Transverse biaxial tests on long fibre reinforced composites

P.L. Zumaquero, E. Correa, J. Justo, F. París

Group of Elasticity and Strength of Materials
Continuum Mechanics and Theory of Structures Department
School of Engineering
Universidad de Sevilla

Measuring transverse strength of UD plies in static tension or compression
October 20th, 2022

Projects P18-FR-3360 and P18-FR-3855
MOTIVATION

TRANSVERSE FAILURE-UNIAXIAL LOADS

MACRO-LEVEL

MICRO-LEVEL

BIAXIAL LOADS?

TENSION

COMPRESSION

MACRO-LEVEL

MICRO-LEVEL

≈ 53°
OBJECTIVE

EXPERIMENTAL T-nT and T-nC TESTING CAMPAIGN

DRAWBACK: A complex manufacturing process!

MAIN RESULTS (*):  
- Effect of the secondary traction on the failure occurrence  
- Orientation of the plane of failure  
- Initial failure point  
- Strain measurements at the centre of the specimen  

‘Apparent’ stresses associated with the vertical and horizontal actuators: $\sigma_v = \frac{F_v}{A}$, $\sigma_h = \frac{F_h}{A}$

FAILURE PREDICTION

\[ \varepsilon_{22} \text{ versus } \varepsilon_{33} \ (\text{centre of the coupons}) \]

\[ y = -0.6883x + 4526 \]
\[ R^2 = 0.9559 \]

Features taken into account in the numerical model (*)
- Different stiffness values for tension and compression
- Different stiffness values for directions 2 and 3
- Non-linear behaviour

Experimental
\[ 1.5 \varepsilon_{22} + \varepsilon_{33} = \varepsilon_{2T} \]

Numerical
\[ 1.4 \varepsilon_{22} + \varepsilon_{33} = \varepsilon_{2T} \]

(*) P. L. Zumaquero, E. Correa, J. Justo J., F. París, Mechanics of Advanced Materials and Structures, accepted for publication
Transverse biaxial tests on long fibre reinforced composites

P.L. Zumaquero, E. Correa, J. Justo, F. París

Group of Elasticity and Strength of Materials
Continuum Mechanics and Theory of Structures Department
School of Engineering
Universidad de Sevilla

Measuring transverse strength of UD plies in static tension or compression
October 20th, 2022