

Floating offshore wind turbines - design and computational approaches

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University of Rostock,
Chair for Windenergy
Technology

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Floating Substructures

Coupled Simulations

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Chair for Wind Energy Technology (exc)

- founded in 2014
- endowed by the wind turbine manufacturer Nordex SE
- focus is industry-oriented research both onshore and offshore wind energy

Research topics at LWET are:

- floating offshore substructures
- sector coupling
- grid integration of wind power (decentralized, storage, grid codes)
- measurements (wind field, wind turbine, operation of research turbine)
- economic efficiency (weight and cost reduction, rotor blades, towers, improved control algorithms)

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Floating Substructures

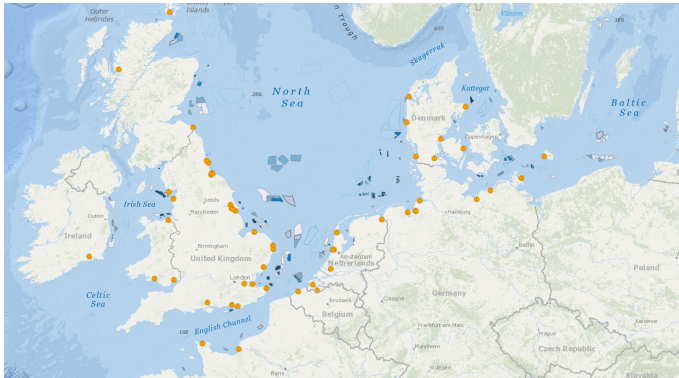


Figure: Windparks in northern Europe | source: 4coffshore.com

Floating Substructures

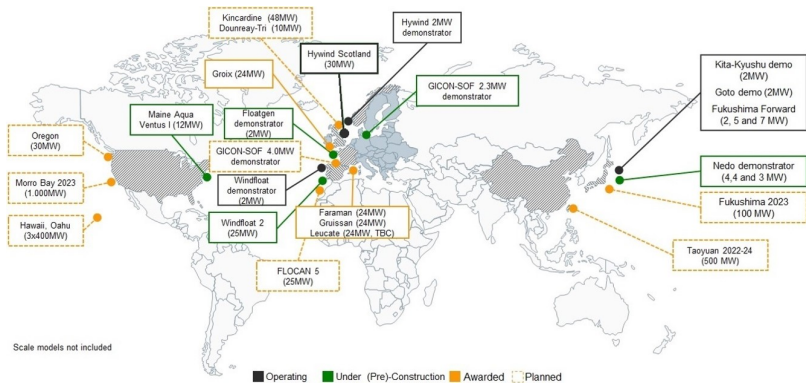


Figure: Current State | source: © J. Møller (SIEMENS) – Offshore Wind Conference June 2017 London

Floating Substructures

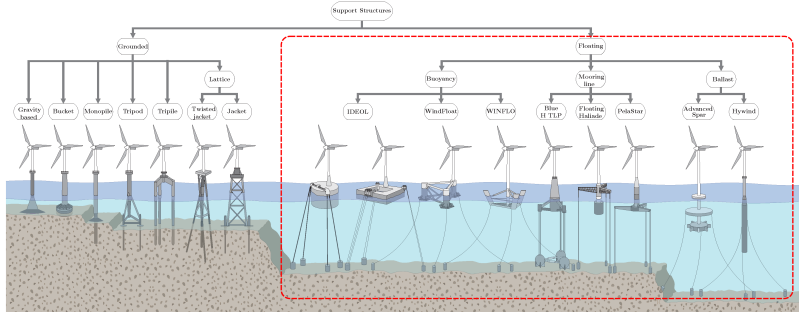


Figure: Fixed and Floating substructures| source: Silvio Rodrigues et al.

