NOWITECH

Norwegian Research Centre for Offshore Wind Technology

The objective of NOWITECH is pre-competitive research laying a foundation for industrial value creation and cost-effective offshore wind farms. Emphasis is on "deep-sea" (+30 m) including bottom-fixed and floating wind turbines. Work is focused on technical challenges including a strong PhD and post doc programme:

- Integrated numerical design tools for novel offshore wind energy concepts.
- Energy conversion systems using new materials for blades and generators.
- Novel substructures (bottom-fixed and floaters) for offshore wind turbines.
- Grid connection and system integration of large offshore wind farms.
- Operation and maintenance strategies and technologies.
- Assessment of novel concepts by numerical tools and physical experiments.

- Total budget (2009-2016) is MNOK 320, M€ 38, MUSD 49

Research partners:
- SINTEF (host)
- Institute for Energy Technology (IFE)
- Norwegian University of Science and Technology (NTNU)

Industry partners:
- Aker Solutions
- Devold AMT AS
- Det Norske Veritas AS (DNV)
- DONG Energy Power AS
- EDF R&D
- Fugro OCEANOR AS
- GE Wind Power (Norway) AS
- Lyse Produksjon AS
- NTE Holding AS
- SmartMotor AS
- Statkraft Development AS
- Statnett SF
- Statoil Petroleum AS
- Vestas Wind Systems AS
- Vestavind Offshore AS

Associated research partners:
- National Laboratory for Sustainable Energy at the Technical University of Denmark (Risø DTU)
- Massachusetts Institute of Technology (MIT)
- National Renewable Energy Laboratory (NREL)
- Fraunhofer IWES
- University of Strathclyde
- TU Delft

Associated industry partners:
- Energy Norway
- Enova
- Innovation Norway
- Navitas Network
- NCEI
- Norwegian Wind Energy Association (NORWEA)
- NVE

CENTRE FOR ENVIRONMENT-FRIENDLY ENERGY RESEARCH

Established by the Research Council of Norway

Contact:
NOWITECH Director John O.G. Tande
john.tande@sintef.no

NOWITECH Norwegian Research Centre for Offshore Wind Technology

In this issue

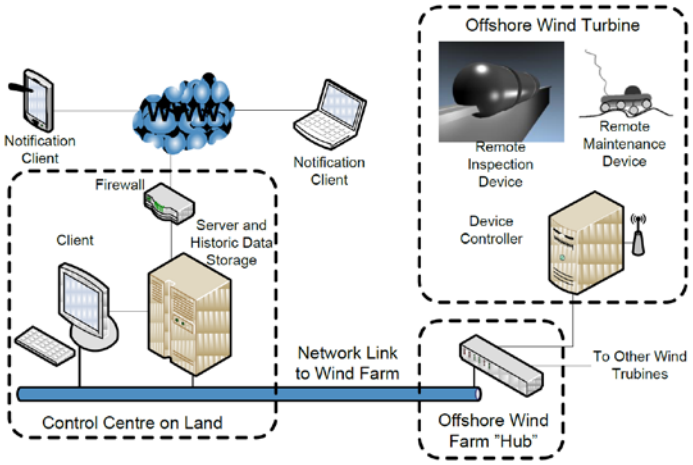
NEWSLETTER
April 2011

www.nowitech.no

Remote presence reduces need for maintenance visits

It is time consuming and costly to have maintenance staff visiting offshore wind turbines. Can some of these visits be avoided by a new concept for remote presence?

In NOWITECH, a pre-study of the possibility to undertake O&M operations remotely has been carried out. A remote presence system makes it possible to feel present and perform work at a remote location, like O&M operations at an offshore wind turbine. Such a system has the potential to significantly reduce the need for manned maintenance visits, since some O&M operations can be performed without having to leave the office. Less transportation is both cost-effective and environmentally friendly. (Article cont. next page)



Contact persons in NOWITECH:
Prof. Amund Skavhaug (amund.skavhaug@itk.ntnu.no) and PhD stud. Øyvind Netland (oyvind.netland@itk.ntnu.no)

Remote presence reduces need for maintenance visits (cont.)

