University of Stavanger

Prof. Tor Hemmingsen

Department of Mechanical and Structural Engineering and Materials Science

UiS Contact Offshore Wind Energy

Offshore Wind Research

## Faculty of Science and Technology

tor.hemmingsen@uis.no

UiS and Faculty of Science and Technology Strategy 2030

UiS

TN

- **Energy**
- **Ocean**
- Health
- Digital Technology
- Safety
- Excellent research and education

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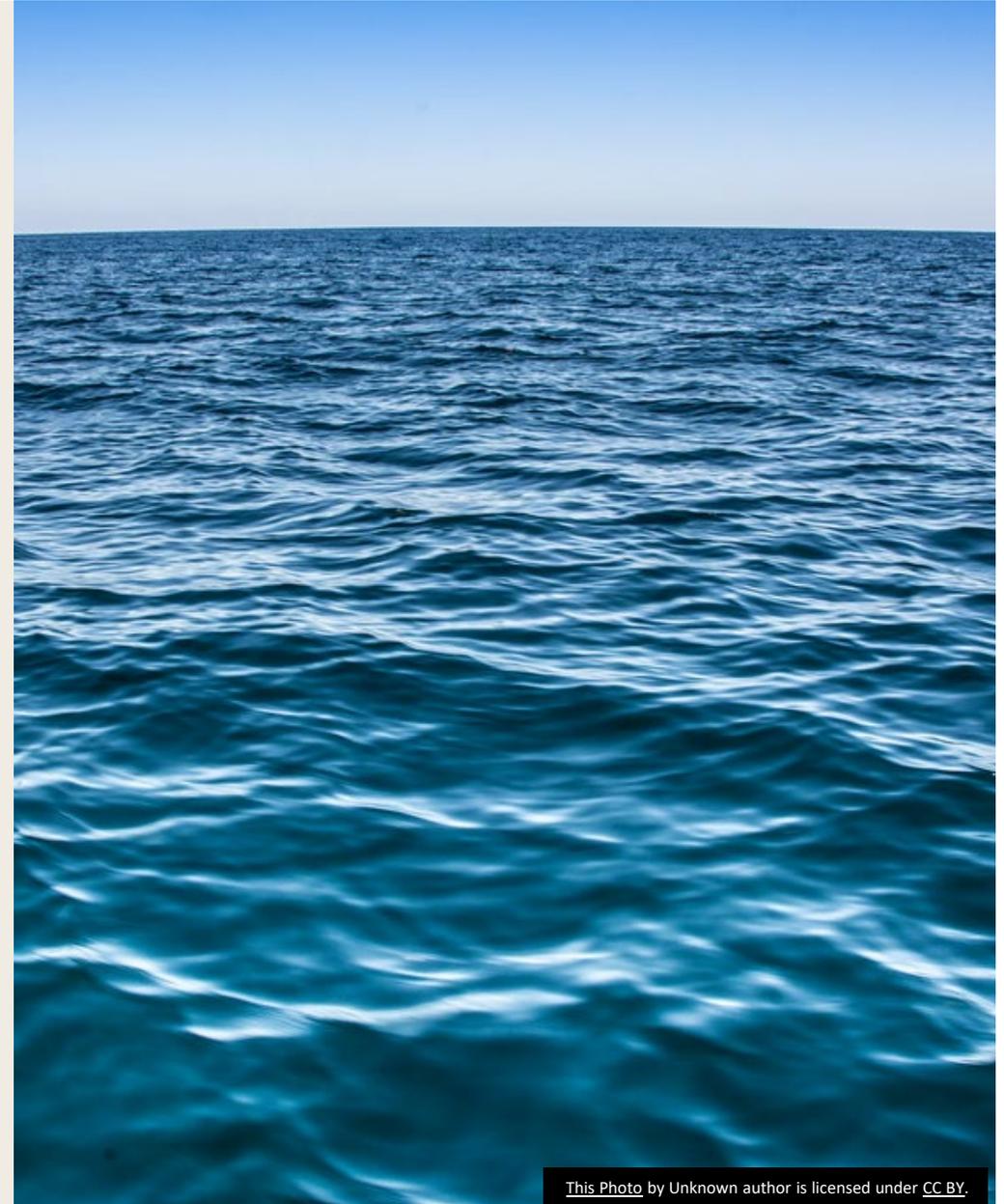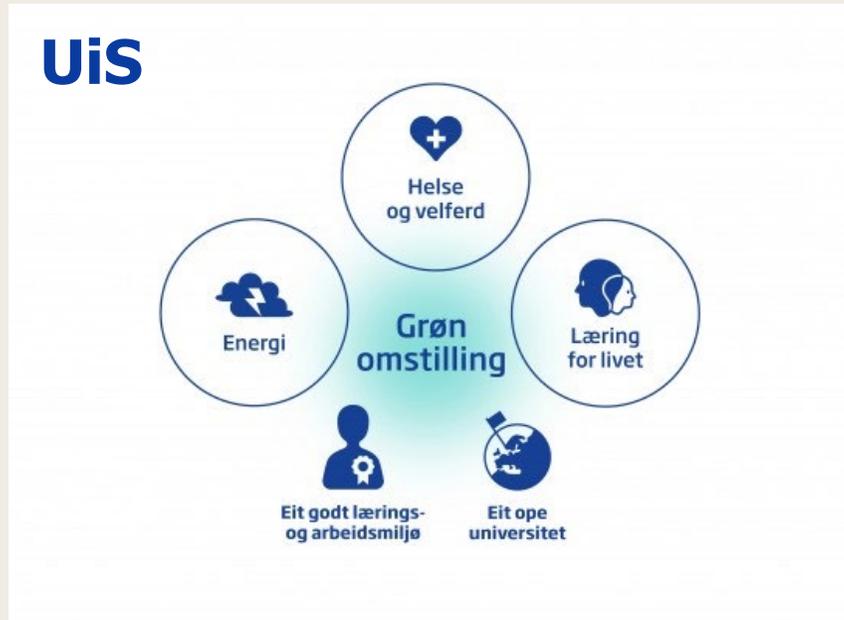
Collaboration agreement signed between UiS and Norwegian Offshore Wind Cluster and MetCentre

