Coastal & Offshore Modelling Symposium
COMS2026

Validation of Numerical FEA Models of Wind and Tidal Turbine Blades Using Full-Scale Structural Testing

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University of Galway

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- Background
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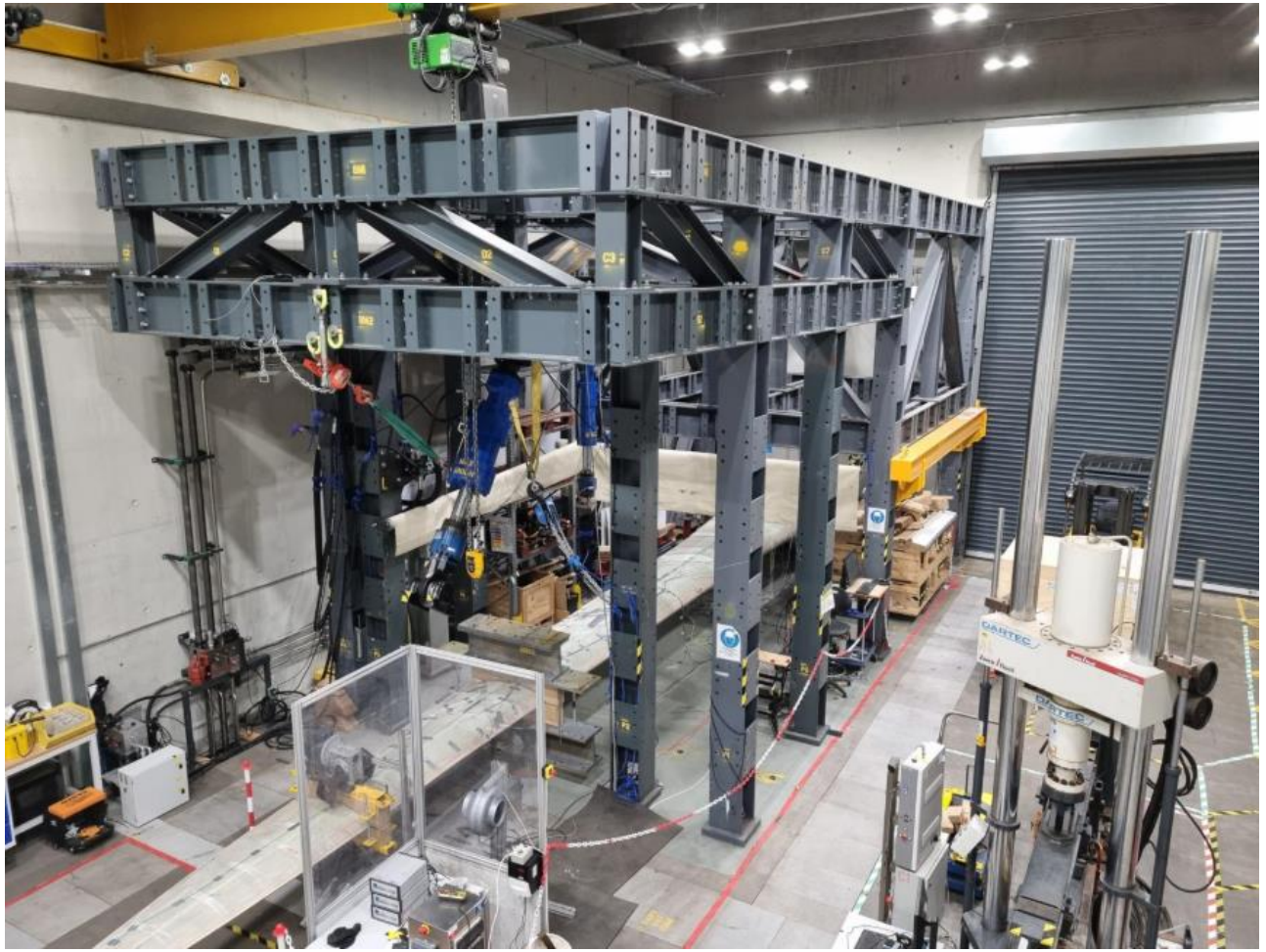
- Acknowledgments



