

# **20th International Conference on Condition Monitoring and Asset Management (CM 2024)**

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### 09.00 Opening Ceremony – Welcome and introduction

Authors - Professor L Gelman, UK, D Gilbert, UK, and Dr S Baboo, Singapore  
Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria

### 09.20 Plenary Keynote Lecture – [IA0] Health monitoring with vibrations at Safran Aircraft Engines: an overview of the ‘doing well’ and the ‘I would like’...N/A

Author - J Griffaton, France  
Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria

### Session A – Data-driven and physics-based modelling for condition monitoring of industrial assets

Chair: Dr A Rahbarimanesh Room: A: Wisteria

### 11.00 [IA1] Application of machine learning in computational fluid dynamics-based design and optimisation of turboexpanders used in natural gas pressure reduction stations...N/A

Authors - S Rahbarimanesh<sup>1</sup>, A Nejat<sup>2</sup>, A Rahbarimanesh<sup>3</sup> and S Mousavi<sup>2</sup>  
<sup>1</sup>University of British Columbia, Canada  
<sup>2</sup>University of Tehran, Iran  
<sup>3</sup>University of Manchester, UK

### 11.20 [IA2] Machine learning-enabled decision support system (ML-DSS) for asset condition monitoring...N/A

Authors - A Rahbarimanesh<sup>1</sup>, M Burrows<sup>2</sup> and S Rahbarimanesh<sup>3</sup>  
<sup>1</sup>University of Manchester, UK  
<sup>2</sup>RS Group plc, UK  
<sup>3</sup>University of British Columbia, Canada

### 11.40 [IA3] Project nautilUS +: a fully autonomous robotic technology for smart floor thickness monitoring of hazardous liquid storage tanks...N/A

Authors - A Rahbarimanesh<sup>1</sup> and M Burrows<sup>2</sup>  
<sup>1</sup>University of Manchester, UK  
<sup>2</sup>RS Group plc, UK

### 12.00 [IA4] Extending B-COSFIRE for automatic extraction of craquelure...1

Authors - M Fernandes<sup>1,2</sup>, R Araújo<sup>1</sup>, G Almeida<sup>1</sup> and S Paredes<sup>2</sup>  
<sup>1</sup>JTA – The Data Scientists, Portugal  
<sup>2</sup>Polytechnic Institute of Coimbra, Portugal

**Session B – Innovations in signal processing and modelling for complex industrial systems**

**Chairs: Professor F Pellicano and Dr A Zippo** Room: **B: Crimson Birch**

**11.00 [IB1] Lateral bearing stiffness effect on the spiral bevel gear non-linear vibration response...8**

*Authors - F Samani<sup>1,2</sup>, M Molaie<sup>2</sup>, S Rakhshani<sup>1</sup>, M Asadi<sup>1</sup>, R Ebrahimnejad<sup>2</sup>, A Zippo<sup>2</sup>, G Iarriccio<sup>2</sup> and F Pellicano<sup>2</sup>*

*<sup>1</sup>Shahid Bahonar University of Kerman, Iran*

*<sup>2</sup>University of Modena and Reggio Emilia, Italy*

**11.20 [IB2] Dynamical response of electrical transmission system...N/A**

*Authors - R Ebrahimnejad, M Molaei, G Iarriccio, A Zippo and F Pellicano*  
*University of Modena and Reggio Emilia, Italy*

**11.40 [IB3] Fault diagnosis for rotating machine based on Mel spectrogram and residual neural network...20**

*Authors - F Tu, S Yang and J Yang*  
*Sichuan University, China*

**12.00 [IB4] Distinguished Overview Lecture: Difference mode decomposition: the uniqueness of classical Fourier transform for machine condition monitoring...N/A**

*Author - D Wang*  
*Shanghai Jiao Tong University, China*

**13.30 Plenary Keynote Lecture – [2A0] Enhancing asset integrity in the oil & gas industry through condition monitoring of storage infrastructures: a sensor-based approach...N/A**

Author - Dr S Babu, Singapore

Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria

**14.00 CM Book Update**

Author - Professor A Hope, UK

Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria

**Session A – Advances in interpretable condition monitoring and diagnostic methods**

Chairs: **Professor D Wang** Room: **A: Wisteria**

**14.10 [2A1] Interpretable fusion methodology of health indices and multi-dimensional analogue on complex industrial turbine cavitation condition monitoring...N/A**

