



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

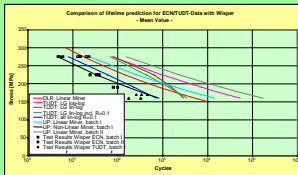
Organisation

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

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

1

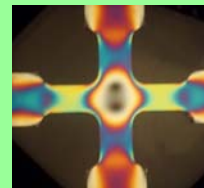


Results of various Lifetime Prediction Models

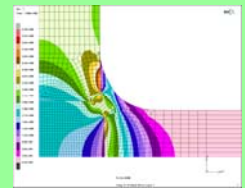
Complex Stress State

- 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

2



ISOCHROMATICS in a bi-axially loaded transparent cruciform

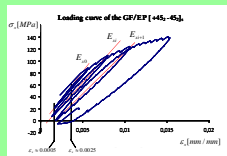


FE analysis of a quarter cruciform Deformation and stress. $F_x = F_y$

Extreme Conditions

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

3

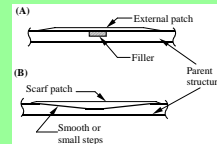


Degradation of Stiffness during Fatigue Life

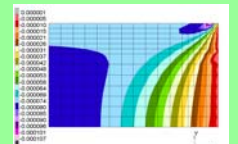
Thick Laminates & Repair

- 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

4



Plug/Patch and scarf repair systems

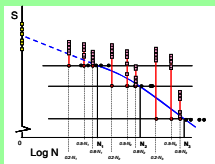


FE analysis of the test specimen

Residual Strength & Condition Assessment

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

5



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

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

6

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

Contact: Arno van Wingerde E-mail: A.M.vanWingerde@ctg.tudelft.nl



Knowledge Centre Wind turbine Materials and Constructions (WMC)
P.O. Box 523, 2600 AM Delft

Research supported by EC contribution, ENK6-CT-2001-00552