Sustainable and Resilient Structures

Construct Innovate
Built Environment Research Ireland

MaREI
Energy · Climate · Marine

Ollscoil na Gaillimhe
University of Galway

Design and Testing of Large-Scale Composites Structures

Space Technology

Drones

Wind Energy

Offshore Wind

Wave Energy

Tidal Energy

Sustainable Processes

Gasification Utilities

Road Construction

Construction Products

Greenways

Sustainable And Resilient Buildings

Earthquake Engineering

Energy Efficient Buildings

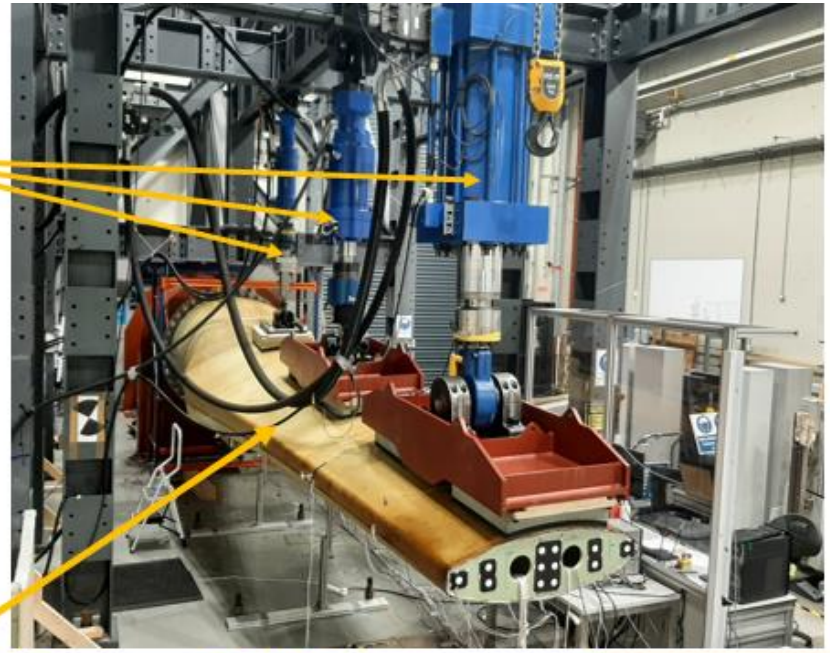
Structural testing facilities

COMS2026

COMS 2026 COASTAL OFFSHORE MODELLING SYMPOSIUM

Hydraulic Actuators

Hydraulic actuators (4 no.) available with capacities up to 750 kN and stroke length of up to 670mm.



Advanced Non-Contact Measurement

- Digital Image Correlation (DIC)
- 3D laser scanner
- Laser Doppler vibrometer

Remote monitoring & control

Capability to monitor and control testing remotely.

Data Acquisition

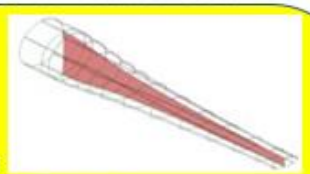
Data acquisition system with up to 120 channels that feature specialized synchronization.

Turbine Blade

Full scale dynamic, static and fatigue testing.

Digital Twins

BladeComp in-house software comprises advanced Finite Element (FE) analysis techniques and design optimisation strategies for efficient, robust and rapid design and analysis of turbine blades.



BladeComp

Material Testing

Innovative static and fatigue testing capabilities for material characterisation

Industry Partners

ÉIRECOMPOSITES · OPENHYDRO NAVAL ENERGIES · ORBITAL MARINE POWER · ORPC · HYDRO · SIEMENS

Supported By

Ireland's European Structural and Investment Funds Programmes 2014-2020 · sfi Science Foundation Ireland · seai Sustainable Energy Authority of Ireland · Horizon 2020 European Union Funding for Research & Innovation

UCC · Marine Institute Foras na Mara · Ollscoil na Gaillimhe University of Galway

26 Feb, 2026
Cork, Ireland

Selection of large-scale blade tests

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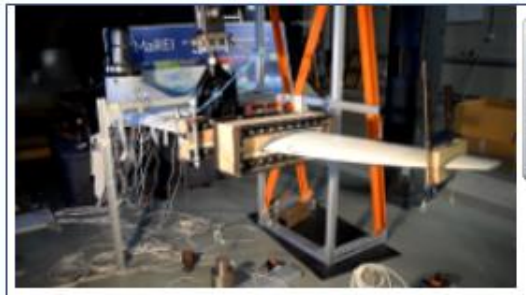
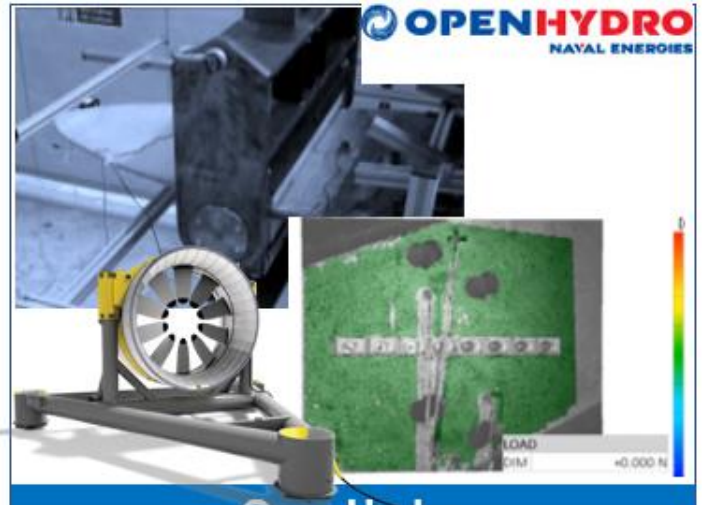
COMS 2026 COASTAL OFFSHORE MODELLING SYMPOSIUM