A report has been published which describes a preliminary design of a complete remote presence system for O&M of an offshore wind turbine. The user can control devices optimized for inspections and maintenance operations from a client computer on land. Preliminary suggestions of possible applications of the designed system are also discussed in the report.

It is time consuming and costly to have maintenance staff visiting offshore wind turbines. Can some of these visits be avoided by a new concept for remote presence?

Read more in article at NOWITECH e-room
(requires password, for NOWITECH partners only)

Voids in blade laminates significantly reduce fatigue life

With the trend of building ever larger turbines the modern blades need to be much more optimized than previous designs while remaining cost effective. NOWITECH is looking into the effect of production parameters of the laminates on the long term fatigue performance and into designing adaptive blades that can change their shape according to the wind loads.

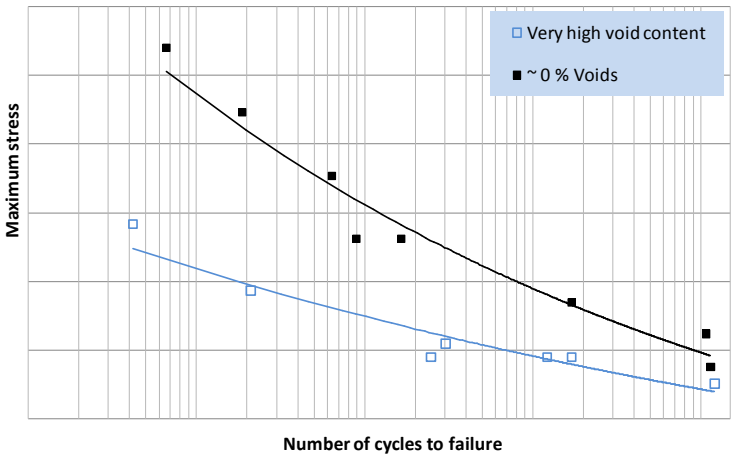
A 10 MW turbine design is developed as part of NOWITECH including structural finite element analysis for the blade. This design will be used as reference for comparison against the new concept of adaptive blades. The adaptive blade design will utilize non-symmetric composite laminates that can twist due to axial loading. This twisting will change the aerodynamic profile giving new possibilities for optimization and safety.

Articles on voids and blade design are in preparation.

Irregularities in blade laminates must be expected. The question is what can be tolerated and what are the consequences of imperfections?

Contact person in NOWITECH:
Prof. Andreas Echtermeyer (Andreas.Echtermeyer@ntnu.no),
Post doc Dr. A Antonarulrajah, anthon.antonarulrajah@ntnu.no and
PhD stud K. Cox, Kevin.Cox@ntnu.no

Fatigue of composite laminates has been studied on perfect laminates produced on a laboratory scale. Producing a 60 m long blade will introduce some irregularities and it is unclear how much the fatigue properties would be affected. NOWITECH is conducting a study on the influence of fiber stitching patterns and voids on the fatigue. Tests are carried out in tension-compression fatigue which creates the most challenging conditions for the material.



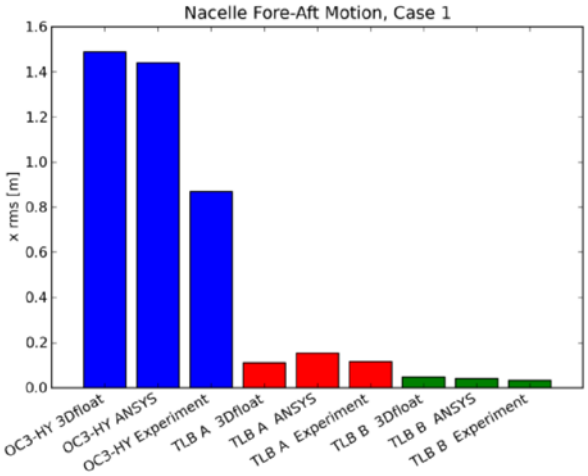
Experimental S-N fatigue plots of glass/epoxy blade laminate.