Floating Substructures

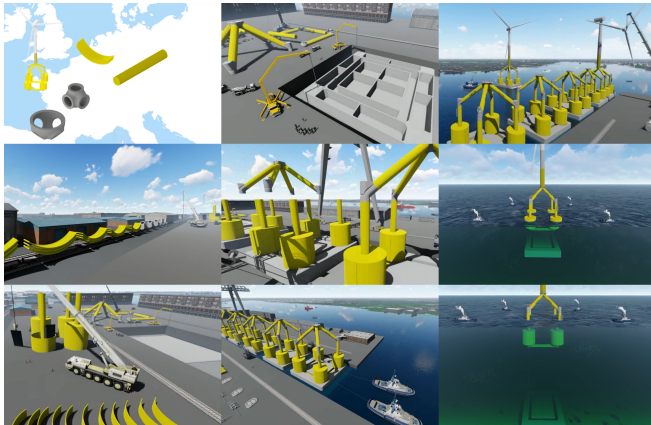


Figure: GICON-SOF - Assembly and Installation

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Coupled Simulations

Aero-Hydro-Servo-Elastic-Coupled simulation tools

- Simpack
- HAWC2
- (Flex5)
- Bladed
- OpenFAST
- ...

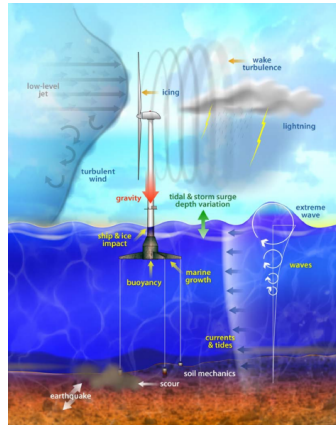


Figure: Loads on Floating Wind Turbines | source: Josh Bauer, NREL

Coupled Simulations

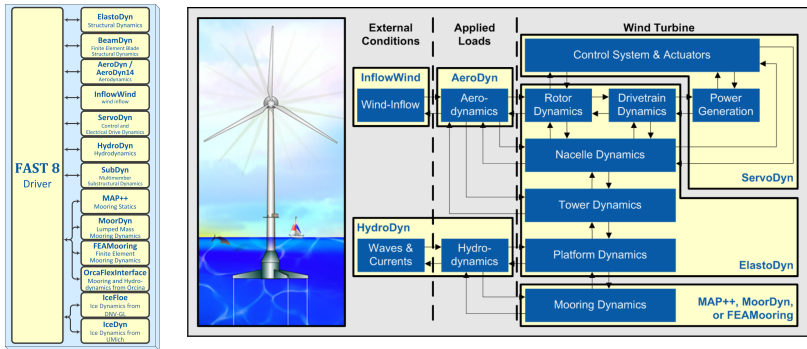


Figure: FAST Modularization | source: Bonnie & Jason Jonkman, NREL

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Physical Model Testing

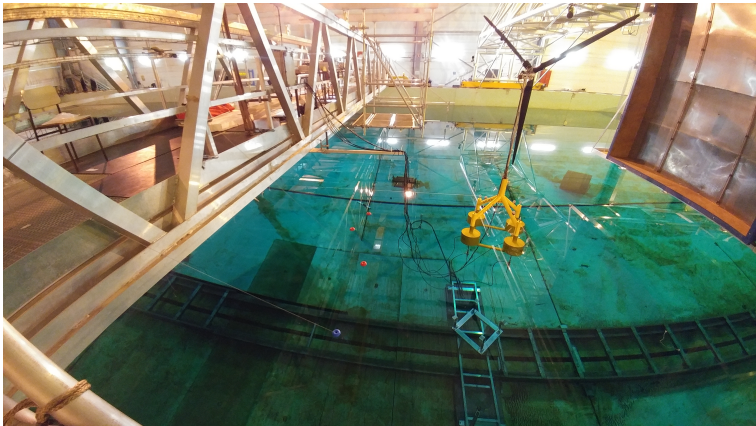


Figure: GICON-SOF - Tank Tests

Physical Model Testing

- Scaling factor: 1:50
- Water depth: 4000 mm (200m)
- Regular Waves:
 - H_s : 40 - 260 mm (2 - 13m)
 - T_p : 1.13 - 2.26s (7.99 - 15.13s)
- Irregular Waves (JONSWAP):
 - H_s : 40 - 260 mm (2 - 13m)
 - T_p : 1.13 - 2.26s (7.99 - 15.13s)
- Wind:
 - 5 - 51 m/s
- + Wind-Only and Wave-Only tests