Authors - Y Fu<sup>1</sup>, D Wang<sup>1</sup> and Z Peng<sup>1,2</sup>

<sup>1</sup>Shanghai Jiao Tong University, China

<sup>2</sup>Ningxia University, China

**14.30 [2A2] Composite health index construction for online monitoring based on control chart performance optimisation...N/A**

Authors - Y Wang, D Wang and B Hou

Shanghai Jiao Tong University, China

**14.50 [2A3] Aero engine remaining life prediction based on grey similarity multi-scale matching...32**

Authors - S Sun<sup>1,2</sup>, H Huang<sup>1</sup>, J Ding<sup>1</sup>, W Lu<sup>1,2</sup> and D Wang<sup>3</sup>

<sup>1</sup>Harbin Institute of Technology, China

<sup>2</sup>Guangdong Provincial Key Laboratory of Intelligent Morphing Mechanisms and Adaptive Robotics, China

<sup>3</sup>Shanghai Jiao Tong University, China

**15.10 [2A4] Gaussian assumptions free interpretable linear discriminant analysis for machine condition monitoring...N/A**

Authors - Y Chen and D Wang

Shanghai Jiao Tong University, China



**Session B – Innovations in signal processing and modelling for complex industrial systems continued**

**Chairs: Professor F Pellicano and Dr A Zippo** Room: **B: Crimson Birch**

**14.10 [2B1] Application of minimum entropy decomposition rolling element bearing fault analysis in a permanent magnet motor...N/A**

*Author - S Ganeriwala  
SpectraQuest Inc, USA*

**14.30 [2B2] Matsuoka non-linear oscillator integration for investigating Parkinsonian tremor dynamics through multibody simulation...44**

*Authors - A Zippo and F Pellicano  
University of Modena and Reggio Emilia, Italy*

**14.50 [2B3] Developing a digital twin model for a centrifugal pump: opportunity and challenges...N/A**

*Author - S Ganeriwala  
SpectraQuest Inc, USA*

**15.10 [2B4] Failure mode and slip frequency analysis in induction motor...N/A**

*Author - S Ganeriwala  
SpectraQuest Inc, USA*

**Session A – Computer vision and deep learning for structural health monitoring of renewable energy**

Chairs: **Professor M Shafiee** Room: **A: Wisteria**

**15.50 [3A1] Computer vision and deep learning for structural health monitoring of wind turbines...N/A**

Author - M Shafiee  
University of Surrey, UK

**16.10 [3A2] Monitoring mooring lines of floating offshore wind turbines: autoregressive coefficients and stacked auto-associative deep neural networks...51**

Authors - S Sharma<sup>1</sup> and V Nava<sup>1,2</sup>  
<sup>1</sup>Basque Center for Applied Mathematics, Spain  
<sup>2</sup>Tecnalia, Spain

**16.30 [3A3] The application of the process capability index (PCI) in a fatigue test of a tidal turbine blade using historic and real-time load data...63**

Authors - M Munko, K Connolly, F Cuthill, M Valdivia Camacho, E McCarthy and S Lopez Dubon  
University of Edinburgh, UK

**16.50 [3A4] THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION**

**Session B – Condition monitoring methods and technologies**

Chair: **D Whittle** Room: **B: Crimson Birch**

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Authors - C Li and L Zhang  
University of Manchester, UK

**16.10 [3B2] Gearbox fault detection method under unseen working conditions and damage...93**

Authors - S Wang, Y Vidal and F Pozo  
Universitat Politècnica de Catalunya, Spain

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Author - J Harris  
Defence Science and Technology Group, Australia



**09.00 Plenary Keynote Lecture – [4A0] Artificial intelligence (AI) and its applications: a future perspective...N/A**

*Author - W Mansoor, UAE*

*Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria*

**Session A – Condition monitoring management, training and certification**

*Chair: S Mills Room: A: Wisteria*

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*Author - E Pereira*

*Glasgow Caledonian University, UK*

**09.50 [4A2] Title to be confirmed...N/A**

*Author - G Walker*

*Faraday Predictive Ltd, UK*

**10.10 [4A3] Effective conference presenting...123**

*Author - S Mills*

*SpectrumCBM Ltd, UK*

**Session B – AI in condition monitoring**

Chair: **D Manning-Ohren** Room: **B: Crimson Birch**

**09.30 [4B1] Alleviating limited dataset in inter-shaft bearing fault diagnosis based on multi-source information with information discriminator...127**

