SYMPOSIUM Vibration of Wind Turbines

organized by Wölfel

June 13 and 14, 2024 - Hamburg

Conference Chairman

Prof. Dr.-Ing. Peter Kraemer, Head of Chair for Mechanics with Focus on Structural Health Monitoring, University of Siegen

Program Committee

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Dr.-Ing. Samer Mtauweg, Managing Partner Product Development, MML Solutions GmbH, Wesel

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Dr. Arno van Wingerde, Chief Scientist, Fraunhofer Institute for Wind Energy Systems (IWES), Bremerhaven

Prof. Dr.-Ing. Jan Wenske, Deputy Institute Director, Technical Director, Fraunhofer Institute for Wind Energy Systems (IWES), Bremerhaven

Dr. Timo Zundel, Head of Modelling & Verification, Winergy, Flender GmbH, Voerde

Venue:
Empire Riverside Hotel
Bernhard-Nocht-Str. 97
20359 Hamburg

Participation Fee:
€ 800,- plus VAT

Click here to register

PROGRAM

First day of the event
Thursday, June 13th

12:00 Registration and Business-Lunch-Buffet

13:00 Welcome and Opening
Prof. Dr.-Ing. Peter Kraemer, Head of Chair for Mechanics with Focus on Structural Health Monitoring, University of Siegen

Key Note

13:15 Tower Thrust and Bending Moment Identification of an Operating 2.5 MW Wind Turbine with Accelerator and Satellite Positioning Data
- Tower thrust
- Tower bending moment identification
- Load identification
- Operating wind turbine

Prof. Dongsheng Li, Civil Engineering and Smart Construction, Shantou University

Simulation and analysis of dynamic behavior

14:00 Powertrain-Integrated Technologies for Effective Tonality Mitigation
- Challenges with direct-couple, highly integrated powertrains
- Dynamic systems behaviour of powertrains
- Investigations on noise and tonality relevant wind turbine vibrations
- Mitigation of mechanical sounds and drivetrain tonality

Alexander Kari, Business Development Manager, Stephan Lange, Manager R&D Vdamp, Geislinger GmbH, Hallwang/Salzburg, Martin Cardaun, Chair for Wind Power Drives, Group Lead Plant Design, RWTH Aachen University

14:30 On Wind Turbine Models for Drivetrain Vibration Simulation: Implementation and Comparison with Field Test Data
- Drivetrain model development
- Aeroelastic wind turbine model
- Fully-coupled wind turbine drivetrain simulation
- Comparison of field vibration response with simulation prediction

M.Sc. Paul Feja, Group Manager Test and Method Development, M.Sc. Muhammad Omer Siddiqui, Research Associate, Fraunhofer IWES, Bremerhaven

PROGRAM

15:00 Influence of Powertrain, Wind Turbine and Measurement Spread on Gear-Excitation Induced Tonality
- Conceptual view on potential sources of spread: From gear excitation over powertrain and wind turbine transfer path to measurement procedure
- Detailed tolerance study at one example (measurement and simulation)
- Simulation process allowing to integrate different spread sources in tonality potential prediction

Philip Becht, Lead Noise and Vibration Engineer, Sebastian Schmidt, Team Lead NVH & Loads, Benjamin Marrant, Senior Technology Engineer, ZF Wind Power Antwerpen NV, Lommel/Lohr am Main

15:30 Wind Turbine Blade Motion Estimation: Integrating Low Cost IMUs with Sensor Fusion Techniques
- Overview on advances in wireless blade-mounted sensors
- Sensor fusion and state estimation for structural monitoring, analysis and control
- Key findings and outlook

Till Pitzke, Project Student, ETH Zürich, Institute of Strucutural Engineering, Chair of Structural Mechanics and Monitoring, Ph.D. Imad Abdallah, Department of Civil, Environmental and Geomatic Engineering, Zürich, Ph.D. Julien Deparday, OST - Eastern Switzerland University of Applied Sciences, Rapperswil-Jona

16:00 Coffee Break

Artificial Intelligence / Machine Learning

16:30 Using Deep Learning to Identify Drivetrain Deflection Shapes Causing Tonalities in Radiated Sound
- Tonalities: definition, causes and reduction methods
- Data: simultaneous acceleration and sound measurements
- Analysis: finding the relevant drivetrain vibration components for reduction of tonalities

Dr. Kilian Schulze-Forster, Development Engineer, Dr.-Ing. Philipp Zech, Head of Development Vibration Control Solutions, Dr.-Ing. Manuel Eckstein, Engineering Director, Wölfel Engineering GmbH & Co. KG, Höchberg

17:00 Framework for Developing AI-Driven Image Analysis Systems for the Wind Energy Industry
- Introduction to AI in image analysis: example of wind turbine gearbox monitoring
- Choosing training data: importance of selecting diverse and high-quality training data
- Selecting the right AI model: decision-making process in choosing AI models like CNNs
- Evaluating AI performance: methods for scientifically assessing the accuracy and reliability of AI systems. Integrating metadata, self-learning mechanisms, and application of these methodologies in different industrial contexts.