○ MoU avtalene (Memorandum of Understanding) ble inngått under åpningen av CoTech-konferansen 25. november 2021.

○ Det var prorektor for forskning, Merete Vadla Madland, og daglig leder ved MetCentre og Norwegian Offshore Wind Cluster, Arvid Nesse, som stod for signeringen.

https://www.uis.no/nb/havteknologi/signerte-ny-samarbeidsavtale-om-havvind

From cradle to grave
- Planning
- Cost
- Construction
- Installation
- Operation and maintenance
- Decomissioning

Turbine: blades, rotor, gear box, shaft, brake, generator

Operations and maintenance: Data-driven decisions, life cycle analysis, condition monitoring and prognostics, digital work processes.

Condition monitoring and Maintenance

Steel structure: Monopile, foundation

Loads: wind and wave loads
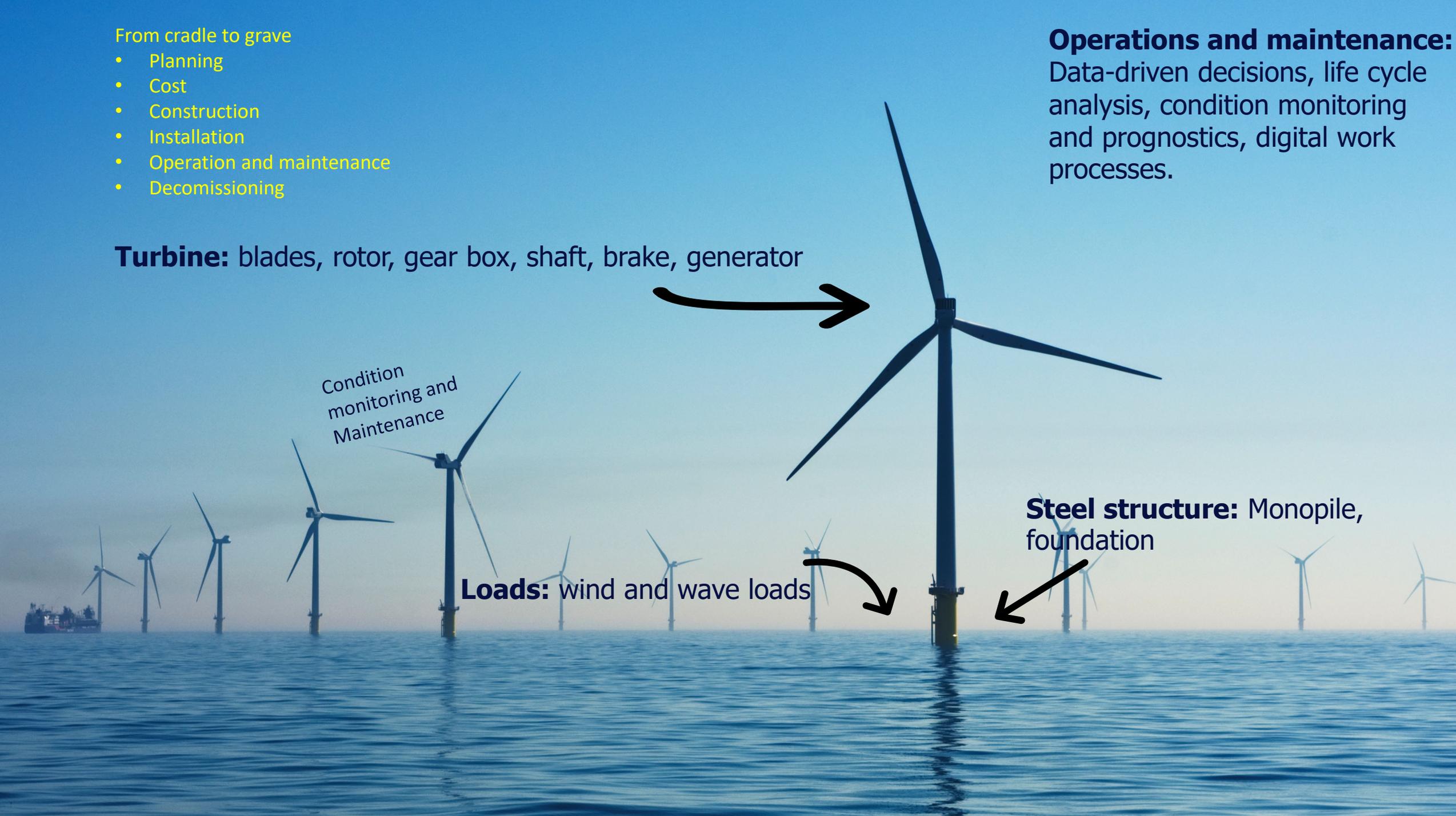
Multi-disciplinary

