical directors of SMEs
- Academic researchers
- Instrumentation engineers
- Measurement methods engineers
- Health monitoring specialists
- Doctorate students

TECHNICAL ADVANTAGES:

- Learn how and where health monitoring is being applied in various engineering situations and domains
- Become up to date with new health monitoring methods and instrumentation
- Examine the existing and future challenges for health monitoring in engineering
- Understand the importance of health monitoring and how it can be used to improve the competitiveness of your company
- Engage with engineers working in similar areas and from other engineering fields
- Network with companies setting a benchmark for health monitoring standards

BY ATTENDING THIS EVENT YOU WILL:

- Extend the life of engineering plants and machinery by developing better health monitoring methods
- Learn to exploit gaps in the current health monitoring market
- Gain an insight into emerging health monitoring technologies
- Improve your company's competitiveness with new health monitoring methods

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EXPERIMENTAL METHODS FOR HEALTH MONITORING OF FLUID SYSTEMS

22 APRIL 2010

ONE BIRDCAGE WALK, LONDON SW1H 9JJ

10:00 REGISTRATION

SESSION 1:

10:30: WELCOME AND INTRODUCTION BY SEMINAR CHAIR

Kam Chana, Head of Instrumentation & Experimental Programmes, QinetiQ

Kam Chana has over 20 years of experience in fluid-dynamics and heat transfer research and development, with particular application to arduous environments such as the hot gas path of a gas turbine engine. He now uses this expertise to lead QinetiQ's research and development activities in the advanced sensor technology area. Kam is recognised internationally as a propulsion heat transfer, sensor and health management system innovator. He holds a Visiting Fellow position at Warwick University and has published in excess of 100 conference and journal papers.

10:35 KEYNOTE SPEECH – THROUGH LIFE VALUE FROM FLUID SYSTEM MONITORING IN GAS TURBINE OPERATIONS

Pete Loftus, Head of Measurement Capability; Charlie Dibsdales, Head of Global Equipment Health Management Capability; Rolls-Royce, Derby

Pete Loftus has worked in Measurement and Instrumentation at Rolls-Royce for almost 30 years. For most of this time his focus has been on the effective development of gas turbine products through improved instrumentation capability. He currently has a global leadership role in Measurement and Instrumentation. He also serves as President of the European Virtual Institute for Gas Turbine Instrumentation.

Charlie Dibsdales has worked in Equipment Health Management (EHM) for over ten years. His focus is the system level capability for future asset management regimes. He is currently Head of Global EHM capability (Rolls-

Royce) and Chief Engineer (Optimized Systems and Solutions).

- The role of EHM in supporting gas turbine services
- Architectures of an enterprise EHM system
- Fluid systems challenges
- Future directions and needs

10:55 DISCUSSION

11:00 OPTICAL SENSORS FOR GAS TURBINE COMBUSTION MONITORING

Stephen Fasham, Technology Development Director, Oxsensis

Stephen Fasham is Technology Development Director for Oxsensis, a start-up company developing optical sensor systems for use in extreme environments including gas turbine instrumentation. He is responsible for early-stage technology developments for both gas turbines and other market sectors including avionics systems and automotive products.

Stephen has a wide range of experience in the field of applied optics having worked for a number of optical telecoms companies including JDS (the world's largest optical component supplier) and Kamelian, an innovative optical semiconductor start-up where he was one of the founders. He joined Oxsensis from Sharp Laboratories, where he developed a new research theme in the area of display illumination, having previously been involved in innovative LCD technologies including

- The need for improved instrumentation for gas path measurements in gas turbines (GTs)
- State of the art and the major challenges for sensors in GTs
- Design and operation of optical sensors for dynamic pressure measurement at extreme temperature
- Discussion of results from combustion rig and full engine testing
- Further developments towards a more complete optical instrumentation suite for GTs

11:20 DISCUSSION

11:25 REFRESHMENTS

SESSION 2:

11:45 PATTERN RECOGNITION OF ACOUSTIC EMISSION FROM A RADIAL FLOW GAS TURBINE

Mohamad Shadi Nashed, Postgraduate, Heriot-Watt University

Mohamad Shadi Nashed is currently a postgraduate research student at Heriot-Watt University, where he has been conducting experiments within the field of acoustic emission (AE) for the last four years within the university's laboratories.