Dr. Lars Osterbrink, AI Developer, Dr. Thomas Driebe, AI Developer, Daniel Hein, Business Administrator, Adoxin UG, Hamburg/Marburg

17:30 Rolling Element Bearing Fault Detection Based on Pretraining of Deep Neural Networks to Address the Challenge of Data Scarcity
- Rolling element bearing fault detection: Identification and classification of damages to determine the type of fault, such as outer race, inner race, ball, or cage faults
- Pretraining: Training a deep neural network on a large dataset composed of simulation data before fine-tuning it on a task-specific dataset with real world data
- Transformer network: Powerful deep learning model that employs self-attention mechanisms to capture relationships between input elements.

M.Sc. Jessica Selina Ochs, Research Assistant, Technische Hochschule Lübeck

18:00 Wrap Up Day 1 & End of Day 1

Evening Event

19:00 Round Table Exchange with Conference Board Members

20:00 Get-together with dinner

Venue:
Penthouse Elb-Panorama
Bernhard-Nocht-Straße 113
20359 Hamburg

Second day of the event
Friday, June 14th

8:30 Welcome with Coffee Selection

Key Note

9:00 Offshore Wind Turbine Foundation - Overview and Design Challenges due Vibratory Effects
- Expansion goals of offshore wind
- Overview of foundation design aspects (T&I) and operation
- T&I related design aspects (vibro installation, impact installation, noise)
- Operation related design aspects (stress related damages)

Dr.-Ing. Falk Lüddecke, CEO, Jörss–Blunck-Ordemann GmbH, Hamburg

PROGRAM

Condition and Structural Health Monitoring / Non-Destructive-Testing

9:45 Experiences from In-Situ Monitoring of (Offshore) Wind Turbines - from Sensor Installation to Data Driven Modelling of the Dynamical Behavior
- Structural Health Monitoring
- Performance monitoring
- Long-time monitoring of offshore turbine
- Large-scale test rig experiment

Prof. Dr.-Ing. Peter Kraemer, Head of Chair for Mechanics with Focus on Structural Health Monitoring, Marcel Wiemann, Jonas Kappel, Lukas Bonekemper, University of Siegen, Dr. Herbert Friedmann, Wölfel Engineering GmbH & Co. KG, Höchberg, Holger Huhn, WindMW Service GmbH, Bremerhaven

10:15 Coffee Break

10:45 Laser Doppler Vibrometry of Moving Rotor Blades of Wind Turbines
- Distant vibration measurement
- Optical tracking of rotorblades
- Measuring system integrated into car trailer
- Analysis of vibration spectra

Dr. Ilja Kaufmann, Research Associate, Project Manager, Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB, Ettlingen,Thole Horstmann, Research Associate, Fraunhofer Institute for Wind Energy Systems IWES, Bremen, Holger Nawrocki, CEO, Nawrocki Alpin GmbH, Berlin

11:15 A Sensor for Every Turbine; Enabling Fleetwide Fatigue Load Monitoring and Structural Health Monitoring
- A low-cost accelerometer was installed in every wind turbine of a offshore wind farm
- Machine learning is used to relate the measurements to fatigue loads and monitor fatigue progression
- Scour monitoring is enabled through an updated structural model of every turbine

Dr.Ir. Wout Weijtjens, Senior Researcher, Prof. Dr. Christof Devriendt, Head of Research, OWI-lab, Vrije Universiteit Brussel, Dr. Nymfa Noppe, Service manager, 24SEA BVBA, Brussels

11:45 Online Monitoring of Offshore-Converter-Platforms in the North-Sea
- SHM of offshore converter plattforms
- Motion monitoring
- Fatigue assessment

DI Peter Furtner, Authorized Representative and Shareholder, Martin Stöger, Head of Department SHM, VCE Vienna Consulting Engineers ZT GmbH, Wien, Dr.-Ing. Elmar Wisotzki, Tennet TSO GmbH

12:15 Business-Lunch

Measures for vibration and load reduction

13:15 Pitchsystem Dynamics and Interaction with Pitch Gear Wear (Golden Tooth) and Blade Bearing Race Way Life Time
- Field experiences with various types of damage to the teeth of the blade bearing of a wind turbine (Golden Tooth)
- Field experience with damage to the blade bearings (raceway, sealing system, screw connections)
- Measurement solution for early damage detection and root cause analysis
- Counter measures to avoid damage and system optimization (design and control strategy)

Dr.-Ing. Samer Mtauweg, Managing Partner Product Development, MML Solutions GmbH, Wesel

13:45 Video-Based Vibration Check – a Cost-Effective and Simple Way to Detect Rotor Imbalance
- Current case studies on rotor imbalance cost impact
- Procedure and advantages of video-based rotor imbalance check
- Outlook on video-based vibration measurements

Dr.-Ing. Christoph Heilmann, Head of R&D, M. Eng. Martin Peters, Head of Measurement Technology, Green Wind Engineering GmbH, Berlin

14:15 Vibration Control in the Cylinder Holder Section of the Hydraulic Pitch System using a Magnetorheological Damper in a Wind Turbine
- Vibration control
- Magnetorheological damper
- Wind turbine rotor

Dr. Josué Enríquez-Zárate, CEO-Researcher, A. Cabrera Amado, L. Toledo Sesma, AP Engineering Innovación Tecnológica en Energías S.A. de C.V., Ixtepec, Oaxaca

14:45 Wrap Up Day 2 & End of Conference

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in cooperation with the VDI Technical Division Vibration Technology