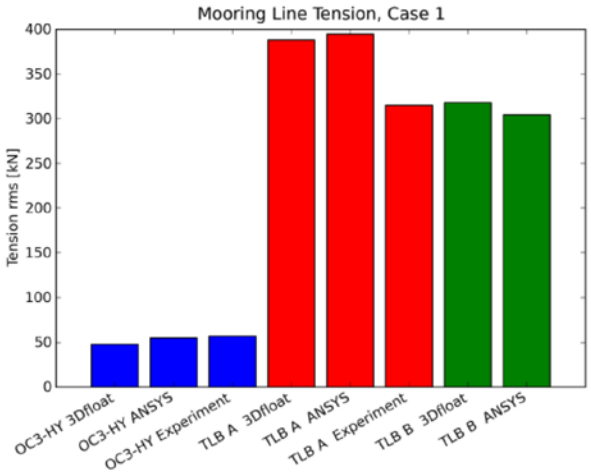
Initial results show that voids can significantly reduce fatigue life especially under high load conditions.

Comparing floating concepts: spar and tension leg

This article gives a sneak peek at results comparing three concepts for floating wind turbines: one spar buoy (SB) ala HyWind and two tension-leg buoy (TLB) systems. Full results are to be published at ISOPE June 2011.

Wave tank experiments with TLB and SB conducted in a student project are supplemented with computations with the models 3Dfloat and ANSYS. Although the small model scale of 1:100 and the scope of the test make quantitative comparisons between experiment and models difficult, **the experiment and models agree reasonably well** qualitatively. **The main differences between TLB and SB** in both experiments and computations **are the smaller motions and the higher anchor loads of the TLB**.





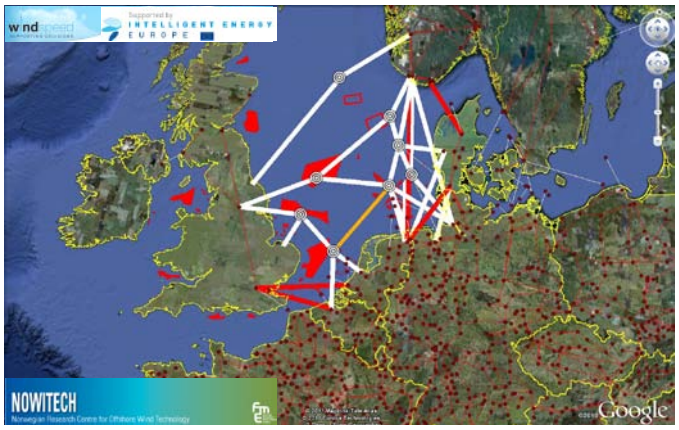
Read more in article at NOWITECH e-room
(requires password, for NOWITECH partners only)

Contact person in NOWITECH:
Tor Anders Nygaard (Tor.Anders.Nygaard@ife.no)

How does the future offshore grid look like?

Likely it will be a meshed system with HVDC transmission. At least, this is the most cost efficient compared to a radial structure.

Two different offshore grid expansion strategies in the North Sea have been studied by power system simulations using PSST and NET-OP. The total net present benefit of a meshed offshore grid compared to a radial grid is estimated to be EUR 3 billions. The benefit is because a meshed grid will relieve more bottlenecks and hence give more efficient operation of the power system.



A possible future meshed offshore grid. Red areas are offshore wind farms.

Read more in article at NOWITECH e-room
(requires password, for NOWITECH partners only)

Contact person in NOWITECH:
Daniel Huertas Hernando
(daniel.h.hernando@sintef.no)