- Background to AE monitoring of machines – 'normal running' and 'incipient fault' signals and the relative use of time and frequency domain signals
- General characteristics of the AE behaviour of gas turbines, both with and without load
- The diagnostic performance of dynamic artificial neural networks using time domain features
- Choosing the time features which offer the most efficient diagnosis
- Diagnostic performance improvement using frequency domain features
- Prospects for recognising gas turbine faults

12:05 DISCUSSION

12:10 FAST RESPONSE INSTRUMENTATION FOR HIGH-TEMPERATURE UNSTEADY ENGINE FLOW MEASUREMENTS

Roderick Lubbock, DPhil Student, University of Oxford

Roderick Lubbock is currently a DPhil Student at the Osney Laboratory, Department of Engineering Science, University of Oxford. He has an MSc in Advanced Mechanical Engineering from Imperial College London and a BSc in Physics, both from Imperial College London.

- The instrumentation challenge
- Probe description and theory
- Engine test details
- Evaluation of results

12:30 DISCUSSION

12:35 LUNCH



THE INFORMATION PRESENTED AT THE SEMINAR HELPED MY COMPANY UNDERSTAND THE VALUE TO GIVE TO OUR PRODUCT WITHIN ENGINEERING DESIGN IN DIFFERENT INDUSTRY SECTORS.

FRANCESCA IUDICELLO
HEAD OF FLUID MECHANICS, IHS
SPEAKING ABOUT DESIGN OPTIMISATION THROUGH VALUE ENGINEERING OF FLUID MACHINERY

SESSION 3:

13:35 METAL DIAPHRAGM PRESSURE SENSORS WITH GLASSED SOI GAGES FOR USE IN HIGH-TEMPERATURE HARSH ENVIRONMENTS

John Chivers, Vice President of Technology, Kulite Semiconductor Products

John Chivers graduated in Electronic Engineering from Southampton University and joined Rolls-Royce Aero Engines in Derby as a graduate apprentice. While at Rolls-Royce, he obtained his PhD from Imperial College London for his research and development of a technique to measure blade tip clearance in gas turbines and became Head of Experimental Instrumentation.

John joined Kulite Semiconductor Products in 1994 as Vice President of Technology based in the UK. He is currently involved in the research, development and application of high temperature steady state and dynamic pressure instrumentation for the aero and industrial gas turbine, oil exploration and Formula 1 industries.

- Introduction to Kulite and the relevance of pressure measurement to condition monitoring in fluid systems
- Kulite's SOI (silicon on insulator) piezoresistive technology
- Capabilities of SOI piezoresistive pressure sensors – ultra high temperature sensors, ultra-miniature sensors, high-temperature SOI electronics, ultra high vibration and acceleration capabilities, multi-function and redundant sensors, high reliability
- Development of the metal diaphragm pressure transducer for condition monitoring and control in extreme environments
- Kulite's experience in severe environments with examples from the gas turbine, airframe and oil exploration/oil production industries and the maturity of Kulite's technology
- Opportunity for attendees to discuss current and future pressure measurement requirements

13:55 DISCUSSION

14:00 PHOSPHOR SENSORS FOR HARSH AND HIGH-TEMPERATURE ENVIRONMENTS

Dr Andy Heyes, Senior Lecturer, Imperial College London

Andy Heyes is a Senior Lecturer in the department of Mechanical Engineering at Imperial College London and Director for Education at the Energy Futures Laboratory of the College. He joined Imperial in 1995, having previously worked in the aerospace industry with BAe and Rolls-Royce. Andy has more than ten years experience of working with phosphor-based sensors and is co-inventor of the phosphor thermal barrier sensor coating technology. He is also a co-founder and director of Southside Thermal Sciences, a spin-out company from Imperial College London, set up

to exploit the sensor coating and other related technologies.

- Review of phosphorescence/phosphor materials
- Measurement/sensory properties of phosphors
- Applications of phosphors for temperature measurement and component life assessment in gas turbines
- Use of phosphors for gas path analysis – temperature and mixing measurement
- The use of phosphors for thermal history sensing

14:20 DISCUSSION

14:25 REFRESHMENTS

SESSION 4:

14:45 FLOW METERING TECHNOLOGY REVIEW

Trevor Cave, Requirements Manager, HP Enterprise Services

Trevor Cave is a Chartered MRAS. He began with an aircraft industry apprenticeship and degree in Engineering at Churchill College, Cambridge in 1971-4. He moved from aerospace to underwater in 1982 and then ran his own consultancy from 1986 to 2008, beginning with studies in Command and Control at NATO. While working in consultancy he became involved in several niche technologies and analyses. Trevor has an interest in fluid flow measurement and has investigated commercially available technologies for a requirement to measure diesel engine fuel consumption at non-standard rates and viscosities.

