NOWITECH Norwegian Research Centre for Offshore Wind Technology

In this issue

NEWSLETTER
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www.nowitech.no

Industry meets Science

NOWITECH, Windcluster Mid-Norway, and Access Mid-Norway cooperate in strengthening the interaction between research and industry for developing offshore wind power technology. A first seminar was arranged 20 September 2012 at NTNU, Trondheim, with six oral presentations and 28 scientific posters. Key-notes were given by Chief Executive Eli Arnstad (SpareBank1 SMN), Vice President Halfdan Brustad, Statoil and Jørgen Krogstad, Statkraft. All presentations are available at NOWITECH e-room (requires password, for NOWITECH partners only).

The next seminar in the series in planned for 6 December 2012, Trondheim, on the topic "Europe as home market". The seminar is announced at www.NOWITECH.no.

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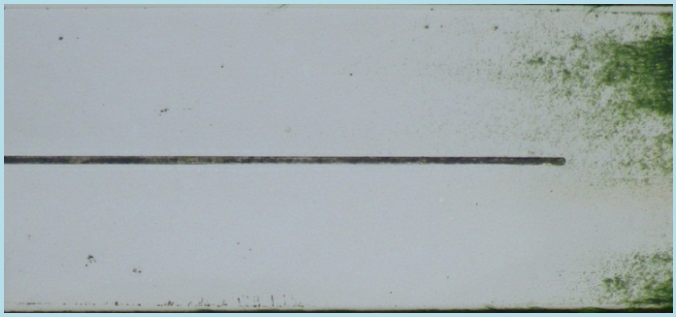
Cost-effective coatings for sub-structures

Coatings are necessary to protect wind turbines and sub-structures against the harsh environmental conditions offshore. Experience from the offshore oil & gas industry can be applied for coating selection. For optimal protection, the NORSOK M-501 standard specifies both pre-treatment quality, type of coatings, film thickness and number of coats, and inspection during construction and service. Shorter lifetime than the specified 20 years designed life of offshore wind turbines is experienced for the atmospheric zone coatings.

Cost-effective and low-maintenance coating systems are essential for offshore wind. Duplex coating systems combining metallization and conventional paints have been successfully used for more than 40 years in marine environments, and are already used on offshore wind turbines. At SINTEF Materials and Chemistry, we are working on developing thinner coating systems and simplified paint systems to reduce costs. Nano-modified paints are also investigated to obtain satisfying coating performance.

Samples after 12 months field exposure show no corrosion from scribe



Coating systems combining thermal sprayed zinc and a paint applied in 1-coat instead of a conventional 3-coat paint system show promising corrosion performance in a field test at Helgoland.

Read more at NOWITECH e-room.
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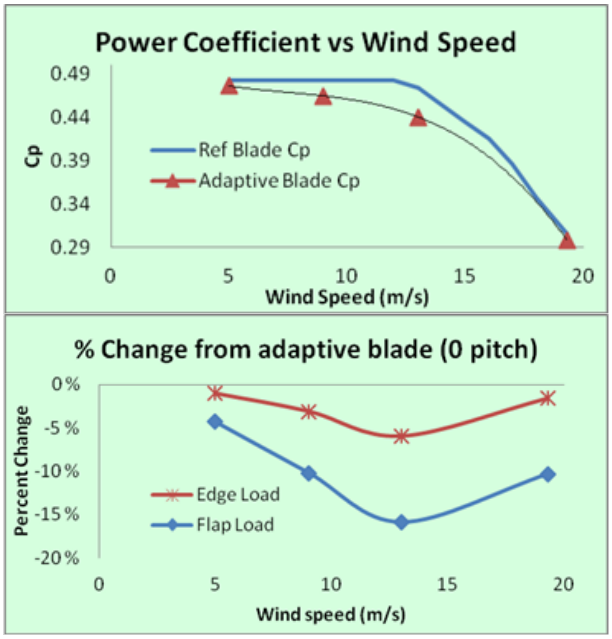
Adaptive blades show potential for saving weight

Adaptive blades can potentially reduce loads and save weight and costs for large wind turbines. This hypothesis is tested by applying the NOWITECH 10 MW reference turbine and modifying the blades to be adaptive by incorporating bend-twist coupling in the composite layup. The goal is to determine the degree of twisting achieved at various wind speeds and to find what effect the induced twisting has on efficiency (Cp) and loads.

The analyses predict a flap load reduction of 15.9% at the design wind speed with a 7% drop in Cp as compared to the reference blade, see graphs.

A nonlinear buckling simulation shows that the adaptive blades, for achieving the same critical buckling load as the reference blades, can be made 2.2% lighter. Overall, adaptive blades reduce loads and show potential for saving weight, but on the cost of reduced efficiency.

Read more at NOWITECH e-room.



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NOWITECH applies TRL methodology

Technology Readiness Level (TRL) is introduced in NOWITECH, aided by DNV, to facilitate efficient communication of results, and enhance focus on innovations. The method was first developed by NASA in the 1980s, and has since then developed and gained application in a range of public agencies and industries.

The TRL scale defines 9 levels where 1-3 is for research, 4-5 development and 6-9 is for industry prototyping and demonstration. The method is expected to assist management, audit, internal and external communication in NOWITECH.

See NOWITECH e-room for more information.

Focus on people: PhD candidate Amir R. Nejad

Amir R. Nejad is a newly (August 2012) employed PhD candidate in NOWITECH on Operation, Maintenance and Condition Monitoring. He is a Mechanical Engineer with experience in machinery design and operation in automotive industry, as well as offshore structural mechanics in oil & gas field. Nejad is an ASME member and CEng from Institute of Marine Engineering in UK.