- Department of mechanical and structural engineering and materials science

- Department of energy and petroleum engineering

- Department of energy resources

- Department of safety, economics and planning

- Department of electrical engineering and computer science

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Key professors Offshore Wind Energy*

* More detailed presentation at the end of this presentation

Key professors Offshore Wind Energy

- Muk: Structural Dynamic Analysis of Offshore Wind Turbines
- Charlotte: Extreme wave loads on wind turbine foundations
- Yian: Wind Turbine Drivetrains
- Jasna: Wind loads on structures
- Lin: Installation of Offshore Wind Turbines
- Knut Erik: Computational fluid dynamics
- Jayantha: Systems and Asset integrity
- Idriss: Predictive Health monitoring of machines
- Guillermo:Fatigue in concrete of concrete offshore wind turbine foundations
- Hirpa: Design optimization of energy convertors (incl. wave and wind energy)
- Dimitrios: Fatigue Design of Turbines and Monopile Structures

UiS PhD projects within Offshore Wind Turbines

	Title of PhD project	PhD candidate	Supervisors	Financing
1	Multi rotor offshore wind turbines	Omar El Beshbichi	Muk Chen Ong/Yihan Xing	UiS/KD
2	Combined wind and wave energy concepts	Chern Fong Lee	Muk Chen Ong/Dan Sui/Yihan Xing	NFR
3	Flexifloat truss-based turbine	Filippo Malaguti	Muk Chen Ong/Knut Høiland/Einar Sundal	Rosenberg Worley/NFR
4	Dynamic Analysis of Floating Offshore Wind Turbines	Rieska Putri	Charlotte Obhrai/Jasna Jakobsen	UiS/KD
5	Design optimization of power cables, shared electrical lines and mooring configurations for floating offshore wind turbines	Anja Schnepf	Muk Chen Ong/Carlos Lopez-Pavon/Øyvind Johnsen	Core Marine/NFR
6	Optimalisation of turbin control system and installation	Soheil Salahshour Langeroodi	Muk Chen Ong/Bjørn Skaare/ Zhiyu Jiang	Equinor-UiS Akademia programmet
7	Non-neutral wind profile on large rotor wind turbine	NN - 2022	Charlotte Obhrai/Jasna Jakobsen	NFR-FRIPRO
8	Integrated systems for offshore fish farming and marine renewables	NN -2022	Lin Li/Muk Chen Ong/Sverre Haver	UiS/KD

Some related projects at UiS for offshore wind

○ https://tv.nrk.no/serie/distriktsnyheter-rogaland/201901/DKRO98011419/avspiller

○ Bilde fra https://www.norceresearch.no/nyheter/vind-viser-vei

Klar for montering av vindmålere ved Obrestad fyr. Fra venstre Jarle Berge (UiS), Martin Flügge (NORCE), Benny Svardal (NORCE) og Pablo Saavedra (UiB).

Vertical-axis floating wind turbine (Gwind)
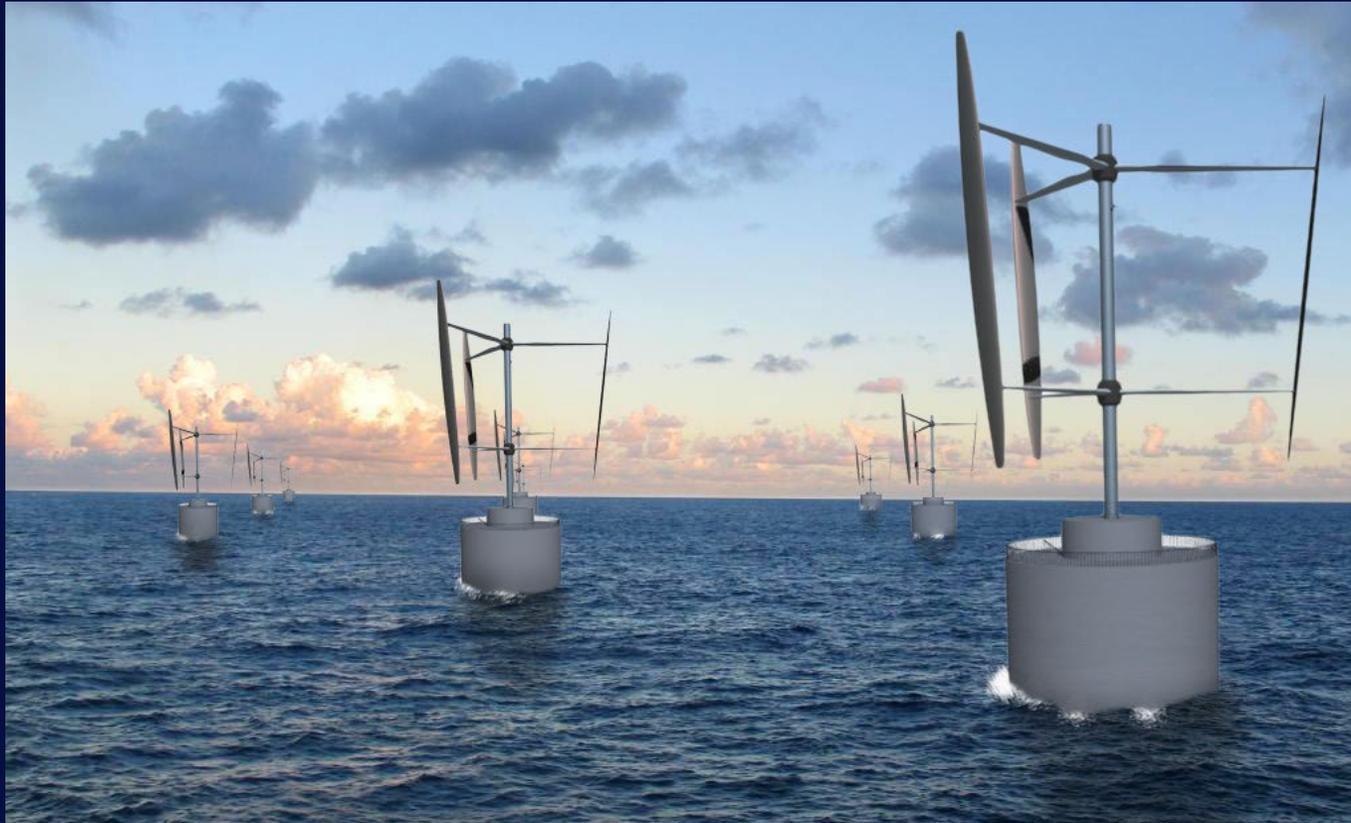
Wind measurement on the Lysefjord bridge