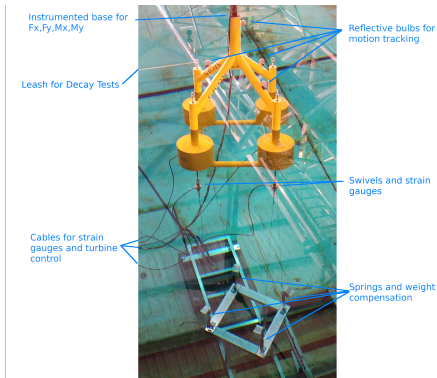


Figure: GICON-SOF - Sensors

Physical Model Testing

Video

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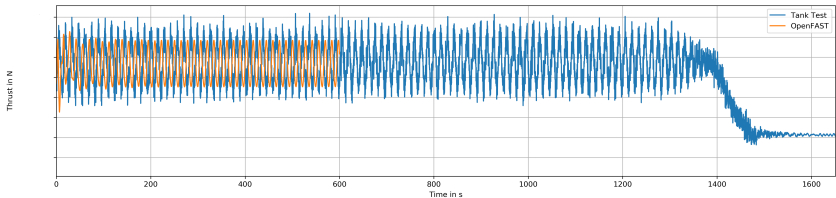
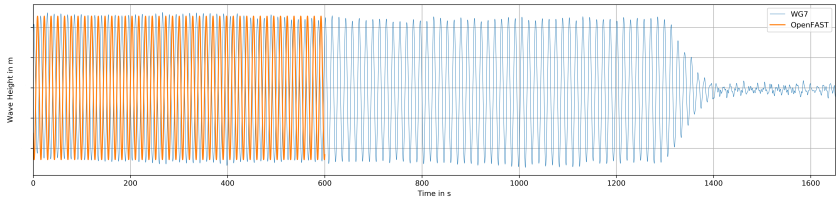
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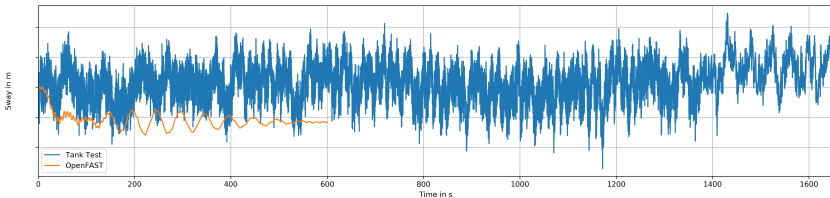
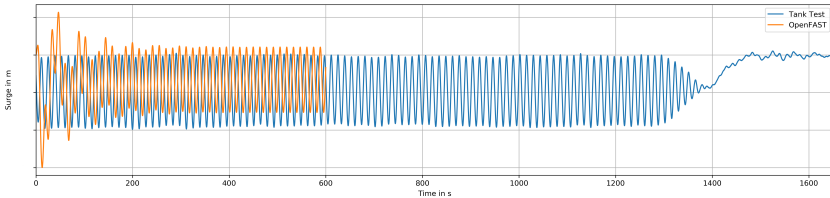
Physical Model Testing

