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CABOT INSTITUTE

Living with global uncertainty

Composites for Wind & Tidal Power

Advanced Composites Centre for Innovation & Science

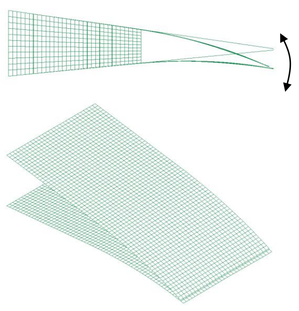
www.bristol.ac.uk/composites

The Advanced Composites Centre for Innovation and Science (ACCIS) has a leading reputation in composite rotor blade research. This is directly relevant to the Wind and Tidal Power industries, where composite materials are widely used to meet strength and fatigue life requirements, whilst minimising structural mass. Current applied research includes:

Blade Design and Manufacture

Contact: Professor Paul Weaver (paul.weaver@bristol.ac.uk)

- A partnership with the leading wind turbine company Vestas is exploring the transfer of composite design and manufacturing techniques previously developed for the Aerospace industry to wind turbine blades.
- A collaboration with Garrad Hassan is developing Intelligent Responsive Composite Structures (IRCS), which enable blade load shedding, facilitating light-weight design and enhanced fatigue life.



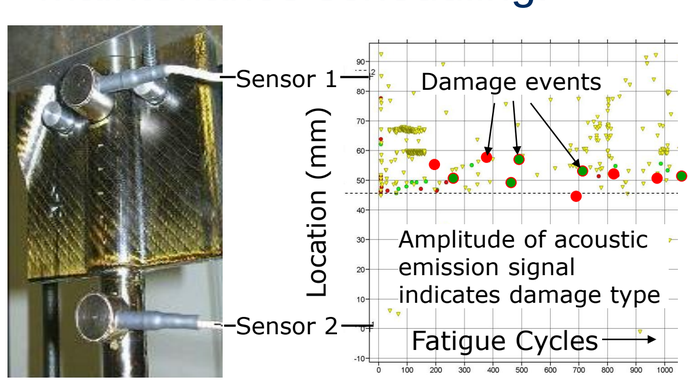
Elastic properties of composite exploited to enable rapid changes in blade profile in response to aerodynamic forces, reducing blade root and rotor hub stress concentrations.

Knowledge transfer from Aerospace rotor blade design to wind turbines

Fatigue Life Analysis and Structural Health Monitoring

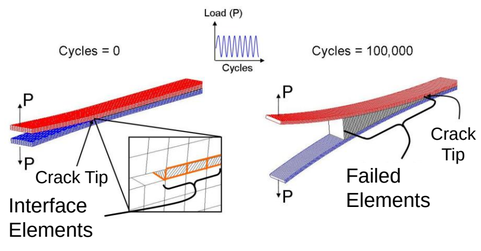
Contact: Dr Stephen Hallett (stephen.hallett@bristol.ac.uk)

- Linked with a range of industrial partners, a Technology Strategy Board funded project is developing fatigue modelling techniques for the design/analysis of tidal turbine blades. Such techniques are equally applicable to wind turbine structures.
- A range of structural health monitoring techniques are developed within the £20M BLADE (Bristol Laboratory for Advanced Dynamics Engineering) facility, essential for damage prognosis and optimised maintenance scheduling.



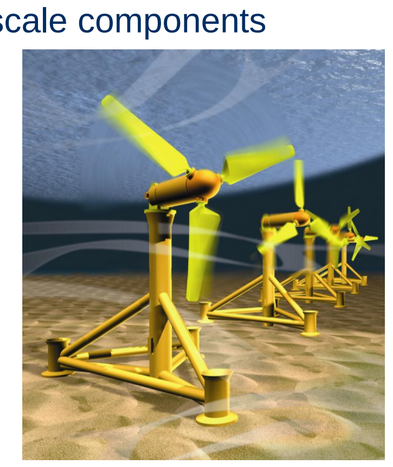
Acoustic Emission signals are used to monitor both the location and type of damage in structures under cyclic loading.

Other relevant technologies include Wireless Intelligent Sensing Devices for vibration monitoring and high resolution video-gauge systems for detecting deformation in remote structures.



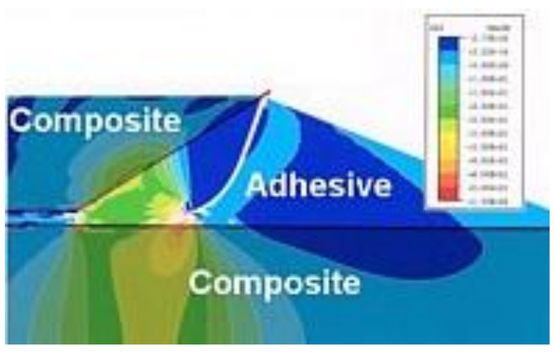
Fatigue model calibrated using low-cost tests on standard specimens

Analysis of full-scale components

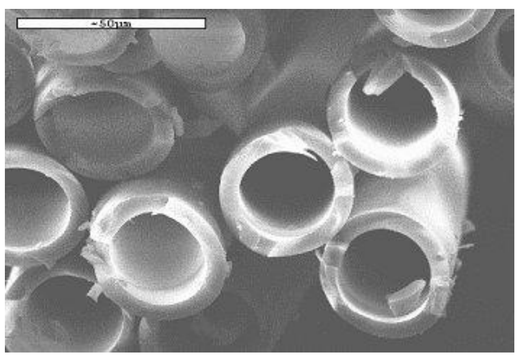


Additional research strengths:

- Joint design and manufacture.
- Crack arrest and self-healing technologies.
- Blade coatings for increased wear-resistance.
- Integration of composites into electrical drives and generators.



Optimised adhesive joint design is essential for preventing high shear and peel stress concentrations (e.g. at blade-hub connections).



In self-healing composites, resin bleeds from hollow fibres to repair/arrest damage and prolong service-life.

GARRAD HASSAN

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Vestas