SCHOTTEL HYDRO

ORPC



OpenHydro

Orbital Marine Power

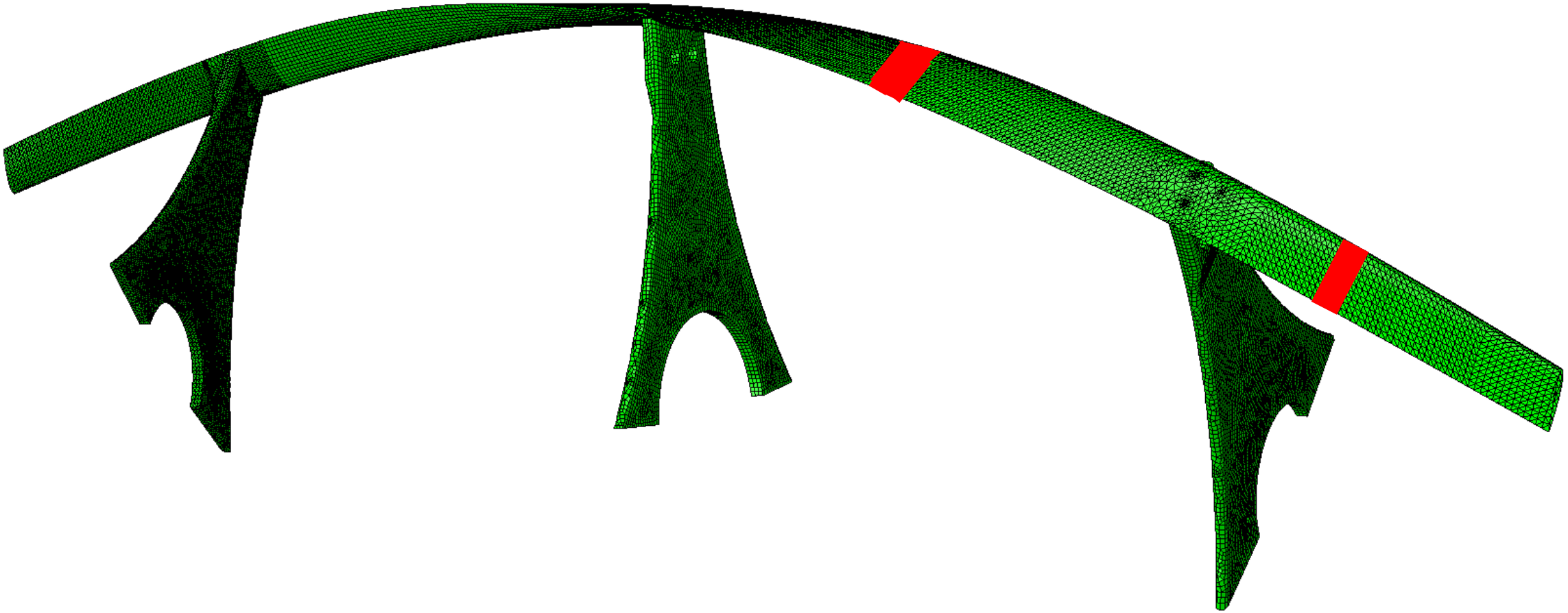
ÉireComposites

G-Kinetic

Case study 1: Helical blade

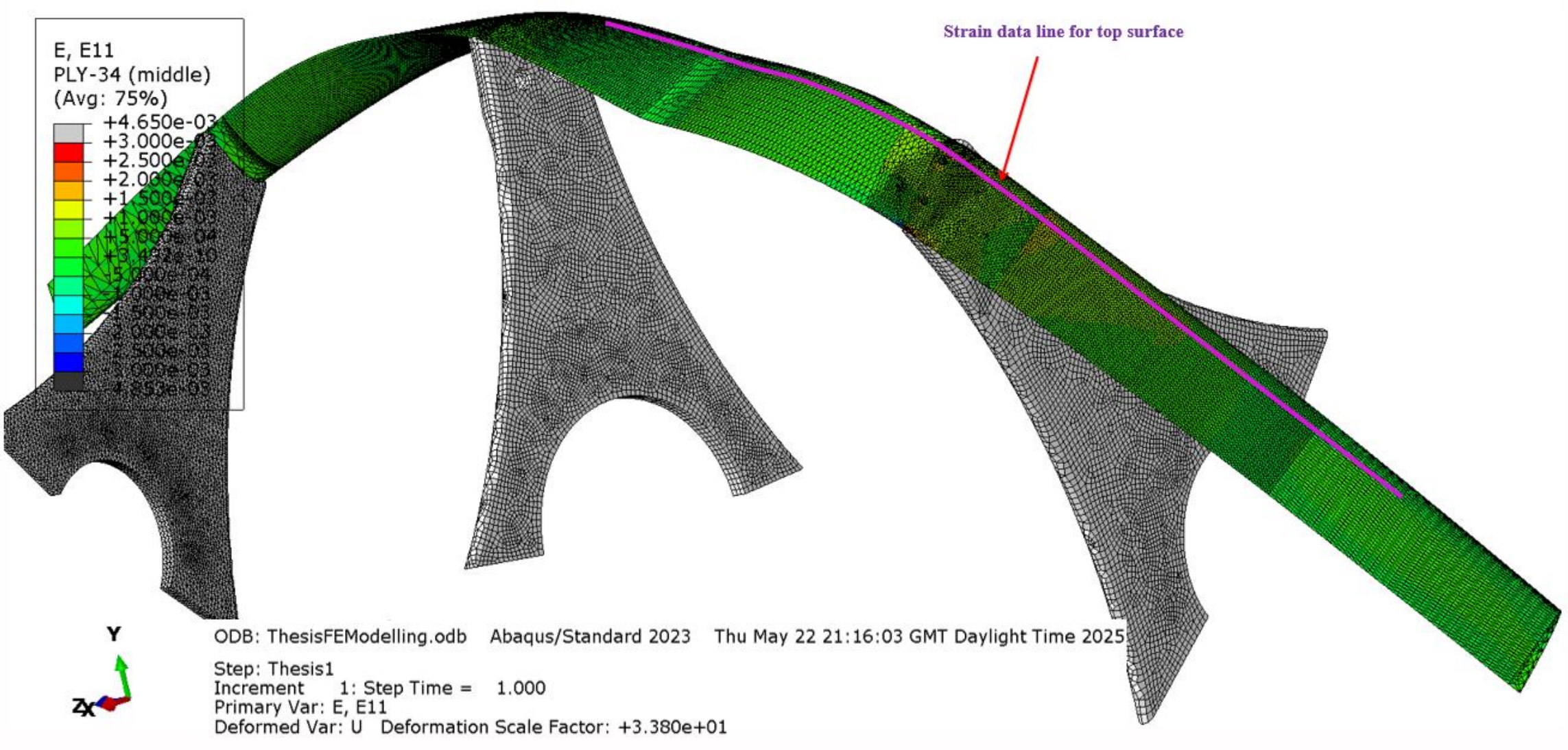
- Testing programme :
  - Static (hydraulic actuators)
  - Dynamic
  - Fatigue (rotating mass)
  - Static test to failure
- Manufactured by ÉireComposites from carbon fibre reinforced epoxy
- Accelerated fatigue testing of over 1.3 million cycles
- Static tested to failure in the cantilever section

