



KU LEUVEN



Measuring shear strength and the factors affecting it

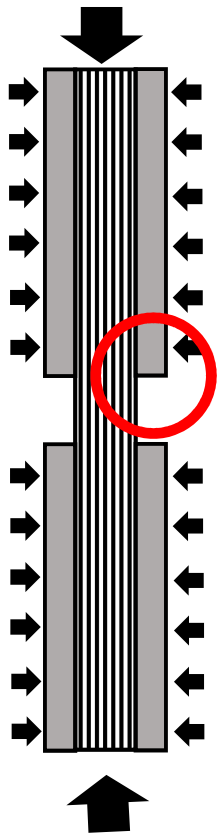
7 March 2022

Considerations on getting the Shear Strength in Composites

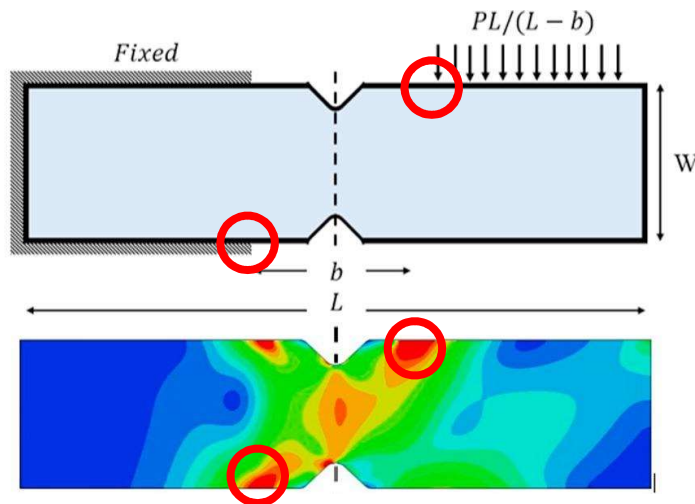
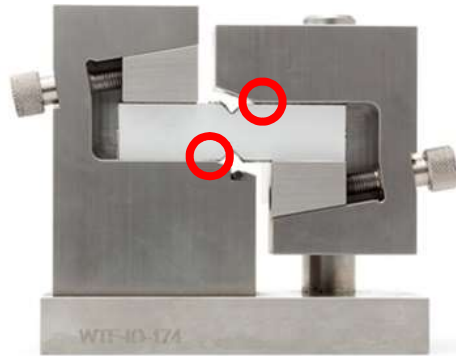
A. Barroso, J.C. Marín, F. París



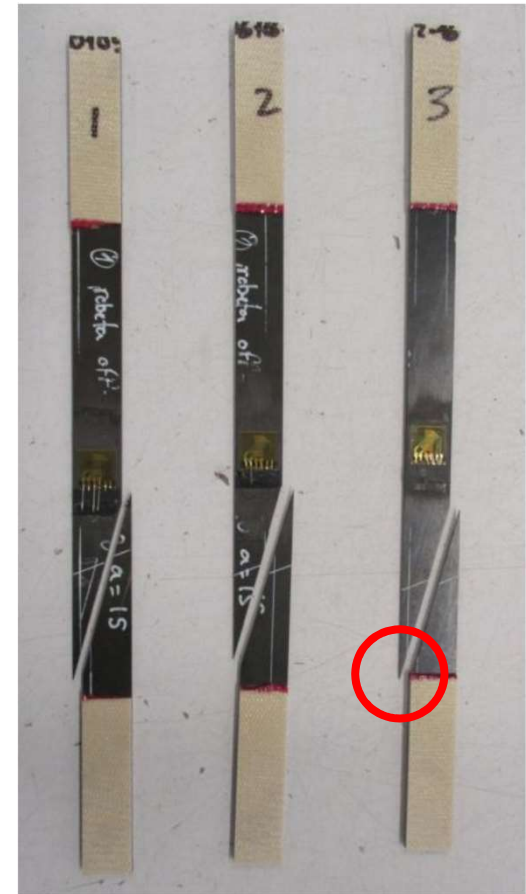
Previous WS
(compression)