Authors - Y Yu and H R Karimi  
Politecnio di Milano, Italy

**09.50 [4B2] A post-hoc analysis of deep learning approach for cracks identification in concrete structures...N/A**

Authors - M Sohaib<sup>1</sup>, M Junayed Hasan<sup>2</sup> and Z Zheng<sup>1</sup>  
<sup>1</sup>Zhejiang Normal University, China  
<sup>2</sup>Robert Gordon University, UK

**10.10 [4B3] Enhancing gas pipeline monitoring with graph neural networks: a new approach for acoustic emission analysis under variable pressure conditions...134**

Authors - M Junayed Hasan<sup>1</sup>, M Arifeen<sup>1</sup>, M Sohaib<sup>2</sup>, A Rohan<sup>1</sup> and S Kannan<sup>1</sup>  
<sup>1</sup>Robert Gordon University, UK  
<sup>2</sup>Zhejiang Normal University, China

**Session A – General condition monitoring**

Chair: **Professor A Hope** Room: **A: Wisteria**

**11.10 [5A1] Visualising vibration: a ‘gamechanger’ for troubleshooting, diagnostics and root cause analysis...N/A**

Author - D Whittle  
RMS Ltd, UK

**11.30 [5A2] Update on ISO standards in condition monitoring...144**

Author - S Mills  
SpectrumCBM Ltd, UK



**Session A – Vibration monitoring and analysis**

Chair: **Professor A Hope** Room: **A: Wisteria**

**11.50 [5A3] Mind the gap...N/A**

Author - D Manning-Ohren  
Eriks, UK

**12.10 [5A4] Instrumentation condition monitoring vibration and failure analysis of screw air compressor package in liquefied natural gas plant...155**

Author - E Pereira  
Glasgow Caledonian University, UK



**Session B – AI in condition monitoring**

Chair: **Dr J Griffaton** Room: **B: Crimson Birch**

**11.10 [5B1] Modelling of the vibratory response of an aircraft engine using AI...167**

Authors - J Gomez and J Griffaton  
Safran Aircraft Engines, France

**11.30 [5B2] Anomaly detection for complex equipment monitoring...179**

Authors - J Becu, C Thirard, B Wascot and T Mazoyer  
Acoem, France

**Session B – Human dynamics and health-related condition monitoring**

Chair: **Professor S Noroozi** Room: **B: Crimson Birch**

**11.50 [5B3] Cadaveric testing of a novel sensor for non-destructive load balancing in total knee replacements (TKRs)...191**

*Authors - S Al-Nasser, S Noroozi and A Harvey  
Bournemouth University, UK*

**12.10 [5B4] The need for monitoring deltoid tension and shoulder kinematics during a total reverse shoulder arthroplasty (RSA)...196**

*Authors - S Noroozi, N Aslani, S Al-Nasser and R Hartley  
Bournemouth University, UK*

**13.30 Plenary Keynote Lecture – [6A0] Ultra-fast laser-enabled ultrasonic material characterisation and AI-facilitated quality monitoring in additive manufacturing...N/A**

*Author - Professor Z Su, China*

*Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria*

**Session A – General condition monitoring**

*Chair: S Greenfield Room: A: Wisteria*

**14.00 [6A1] Criticality, risk assessment and cost-effective condition monitoring examples...203**

*Author - S Greenfield*

*Anokhi Consulting Engineers, UK*

**14.20 [6A2] Varnish in oil: the true amount...N/A**

*Author - R Cutler*

*Oil Analysis Laboratories, UK*



**Session A – General condition monitoring continued**

Chair: **S Greenfield** Room: **A: Wisteria**

**14.40 [6A3] Monitoring energy recovery in a full-scale fatigue test...217**

Authors - M Munko<sup>1</sup>, S Lopez Dubon<sup>1</sup>, F Cuthill<sup>1</sup>, W Rampen<sup>1</sup> and C Ó Brádaigh<sup>2</sup>

<sup>1</sup>University of Edinburgh, UK

<sup>2</sup>University of Sheffield, UK

**15.00 [6A4] Impulsive mode decomposition and its four application cases to impulsive signal extraction...229**

Authors - B Hou and D Wang

Shanghai Jiao Tong University, China



**Session B – Advanced signal processing and diagnostics in condition monitoring**

Chair: **Dr E Juuso** Room: **B: Crimson Birch**

**14.00 [6B1] Natural language-based information in intelligent condition monitoring and control...236**

Author - E Juuso

University of Oulu, Finland

**14.20 [6B2] Estimation of remaining useful life (RUL) of rolling element bearings based on the adaptive kernel Kalman filter...247**

