RELIABLE OPTIMAL USE OF MATERIALS FOR WIND TURBINE ROTOR BLADES

OPTIMAT BLADES

(ENK6-CT-2001-00552)

Test program for basic material (UD plate) characterization

TASK GROUP 2: Investigation of blade material behavior under complex stress states

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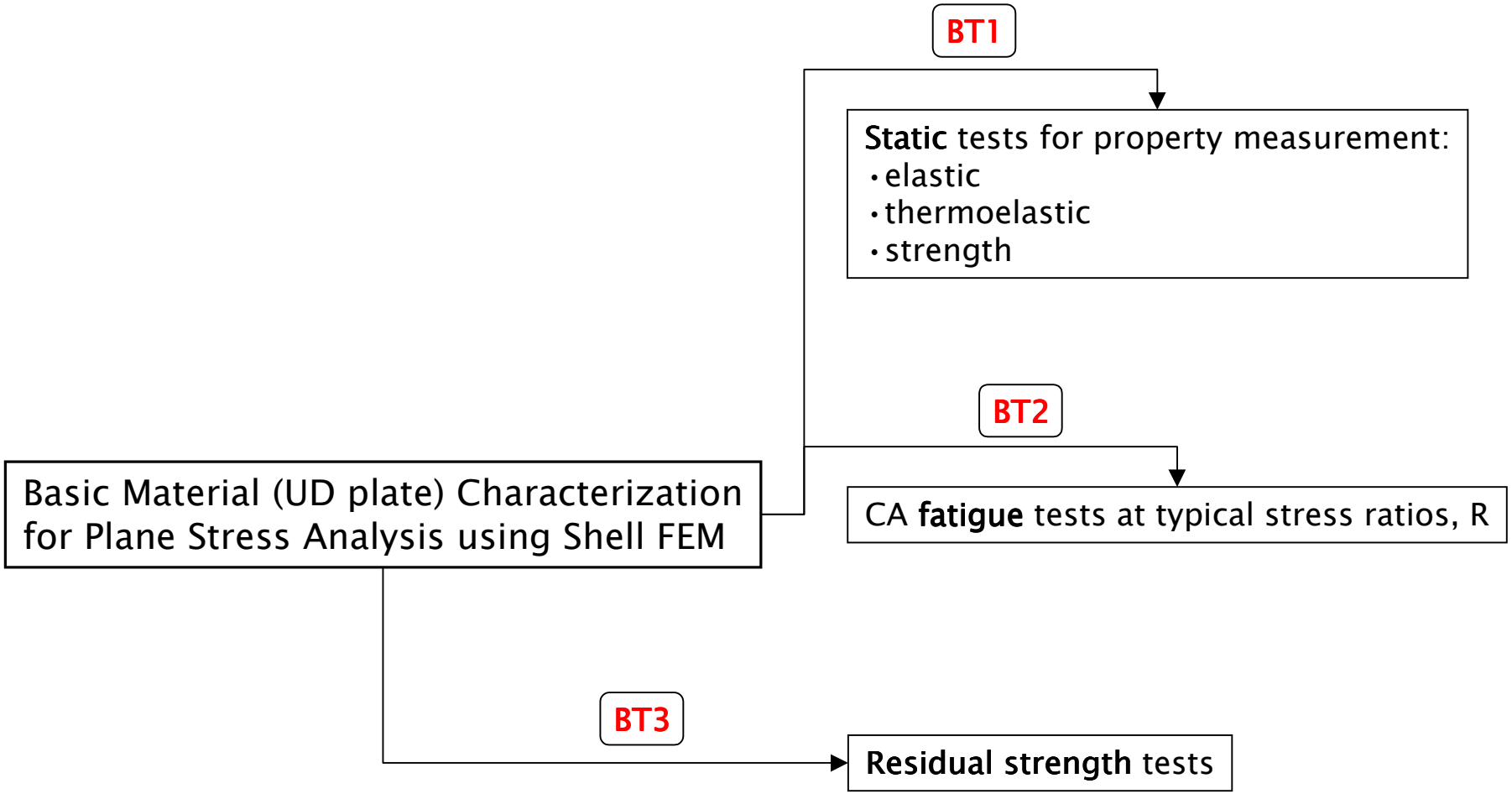
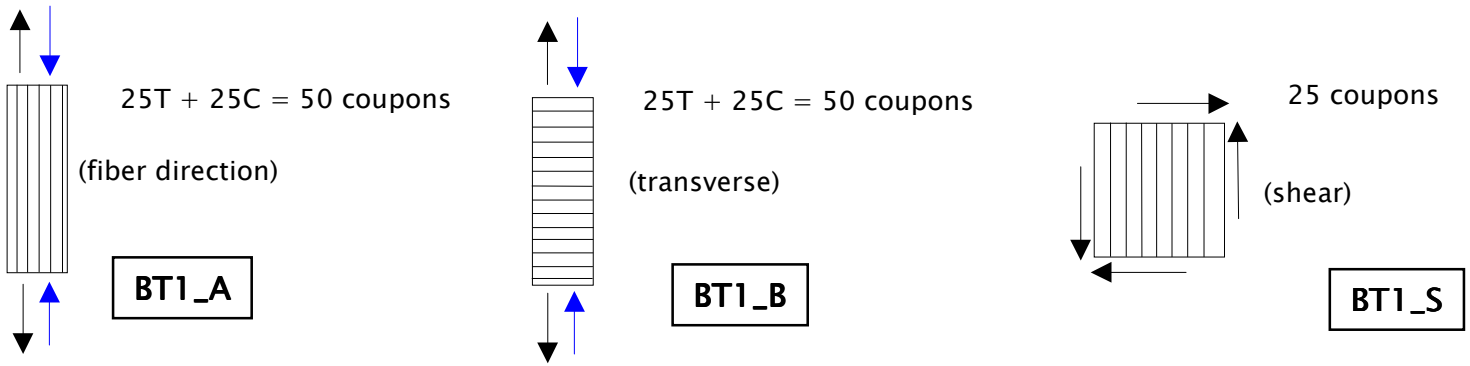