- NORCOWE project
- Collaboration with the Norwegian Public Roads Administration (NPRA)
- Giant project Coastal Highway Route E39 (Ferjefri E39)

Multi-Rotor Floating Wind Turbine

Vestas 4R-V29 in DTU Wind, Denmark (2017).

UiS OpenModelica Wind

Aero-Hydro-Servo-Elastic Simulation
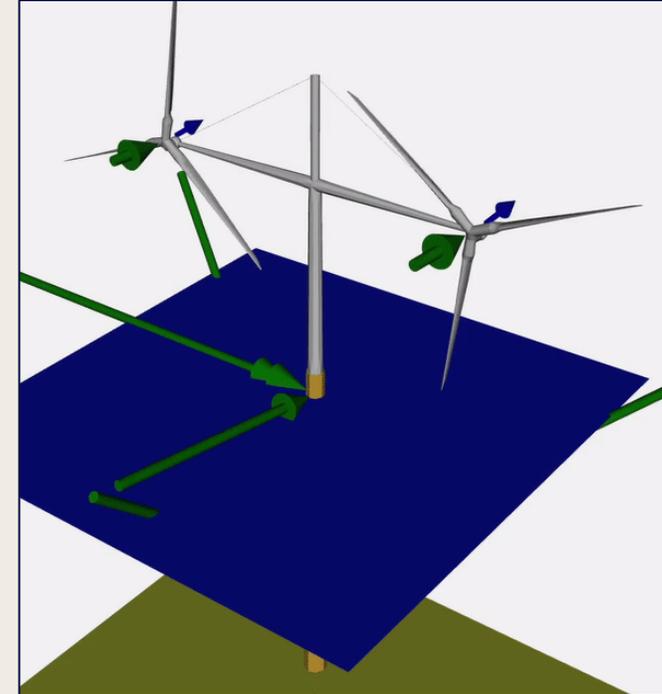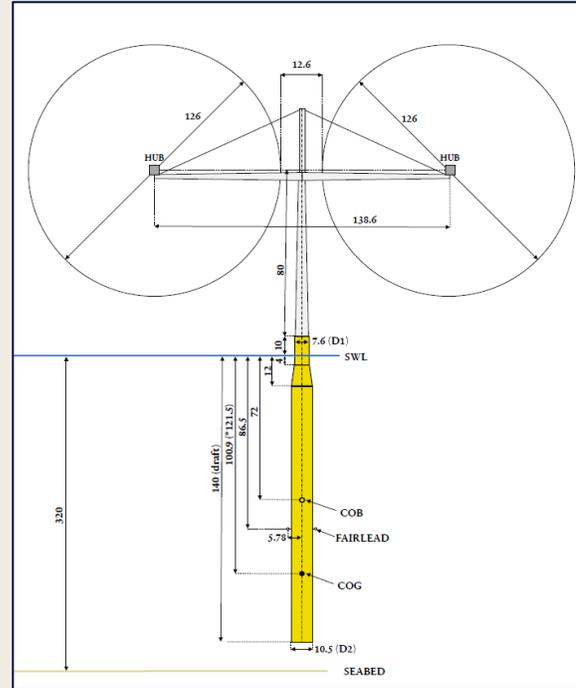
- Two-Rotor prototype study
- 28% potential mass saving

