Reliable optimal use of materials for wind turbine rotor blades (OPTIMAT BLADES)

Arkusz informacyjny

Informacje na temat projektu

OPTIMAT BLADES

Identyfikator umowy o grant: ENK6-CT-2001-00552

Data rozpoczęcia: 1 Stycznia 2002
Data zakończenia: 30 Kwietnia 2006

Finansowanie w ramach FP5-EESD
Całkowity budżet: € 4 390 548
Wkład UE: € 2 399 088

Koordynowany przez: N/A

Ten projekt został przedstawiony w...

MAGAZYN RESEARCH*EU
Results Supplement No. 002

NR 2, LUTY 2008
Cel

Industrial objectives and strategic aspects:
As the required financial investments to achieve the expansion of the installed capacity of wind turbine grow, the economical pressure on reliable and structurally optimised blades, that are fit for their designed life, will increase. Especially for larger wind turbines, optimisation of the use of material becomes more effective and necessary since the blade mass increases more than proportional to the blade energy output capacity. Very large blades may even become practically impossible without further knowledge of the material behaviour since the dominating loads on the material are caused by the blade mass. At the same time, economical utilisation of large wind farms, offshore and onshore, consisting of MW wind turbines demands reliable and non-stop operation. This is especially true for offshore turbines, due to poor accessibility.

Rotor blades are unique because of a combination of factors:
- Blades are subjected to complex and severe fatigue loads (variable amplitude loads), comprising often more than one billion of fatigue cycles.
- Blades are subjected to a variety of external environmental conditions.
- The inner structural parts of the blades where most of the material is located consist of thick laminates that have a complex stress state.

Therefore, a sound and accurate understanding of the structural behaviour of the material under complex loading, complex stress states and a variety of environmental conditions and their possible interactions is necessary, in order to optimise the use of material in the blade and to obtain reliable blades. This also includes the knowledge of thick laminates and the effects of residual stresses.

Description of work:
The project aims to provide accurate design recommendations for the optimised use of materials within wind turbine rotor blades and to achieve improved reliability. This considers the design of new blades, but also the prediction of the residual strength and life. The latter can be used to extend the life of the blade or avoid unexpected failures, which will result in a better use of material. Furthermore, the possibility of repair will prevent waste of material. To achieve this overall objective, the project will investigate the structural behaviour of the composite material under the unique combination of conditions experienced by rotor blades such as variable amplitude loading, complex 3-D stress states, extreme environmental conditions, thick laminates and their possible interactions. Techniques will be developed for life extension, condition assessment and repair. The major deliverable of the project will be improved design recommendations for the next generation of rotor blades.

Expected results and exploitation plans:
With the accurate and reliable design recommendations resulting from this project, reliable blades with optimised use of materials can be designed. Together with the application of condition assessment and repair, this will result in:
- Reliable blades (fewer unexpected or premature failures)
- Reduced use of material and environmental impact- Life extension of blades
- Less waste of material (fewer rejected blades and components)
- Larger availability of the wind turbine- Extension of the possible size of turbine

All these aspects can contribute to the reduction of costs for wind energy. This concerns
investment costs by lighter components and less waste of material as well as running cost due to the larger availability. The possible reduction of the material use will lower the impact on earth’s resources and environment. The reduction can result from direct weight saving and from the increased reliability which prevents the need for replacements and waste of material.

Program(-y)

Temat(-y)

System finansowania

CSC - Cost-sharing contracts

Koordynator

N/A

Uczestnicy (16)

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Ostatnia aktualizacja: 28 Lipca 2005
Numer rekordu: 60342

Permalink: https://cordis.europa.eu/project/id/ENK6-CT-2001-00552/pl

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