Case study 1: FEA model overview

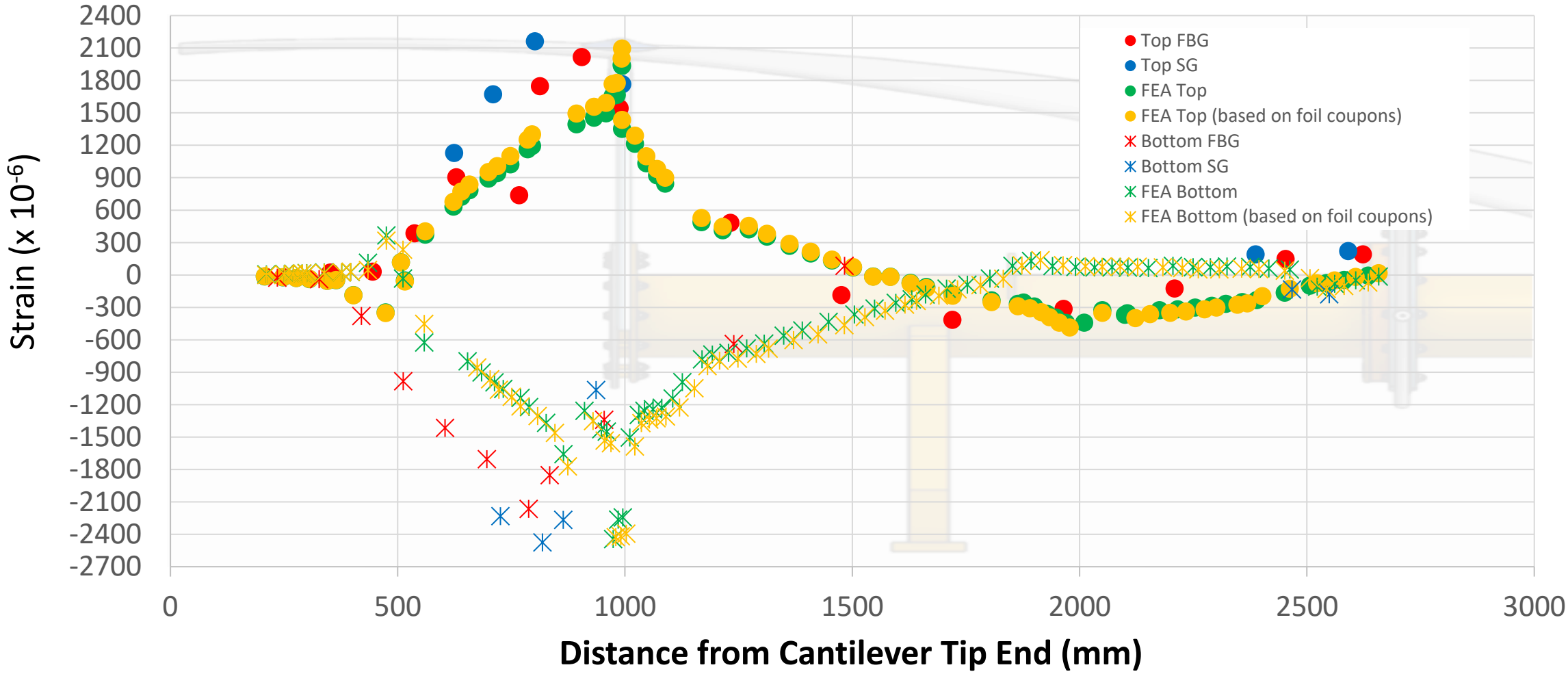


22,931 nodes and 39,186 elements, incorporating both 3-node triangular and 4-node quadrilateral general purpose shell elements.

Case study 1: Strain

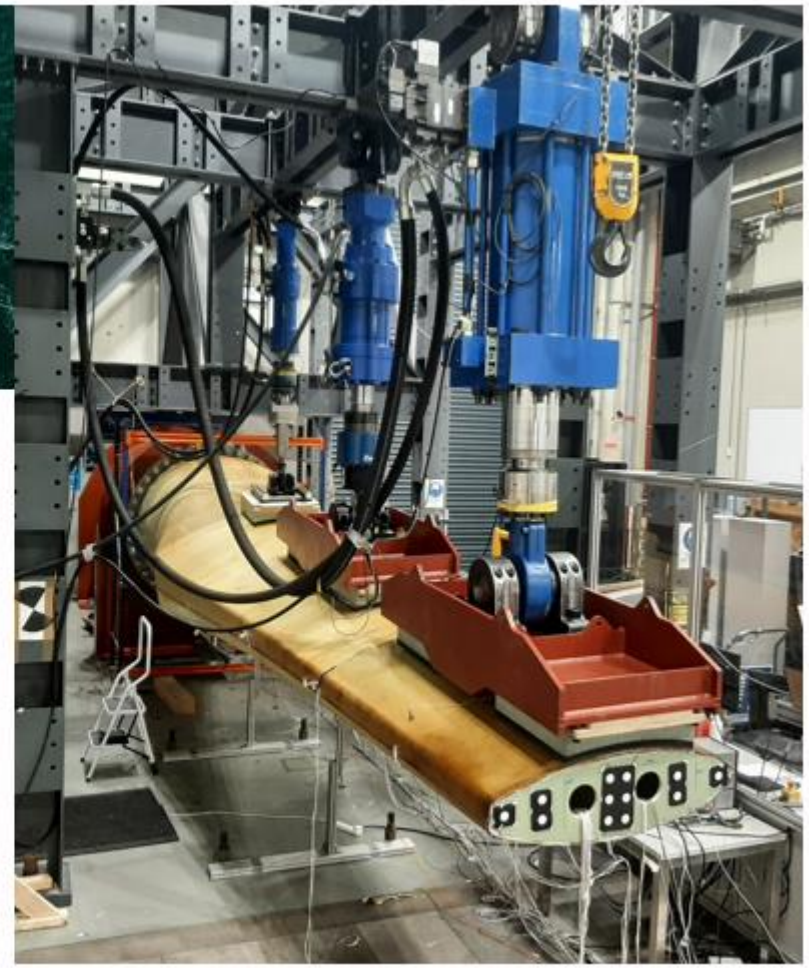


Case study 1: FEA model validation



Case study 2: Large tidal blade

- Blade development for Orbital Marine Power's O2 tidal turbine
- Blade design by University of Galway and OMP using an advanced digital twin.
- Manufactured by ÉireComposites
- Static test load applied in excess of 1,000 kN – largest load ever reported on a tidal turbine blade
- Accelerated fatigue testing for an equivalent design life of >25 years



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Horizon 2020 European Union Funding for Research & Innovation

