



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

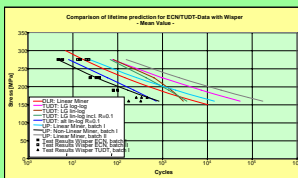
Organisation

- ❑ 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

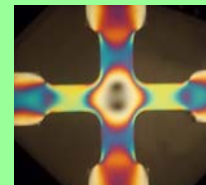
1



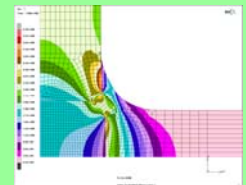
Complex Stress State

- ❑ 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

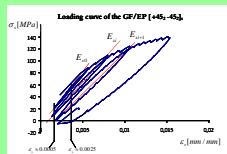


FE analysis of a quarter cruciform Deformation and stress. $F_x = F_y$

Extreme Conditions

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

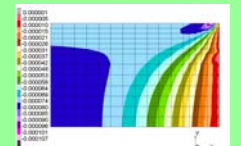
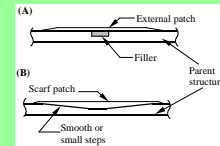
3



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

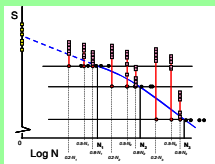


FE analysis of the test specimen

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



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