**Equinor-UiS Akademia Program**

Combined Wind-Wave Energy System

Equinor-UiS Akademia Program
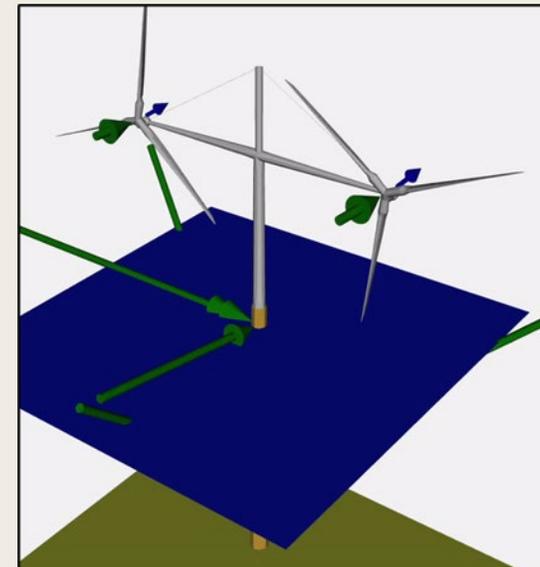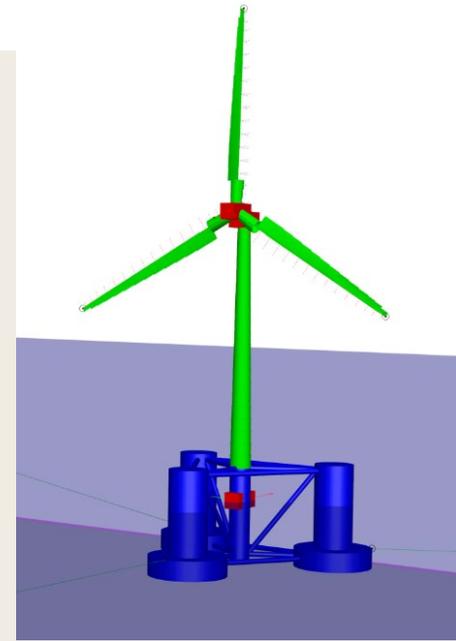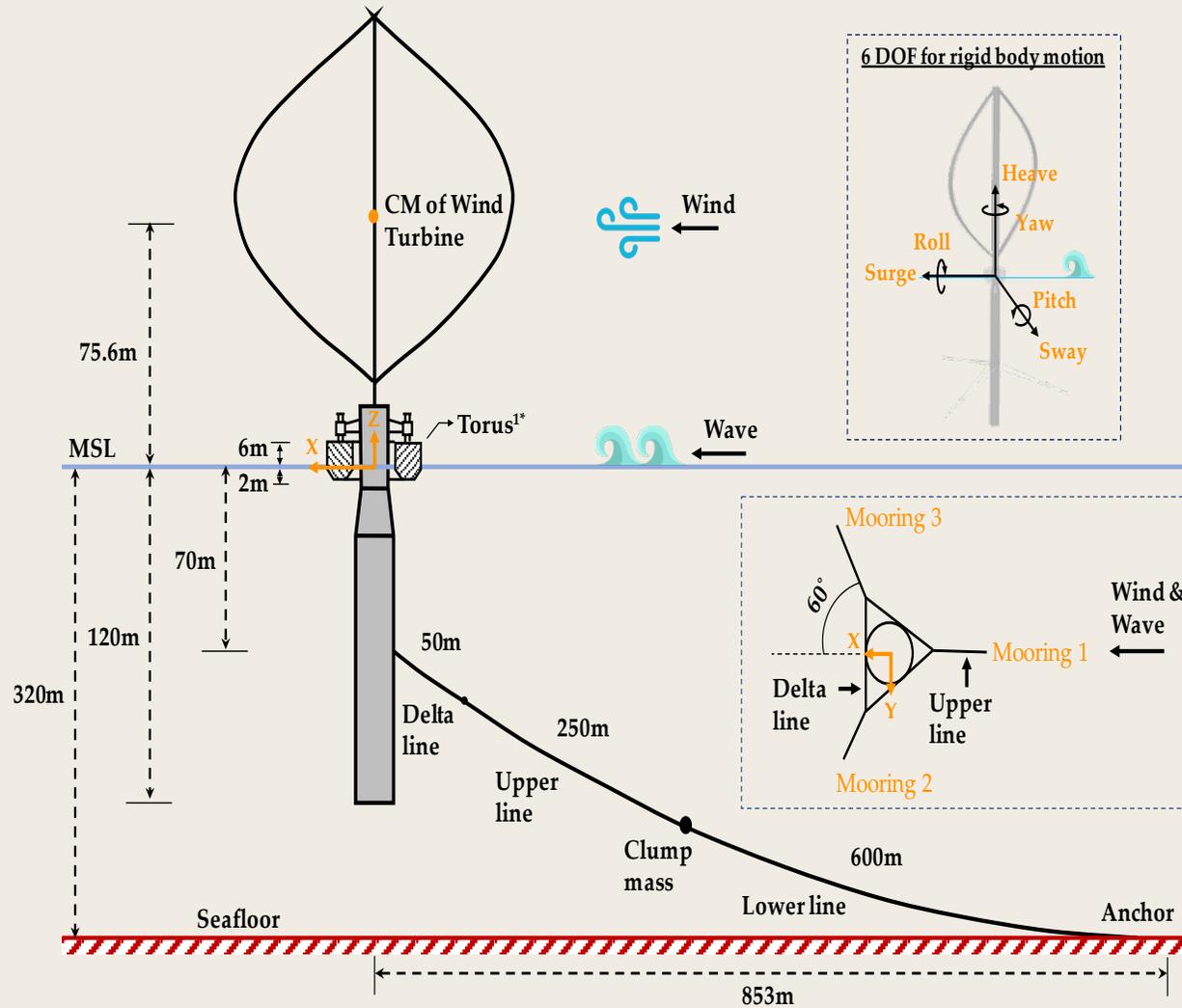
FlexiFloat