BT1
Static tests for property measurement:
• elastic
• thermoelastic
• strength
BT2
Basic Material (UD plate) Characterization for Plane Stress Analysis using Shell FEM
CA fatigue tests at typical stress ratios, R
BT3
Residual strength tests

BT1. Static tests for basic material (UD plate) characterization

Measurement of elastic engineering constants {E_1, E_2, G_{12}, ν_{12}}, TEC {α_1, α_2}, strength {X, X', Y, Y', S}



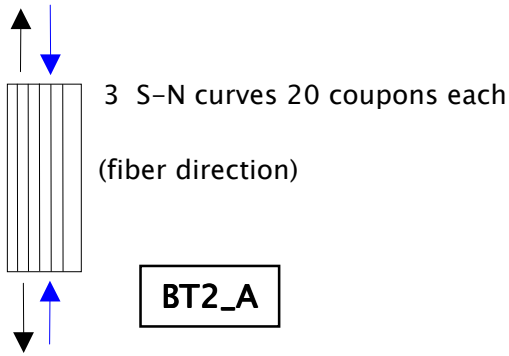
Thermal Expansion Coefficients (TEC): 15 specimens per direction using TMA = 30 specimens

For an orthotropic material, complete, in-plane, characterization:
125 coupons + 30 TEC specimens = 155 experiments in 2 months

(Total test time corresponds to one testing machine and one TMA device by assuming that 5 static tests/day and 5 TEC tests/day can be performed)

BT2. CA fatigue tests for basic material (UD plate) characterization

CA cyclic tests at R=0.1, R=-1, R=10 in the fiber direction, transversely to it and in shear



3 S-N curves 20 coupons each

(fiber direction)

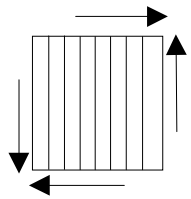
BT2_A

3 S-N curves 20 coupons each

(transverse)

BT2_B

R=0.1, 20 coupons



(shear)