Condition Monitoring & Reliability of Mechanical Drivetrains

The main objective of Nejad's research is to explore methods improving the reliability of wind turbine mechanical drivetrains in the design stage and to establish models for preventive actions and condition monitoring. Drivetrains in land-based turbines will be the reference for reliability-based comparison of different design concepts for floating offshore wind turbines. Numerical multi body system model tools will be applied for dynamic investigation of large multi megawatt drivetrains for offshore turbines. The current collaboration with NREL on wind turbine drivetrains will continue and be enhanced as part of this study.

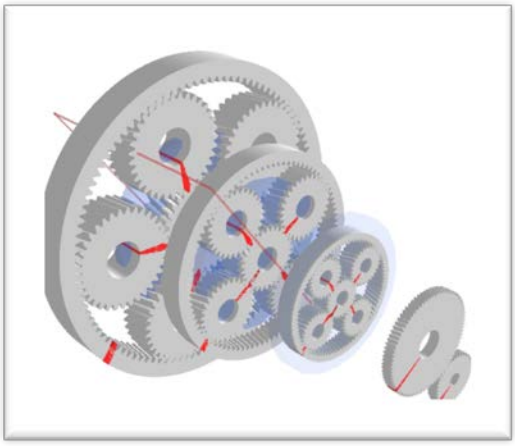

Illustration of torsional model of a 5 MW wind turbine gearbox for internal dynamic investigation of gears.

Drivetrains in wind turbine are not like any other "conventional" power transmission system. Large input torque variations due to the stochastic nature of wind, difficult and expensive maintenance along with access restrictions are specific features for wind turbine gear systems. In particular, it is expected that gearboxes in offshore development should offer higher reliability, availability, maintainability and serviceability (RAMS) than land-based designs.

Read more in internal presentation at NOWITECH e-room.

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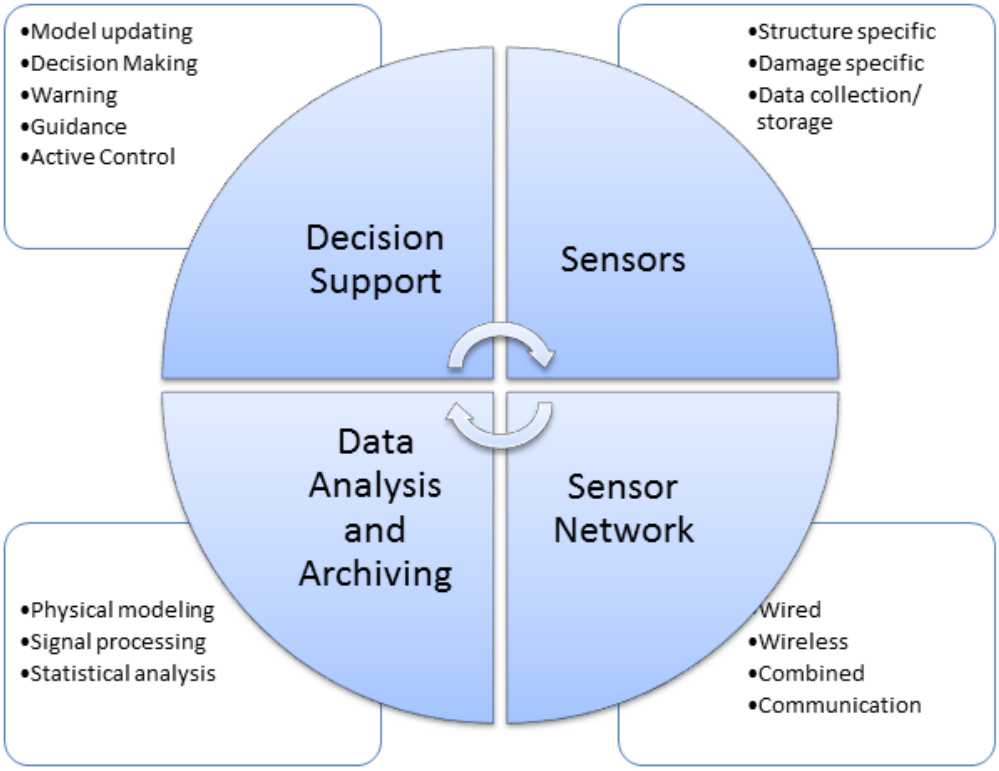
Sensors for condition monitoring of (offshore) wind power plants: Possibilities for further evaluation in NOWITECH and beyond

A report on innovative sensors and their potential for establishing a reliable and cost effective condition monitoring & structural health monitoring (SHM) system has been published on the NOWITECH e-room.

The report focused on two of the most promising sensor technologies available, and the researchers from SINTEF MC and ICT also worked together to establish a roadmap in order to achieve the ultimate goal of a SHM system: A strategy for the identification of failures in terms of existence, location, type and extent and their effect on the overall reliability of the structure.

The roadmap includes steps to:

- Determine and qualify mounting (surface/embedding) procedures
- Determine number of sensors and positions
- Data storage and transfer issues (wireless monitoring systems are an inevitable part of the future)
- Combine measurements with Finite Element analysis and smart algorithms in order to determine the relation between measured data and condition of structure



The report concludes that: "**The key to a successful [Condition Monitoring / Structural Health Monitoring] system is providing information and decision support, not just data**".

An efficient structural health monitoring system is an important sub-system in the future cost-effective Integrated Operations (IO) for offshore wind turbines. In the near future, the operation and maintenance of offshore wind turbines will be managed remotely, onshore using highly automated monitoring systems, while using high value resources where they are most critically needed. Inspiration and valuable lessons are learnt from the development of IO for offshore oil and gas recovery.

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