Combined Wind and Wave Energy System (Solar Energy)

FLOATING WINDPARK   SOLUTION   THE TEAM

FLOATING STORAGE OF WIND TURBINES

We customize and optimize floating foundation of wind turbines in marine areas

Forskningsrådet

**Nærings PhD
Industrial PhD**

ROSENBERG

Worley
energy | chemicals | resources
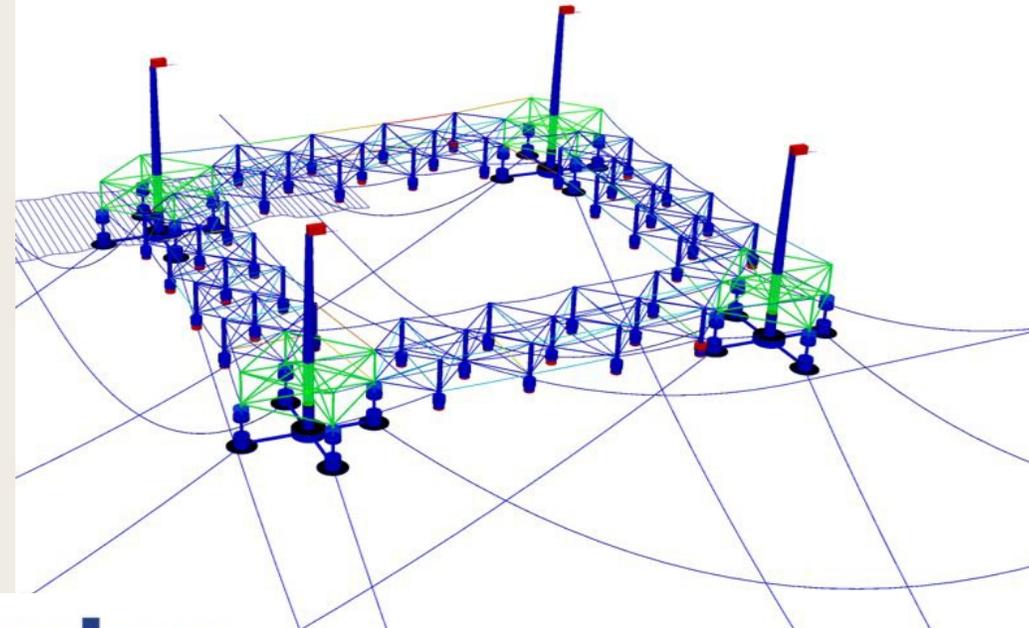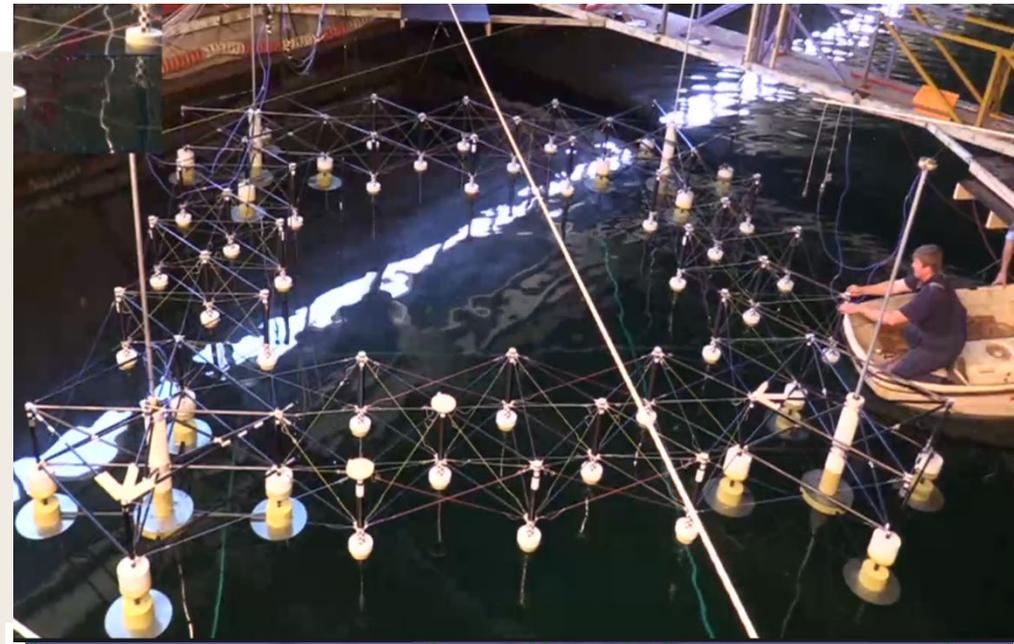
Failure Analysis and Wear monitoring of Mechanical Components