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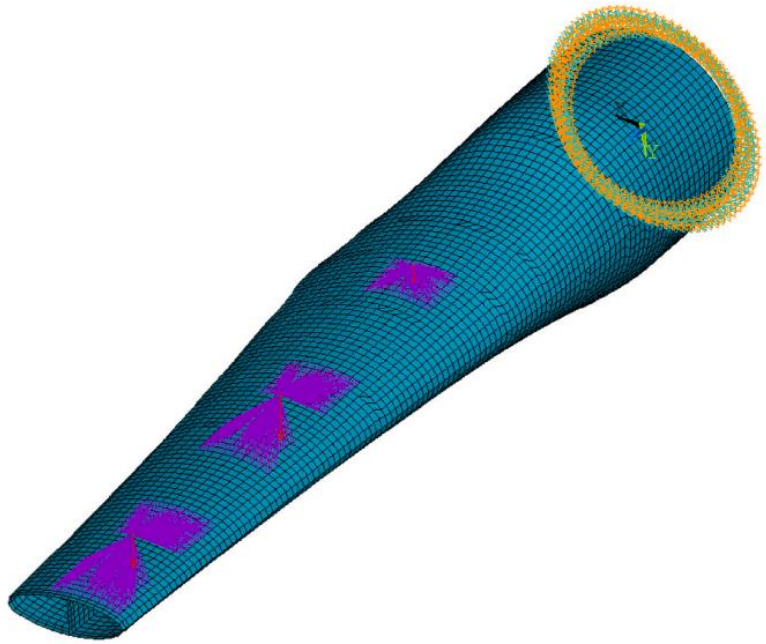
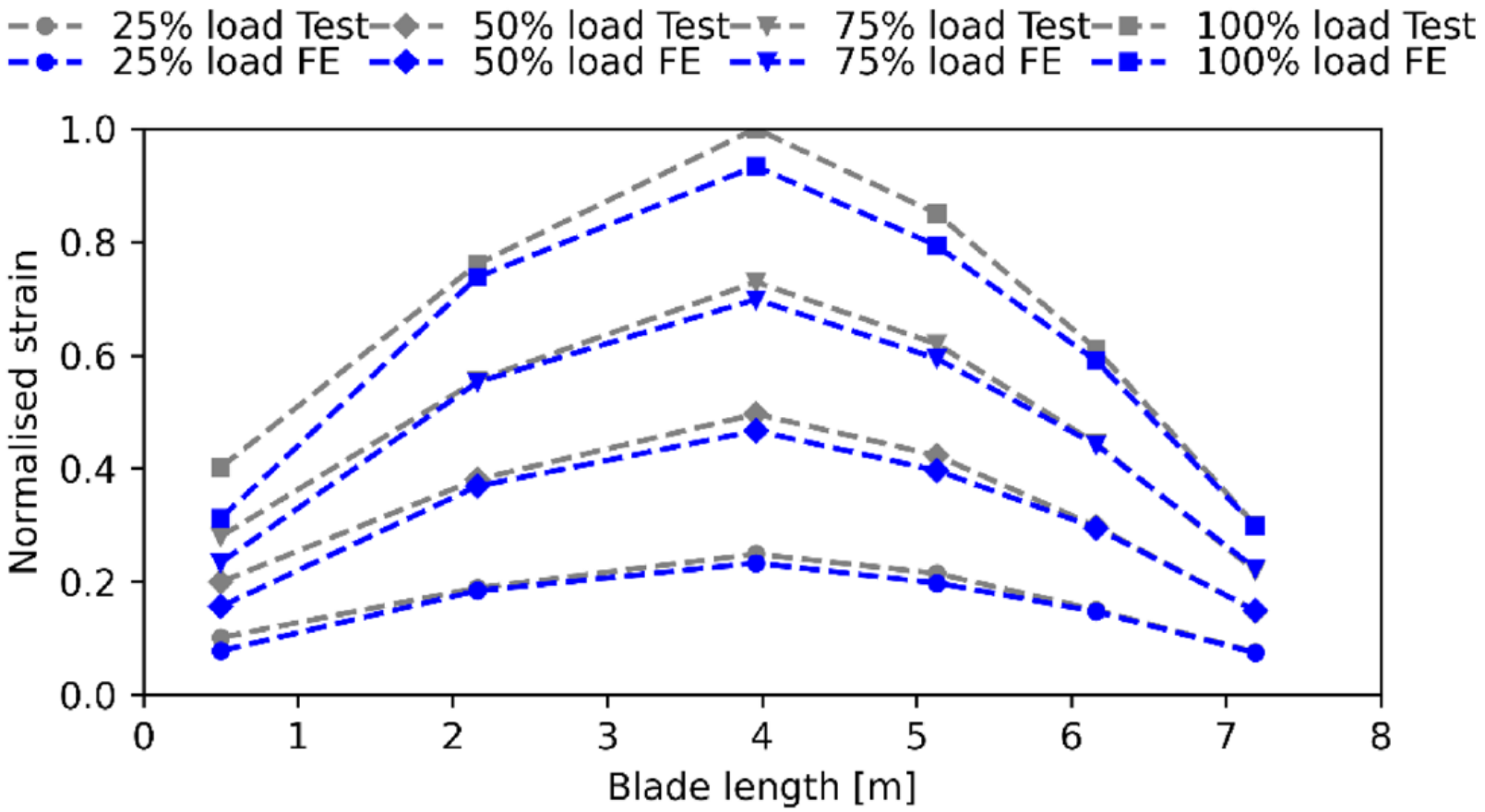
ORBITAL MARINE POWER