- Review the benefits of a compact, cheap, accurate, simple meter with an ample 'turn-down ratio' of Omax: Omin
- Measuring flow meter performance
- Understanding the physics required to measure diesel fuel flow and how this stretches across commercially available technologies
- Available and novel technologies are explored and compared

15:05 DISCUSSION

15:10 THE USE OF OPTICAL PYROMETRY FOR GAS TURBINE CONDITION MONITORING

Dr Andrew Hallam, Optical Consultant, Meggitt Sensing Systems

Andrew Hallam has been actively involved in optical fibre technology for 30 years and has extensive experience in optical measurements and instrument design. Recent experience includes the design and fabrication of computerised test equipment for qualifying multimode optical fibres, a PhD research programme on optical fibre components, design of an optical viewfinder system, and a project to improve the performance of radiation pyrometry for aerospace applications. As former Head of the Measurement Standards department at GN Nettest, Andrew was responsible

for setting up and running a calibration laboratory to ISO 9000 standards. His work included the development of a suite of calibration standards, working closely with NPL in the UK and NIST in the USA. Andrew is the author of various technical papers and international standards, and holds patents for several optical devices.

- The use of optical pyrometry to monitor the condition and health of high-pressure turbine blades
- Fundamentals of pyrometry
- Limitations and error mechanisms inherent in pyrometry
- Possible techniques to reduce these error mechanisms
- Ongoing research on pyrometry within Meggitt Sensing Systems

15:30 DISCUSSION

15:35 IN-FLIGHT BLADE HEALTH MANAGEMENT AND FOREIGN OBJECT DAMAGE DETECTION

Dave Cardwell, Gas Turbine Engineer, QinetiQ

Dave Cardwell has over 14 years of experience in experimental and CFD of turbine aerodynamics and heat transfer, with particular application to gas turbine technologies including the hot gas path. He currently leads the QinetiQ research and development activities in blade health management. Dave is recognised as a propulsion heat transfer and sensor health management system specialist.

- Development of a prototype in-flight foreign object damage (FOD) detection system capable of detecting objects as small as one gram mass
- Eddy current sensor-based tip timing system and acoustic emissions vibration sensors controlled through a digital signal processor (DSP)
- Validation of engine trials
- Investigation into the system's sensitivity to foreign object impacts

15:55 DISCUSSION

16:00 CLOSING REMARKS BY CHAIRMAN

16:10 SEMINAR ENDS

This programme is subject to change

Thermofluids Group

Organising Committee:

Paul Beard, University of Oxford
Kam Chana, QinetiQ

The committee would like to thank the following supporters:

Aerospace Division, Combustion Engines & Fuels Group and Fluid Machinery Group

FORWARD THINKING.

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www.imeche.org/events/c1310

16 SEPTEMBER 2010: LONDON CLEAN COAL CHALLENGES THERMOFLUIDS

Mechanical engineers and those engaged in the thermodynamic and fluids analysis of the processes and technologies relating to clean coal will be able to acquire knowledge and an understanding of the problems involved, therefore working towards their solution.

address: www.imeche.org/events/s1489

19-20 MAY 2010: LONDON 9TH INTERNATIONAL CONFERENCE ON TURBOCHARGERS AND TURBOCHARGING

This international event is the latest in a series of highly successful conferences, held every four years since 1978. It will cover all current aspects of design and development of turbochargers, turbocharging systems, other pressure charging devices and their associated systems.

www.imeche.org/events/c1302

18 NOVEMBER 2010: LONDON OIL & GAS THERMOFLUIDS: FUTURE CHALLENGES

Modern computational techniques for known problems and modelling solutions will be offered for the problems associated with new oil & gas reserves. A forum for engineers and manufacturers will be provided in order to discuss the advances and challenges (associated with thermodynamics and fluid mechanics) for the industry.

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EVENT S1488
22/4/10

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Payment must accompany this registration form. Registration will be confirmed only on receipt of full payment.

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Enquiries

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