Fail analysis
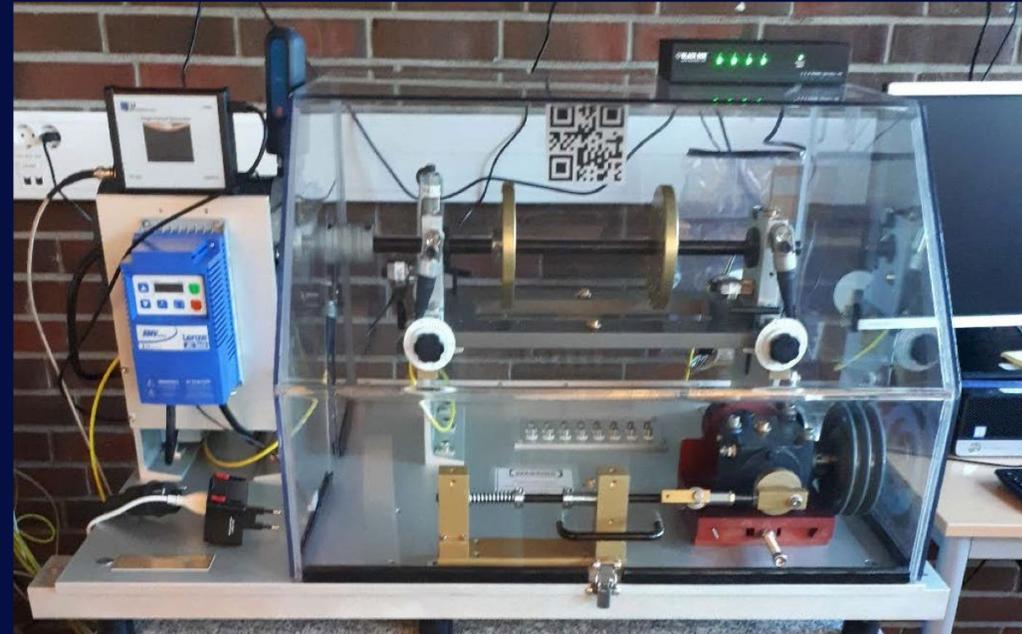
Wear evolution monitoring

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Enhanced Marine Operations for Offshore Wind

Photo: OIM Wind

- Investigating critical marine operation issues encountered during **installations, operation & maintenance.**

- Improving the **efficiency in operations** and further reducing the cost of energy.

Assessing the **decommissioning** process of an offshore wind farm considering cost, the effect on the environment and alternatives to decommissioning.

equinor

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Equinor-UiS Akademia Program

Professor Muk Chen Ong

Research interests

O Computational Fluid Dynamics with Turbulence Modelling

O Marine Operations and Installation

O Hydrodynamics on Offshore and Subsea Structures

O Structural Dynamic Analysis of Offshore Wind Turbines

O Scour and liquifaction around offshore wind turbines

Associate Professor Charlotte Obhrai

Research interests

○ Extreme wave loads on wind turbine foundations

○ The effect of atmospheric stability on the loads and motions of offshore wind turbines

○ The effect of met-ocean conditions on the installation and operation of offshore wind farms

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Professor Yihan Xing

Research interests

o Wind Turbine Drivetrains

o OpenModelica Modeling of Complex Machinery Systems

o Fatigue and Reliability Analysis of Machines and Structures

o Subsea Technology
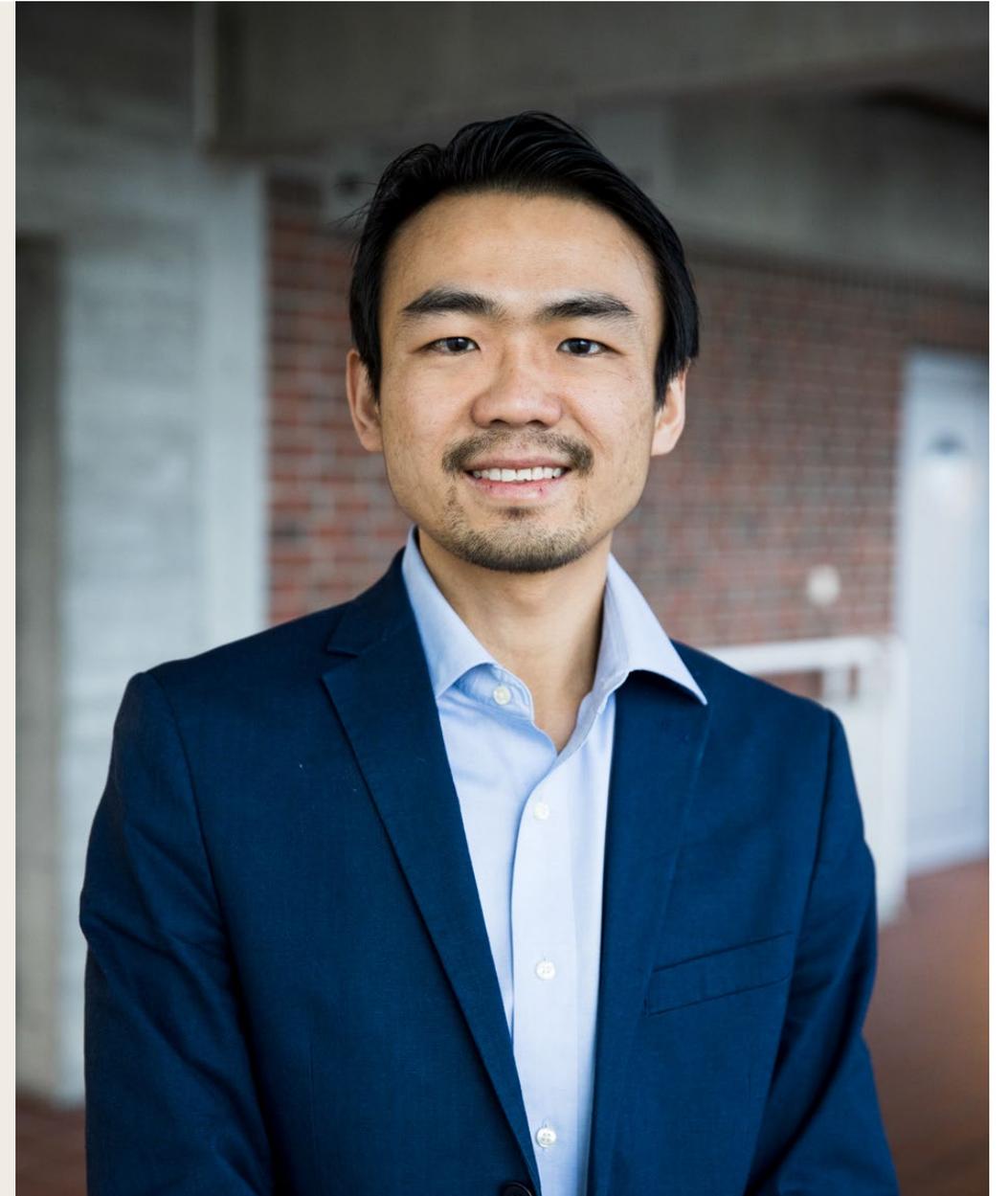
Professor Jasna B. Jakobsen