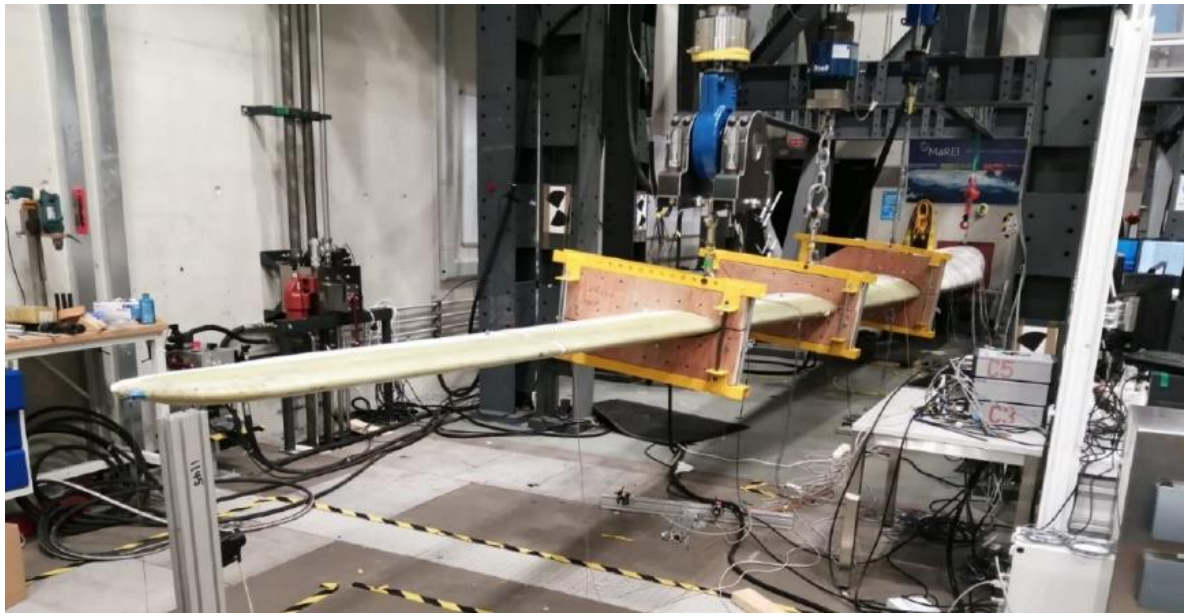
Case study 2: FEA model validation





Case study 3: 13m wind turbine blade

- Blade manufactured by ÉireComposites from glass fibre reinforced powder epoxy
- 3 independent FEA models were created using ABAQUS, ANSYS, and CalculiX
- Models validated against experimental testing under both flapwise and edgewise loading
- Study determined sources of error and recommendations on the development of accurate numerical models