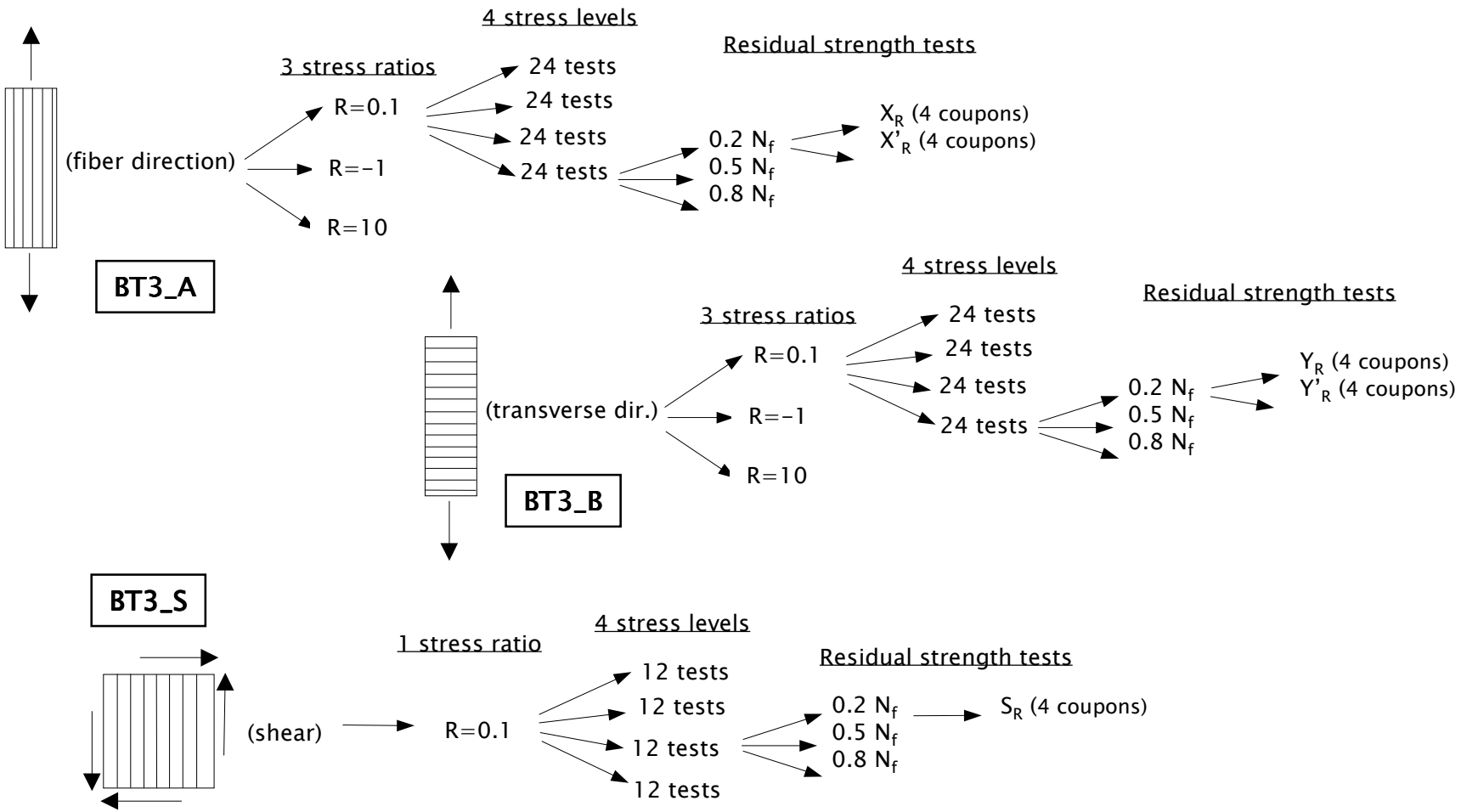
BT2_S

1 month per curve @ 5 Hz

For an orthotropic material, complete, in-plane, characterization:
7 S-N curves = 140 experiments in 7 months

(Derivation of testing time, I.e. 1 month/S-N curve is done as shown in S-N.xls)

BT3. Residual strength tests for basic material (UD plate) characterization



For an orthotropic material, complete, in-plane, characterization:
624 experiments in 18 months (See file res_strength.doc)