Verifying Computational Model

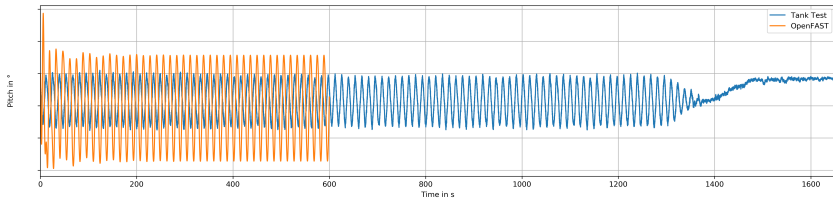
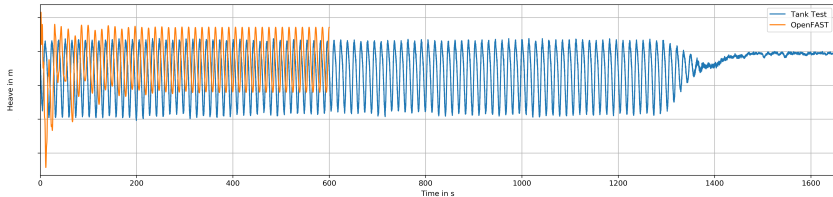
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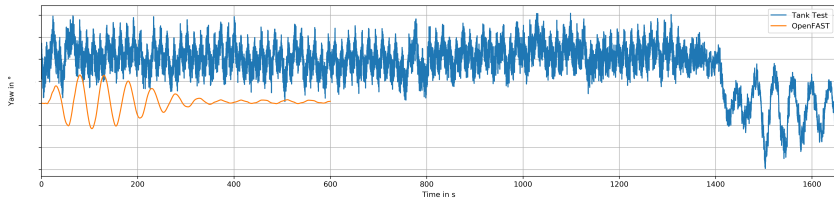
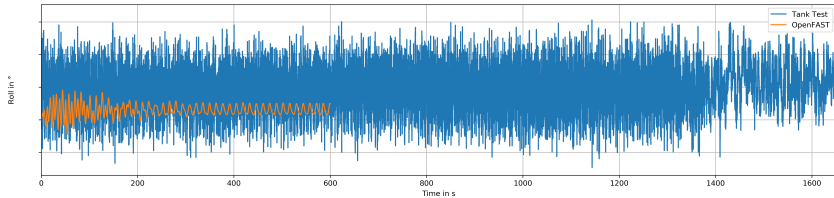
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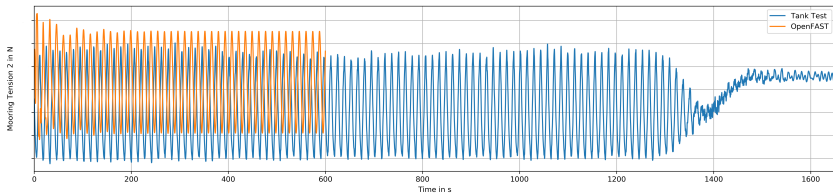
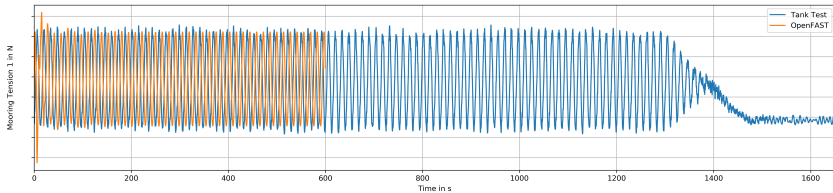
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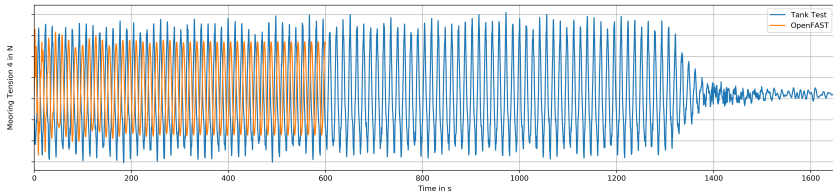
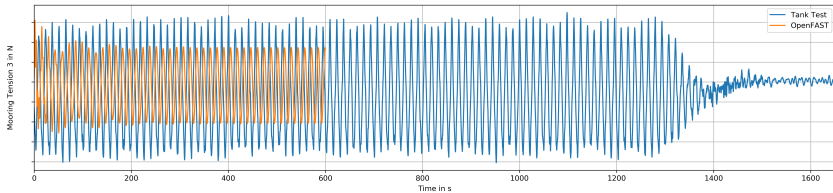
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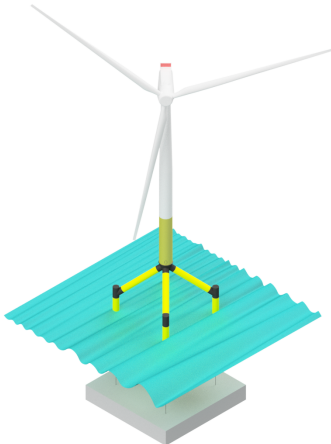
Verifying Computational Model



Thanks to



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