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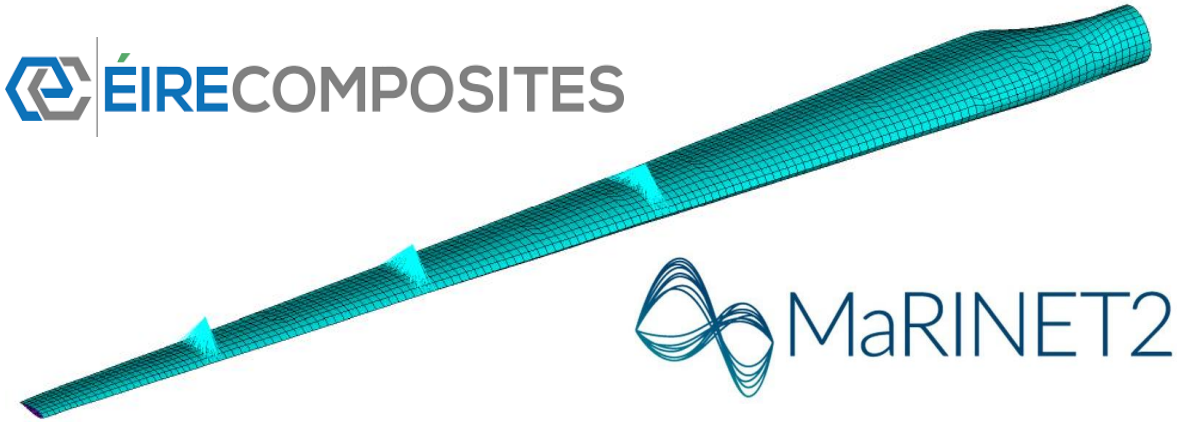
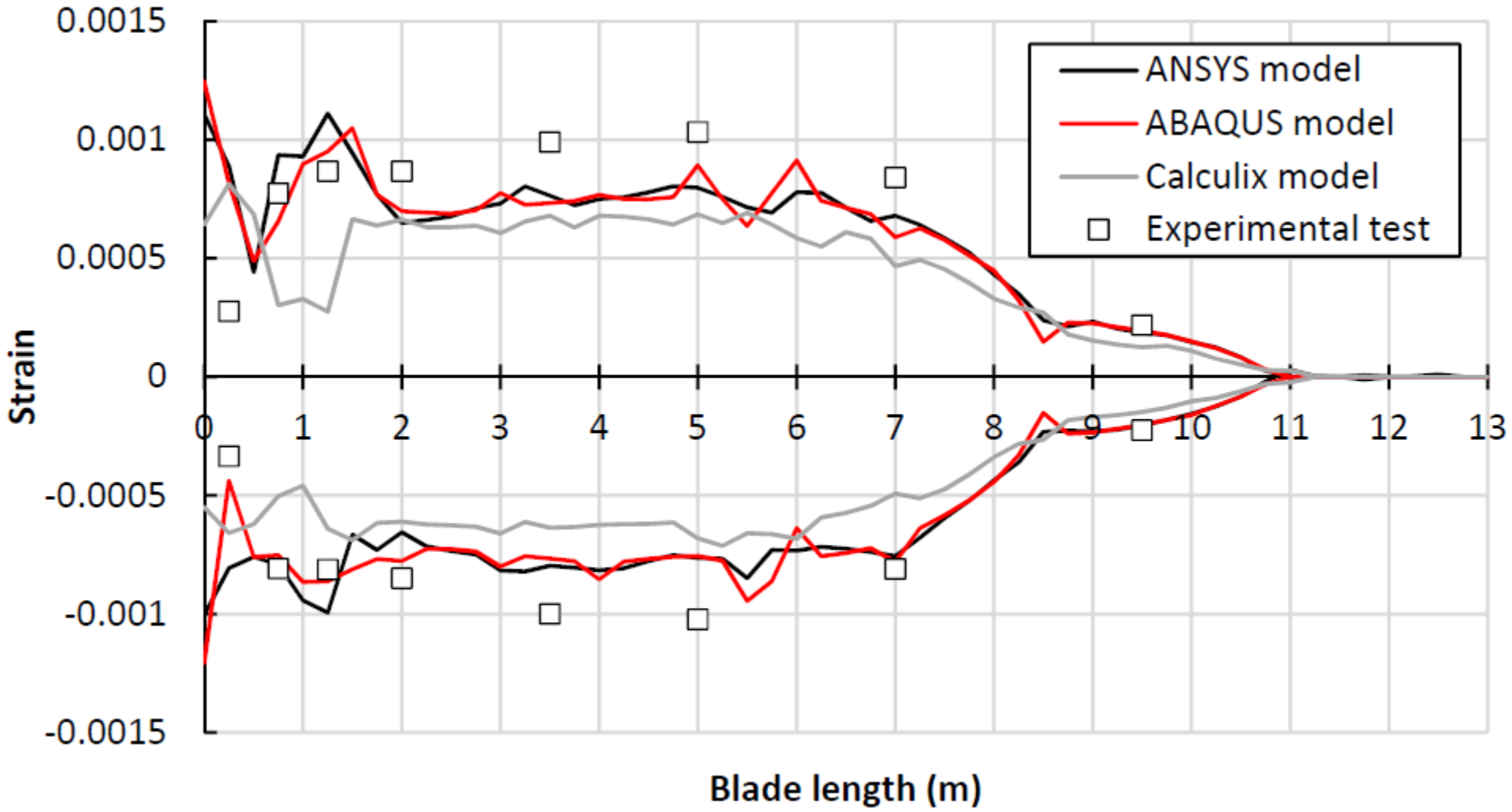


MaRINET2

Case study 3: FEA model comparison



Irish Renewable Energy Technologists Help Power Alaskan Community

10th March 2021 · AfloatIe Team

The ORPC RivGen® Power System floating on the Kvichak River in Igiugig, Alaska ahead of installation in August 2019. A second turbine system for this generator is now also being built by EireComposites in Galway, supported by SEAI

Home > Marine Energy

RivGen sets US marine hydrokinetic turbine record

OPERATIONS & MAINTENANCE

October 6, 2020, by Amir Garanovic

The RivGen Power System has made over seven million revolutions during its ten months of operation, making it the longest operating current energy converter in the United States.

ENERGY

Orbital launches O2, the "most powerful tidal turbine in the world"

By Loz Blain
April 25, 2021

Sustainable Marine exports first floating tidal power to Nova Scotia grid

offshore-energy.biz • 3 min read

Next Generation Marine Turbine Deployed At Strangford Lough

1st November 2024 · AfloatIe Team

Acknowledgements

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MITSUBISHI CHEMICAL ADVANCED MATERIALS
Consiglio Nazionale delle Ricerche
ORBITAL MARINE POWER
SCHOTTEL HYDRO
UNIVERSITY OF LIMERICK OLLSCOIL LUIMNIGH
UCC Coláiste na hOllscoile Corcaigh University College Cork, Ireland
GKINETIC

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