Research interests

- Wind loads on structures
- Structural dynamics
- Wind-structure interactions
- Full scale wind and vibrations monitoring and data analysis
  - Wind gust characterisation for structural design
  - Novel application of lidars
  - System identification

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Associate Professor
Lin Li

Research interests

○ Dynamic Analysis of Offshore Aquaculture Structures

○ Installation of Offshore Wind Turbines

○ Dynamic Analysis of Lifting Operations

○ Hydrodynamics on Offshore Structures

○ Joint Distribution of Environmental Data

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Associate Professor
Knut Erik Giljarhus

Research interests

- Computational fluid dynamics

- Multiphase flow

- Aerodynamics

- Turbulence modelling

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Professor
Jayantha Prasanna Liyanage

Research interests

- Systems and Asset integrity
- Integrated information systems
- Data-driven decisions
- Life cycle analysis,
- Digital work processes
- Complex systems
  performance optimization

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Associate Professor
Idriss El-Thalji

Research interests

- Predictive Health monitoring of machines
- Wear evolution in rolling bearings
- Systems engineering and architecting of innovative systems
- Industrial asset dynamics modelling and simulation

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Guillermo Rojas Orts

Research interests

- **Fatigue in concrete of concrete offshore wind turbine foundations**

- Ultra-High Performance Concrete (UHPC)

- Fiber reinforced concrete (FRC)

- Optimization of structures

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Professor Hirpa G. Lemu

Research Interests

- Design optimization of energy convertors (incl. wave and wind energy)

- Nature inspired approaches to design and optimization

- Multibody dynamic system modelling and analysis

- Computational methods (FEA/CFD)

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Professor Dimitrios Pavlou

Research interests

- Mechanics of Composite Blades

- Fatigue Design of Turbines and Monopile Structures

- Stress Analysis of Wind Turbines with Finite Elements

- Structural Dynamics and Foundation Design of Wind Turbines

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Competence Map of IMBM in Wind Energy

	Blades	Turbine	Tower	Foundation	Environmental loads	Operation, Maintenance, Condition Monitoring
Composite Materials	Dimitrios Pavlou					Jayantha Liyanage Idriss El-Thalji
Finite Elements		Dimitrios Pavlou Hirpa Lemu Ove Mikkelsen	Dimitrios Pavlou Hirpa Lemu Ove Mikkelsen	Dimitrios Pavlou Hirpa Lemu Ove Mikkelsen		
Fatigue Design and Structural Integrity		Dimitrios Pavlou Sudath Siriwardane	Dimitrios Pavlou Sudath Sirivardane Gerhard Ersdal Morten Langøy	Dimitrios Pavlou Sudath Sirivardane Gerhard Ersdal Morten Langøy		
Steel Structures			Sudath Sirivardane Dimitrios Pavlou			Jayantha Liyanage Idriss El-Thalji
Corrosion and Corrosion Protection		Tor Hemmingsen Torfinn Havn	Tor Hemmingsen Torfinn Havn	Tor Hemmingsen Torfinn Havn		
Rotor Dynamics and Vibrations		Hirpa Lemu Yihan Xing				Idriss El-Thalji
Structural Dynamics			Jasna Jakobsen Dimitrios Pavlou Muk Chen Ong	Jasna Jakobsen Dimitrios Pavlou Muk Chen Ong		
Soil Mechanics			Dimitrios Pavlou Muk Chen Ong	Dimitrios Pavlou Muk Chen Ong		
CFD/Hydrodynamics			Muk Chen Ong Knut Erik Giljarhus Lin Li		Muk Chen Ong Charlotte Obhrai Lin Li	
Aerodynamics	Jasna Jakobsen Charlotte Obhrai Knut Erik Giljarhus		Jasna Jakobsen Knut Erik Giljarhus Charlotte Obhrai		Charlotte Obhrai Jasna Jakobsen Knut Erik Giljarhus	