OPTIMAT BLADES

Reliable Optimal use of Materials for Wind Turbine Rotor Blades

Aim of the Project

- New design recommendations for next generation rotor blades

State-of-the-Art

- Current guidelines are based on various research programmes
- Not all the different aspects of design are addressed properly
- On some aspects contradictory effects are reported
- Existing research has limitations, which restrict the effectiveness of current design recommendations

Consortium

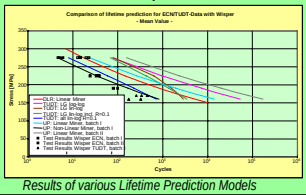
- 18 partners
  - 10 Research institutes
  - 2 Certification bodies
  - 8 Industries
- 8 EU countries

Organisation

- Work carried out in 5 Task Groups
- Design recommendations drafted by Task Group 6

1 Variable Amplitude Loading

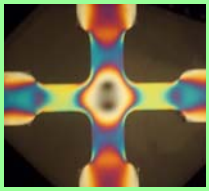
- Establishment of reference S-N curves
- Comparison between CA and VA
  - Wisper spectrum
  - Block tests
- Establishment of new Wisper spectrum
- Influence load sequence



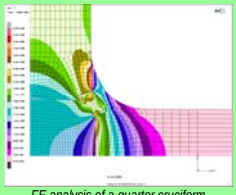
Results of various Lifetime Prediction Models

2 Complex Stress State

- Checks on uni-axial and bi-axial tests
- Investigate beam model of rotor blade vs. shell model for stress components
- Establish guidelines and safety factors for various levels of sophistication in the design



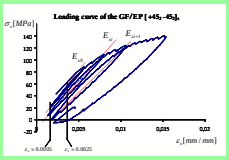
ISOCHROMATICS in a bi-axially loaded transparent cruciform



FE analysis of a quarter cruciform Deformation and stress. Fx= Fy

3 Extreme Conditions

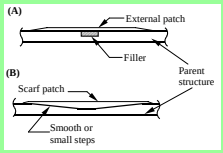
- Check influence of extreme conditions
  - T -40° and +60°
  - Humidity
- Identification of degradation parameters
- Phenomenological modelling and exp. determination



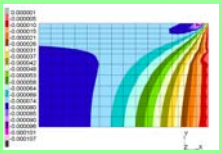
Degradation of Stiffness during Fatigue Life

4 Thick Laminates & Repair

- Difference between thick and thin laminates studied
- Material properties in thickness direction
- Measurements using embedded optical fibres
- Repair techniques
- Influence of brick and shell FE models



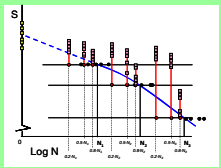
Plug/Patch and scarf repair systems



FE analysis of the test specimen

5 Residual Strength & Condition Assessment

- Development of predictive model for residual strength reduction
- Definition and validation of condition monitoring strategies for laminates in rotor blades



Stress levels for testing the residual strength after a percentage of the expected life

6 Improved Design Recommendations

- Task group leaders and certification bodies
- State-of-the-art analysis of results using results of the task groups 1 to 5
- Based on consistent set of tests
- Interaction effects also covered
- Basis for future design guidelines

Website: http://www.wmc.citg.tudelft.nl/optimat_blades/index.htm

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