Authors - Z Li, R Zhu, T Verwimp, H Wen and K Gryllias

KU Leuven, Belgium

## CM 2024 – Wednesday 19 June

### **Session B – Title to be confirmed**

Chair: to be confirmed Room: **B: Crimson Birch**

#### **14.40 [6B3] Condition monitoring of aero engines: big data challenges and a comparison to NDT...N/A**

Author - I Baillie  
Rolls-Royce plc, UK

#### **15.00 [6B4] THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION**

**Session A – Title to be confirmed**

Chair: to be confirmed Room: **A: Wisteria**

**15.40 Workshop – An introduction to oil debris monitoring technologies...N/A**

Author - S Greenfield

Anokhi Consulting Engineers, UK

**16.20 Workshop – Vibration analysis diagnostics and case study challenge...N/A**

Author - D Whittle

RMS Ltd, UK



**09.00 Plenary Keynote Lecture – [7A0] Non-contact-based sensing: fundamentals, impact and challenges...N/A**

*Author - Dr M Khan, UK*

*Chair: Professor A Hope, UK - Room A: Wisteria*

**Session A – General condition monitoring**

*Chair: to be confirmed Room: A: Wisteria*

**09.30 [7A1] Distinguished Overview Lecture: Deep information fusion for mechanical fault diagnosis...N/A**

*Author - H R Karimi*

*Politecnico di Milano, Italy*

**09.50 [7A2] Artificial intelligence on wind turbines...N/A**

*Author - T Lau*

*Sensonics Ltd, UK*

**10.10 [7A3] Distinguished Overview Lecture: Challenges in condition monitoring for industry, academics and standardisation organisations...N/A**

*Authors - M Behzad<sup>1</sup> and L Gelman<sup>2</sup>*

*<sup>1</sup>Sharif University of Technology, Iran*

*<sup>2</sup>University of Huddersfield, UK*



**Session B – NDT and SHM**

Chair: **Dr J Griffaton** Room: **B: Crimson Birch**

**09.30 [7B1] Non-destructive evaluation of debonding in composites using air-coupled coda wave analysis and local defect resonance techniques...N/A**

Authors - Z Li and J Jiao  
Beijing University of Technology, China

**09.50 [7B2] Construction of tensile curves via conformal prediction...259**

Authors - D Razafindrakoto<sup>1,2</sup>, A Celisse<sup>1</sup>, J Lacaille<sup>2</sup>, L Sadeg Martelet<sup>2</sup> and F Corpace<sup>2</sup>  
<sup>1</sup>Université Paris I Panthéon-Sorbonne, France  
<sup>2</sup>Safran Aircraft Engines, France

**10.10 [7B3] Distinguished Overview Lecture: Automated defect detection in aeronautic materials using machine learning and neural networks...N/A**

Author - J Lacaille  
Safran Aircraft Engines, France

**Session A – General condition monitoring**

Chair: **Professor L Gelman** Room: **A: Wisteria**

**11.00 [8A1] Distinguished Overview Lecture: Quantum physics and artificial intelligence: current challenges and opportunities in technical diagnostics and condition monitoring...269**

Author - R Burdzik  
Silesian University of Technology, Poland

**11.20 [8A2] Novel condition monitoring technologies via motor current signature analysis...N/A**

Author - L Gelman  
University of Huddersfield, UK

**11.40 [8A3] Distinguished Overview Lecture: Assessing the success or failure of a reliability engineering programme in the wind industry...N/A**

Authors - D Hickey and B Simmonds  
Natural Power, UK

**Session B – Maintenance**

Chair: **to be confirmed** Room: **B: Crimson Birch**

**11.00 [8B1] An individual report reviewing the current maintenance effectiveness of a safety-critical site (ABC Chemical Manufacturers) ...281**

Authors - J Watkinson, A Ompusunggu and J Orson  
Cranfield University, UK

**11.20 [8B2] THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION**

**11.40 [8B3] THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION**

**12.00 Plenary Keynote Lecture – [9A0] Condition monitoring of aero engines: big data challenges and a comparison to NDT...N/A**

Author - Professor I Baillie, UK

Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria

**12.30 Panel Session – Future directions in condition monitoring...N/A**

Author - Speaker(s) to be confirmed

Chair: Professor L Gelman, University of Huddersfield, UK - Room A: Wisteria