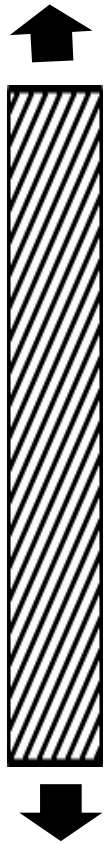


Iosipescu

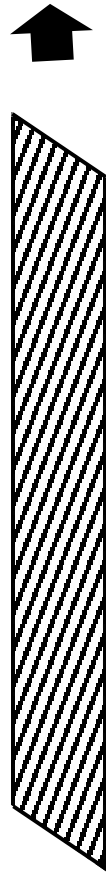


Off-axis

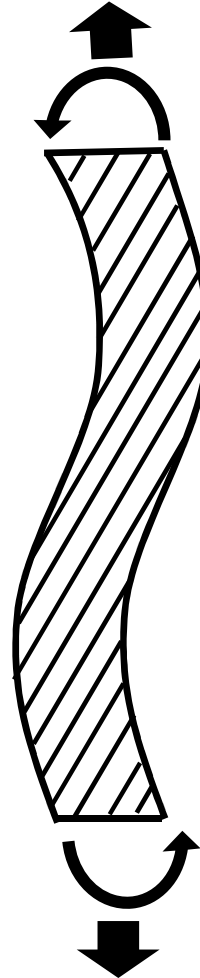




Undeformed



Deformed

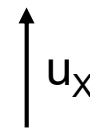


Grip constraints



Oblique tabs

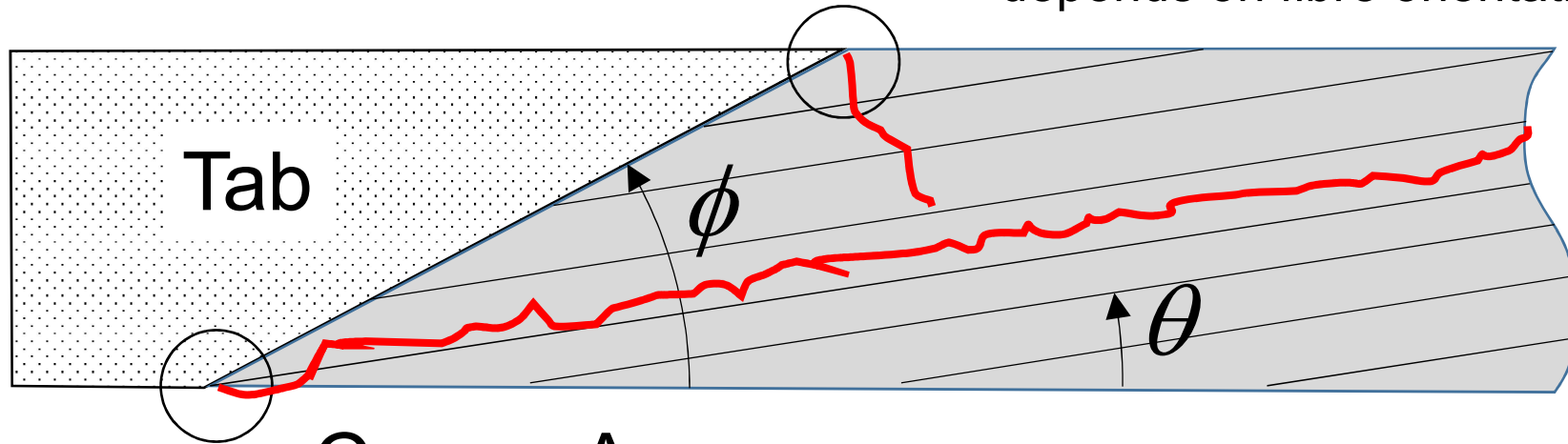
Tab angle
coincides with
a $u_x = \text{cte}$ line



Potential failures starting at bonded tab corners

Corner B

Tab inclination ϕ ($u_x = \text{cte}$)
depends on fibre orientation θ



Tab

ϕ

θ

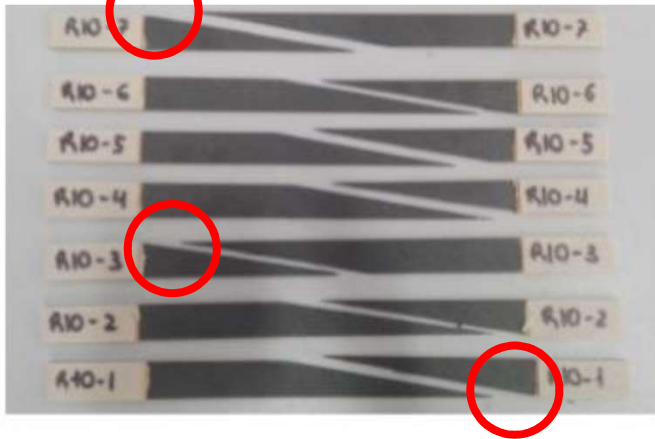
Corner A

$0 < \delta_k < 1$ is the order of the stress singularity and depend on:

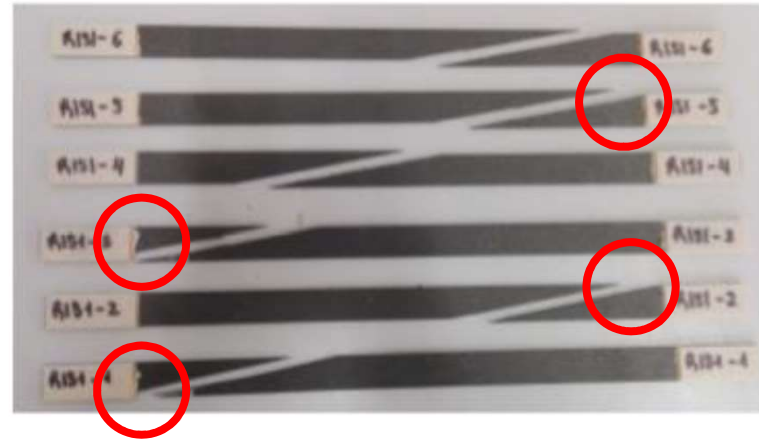
- the local geometry of the corner
- the local material properties
- the local boundary conditions.

$$\sigma_{\alpha\beta}(r, \theta) \cong \sum_{k=1}^n K_k r^{-\delta_k} f_{\alpha\beta}^k(\theta)$$

RATIO 10

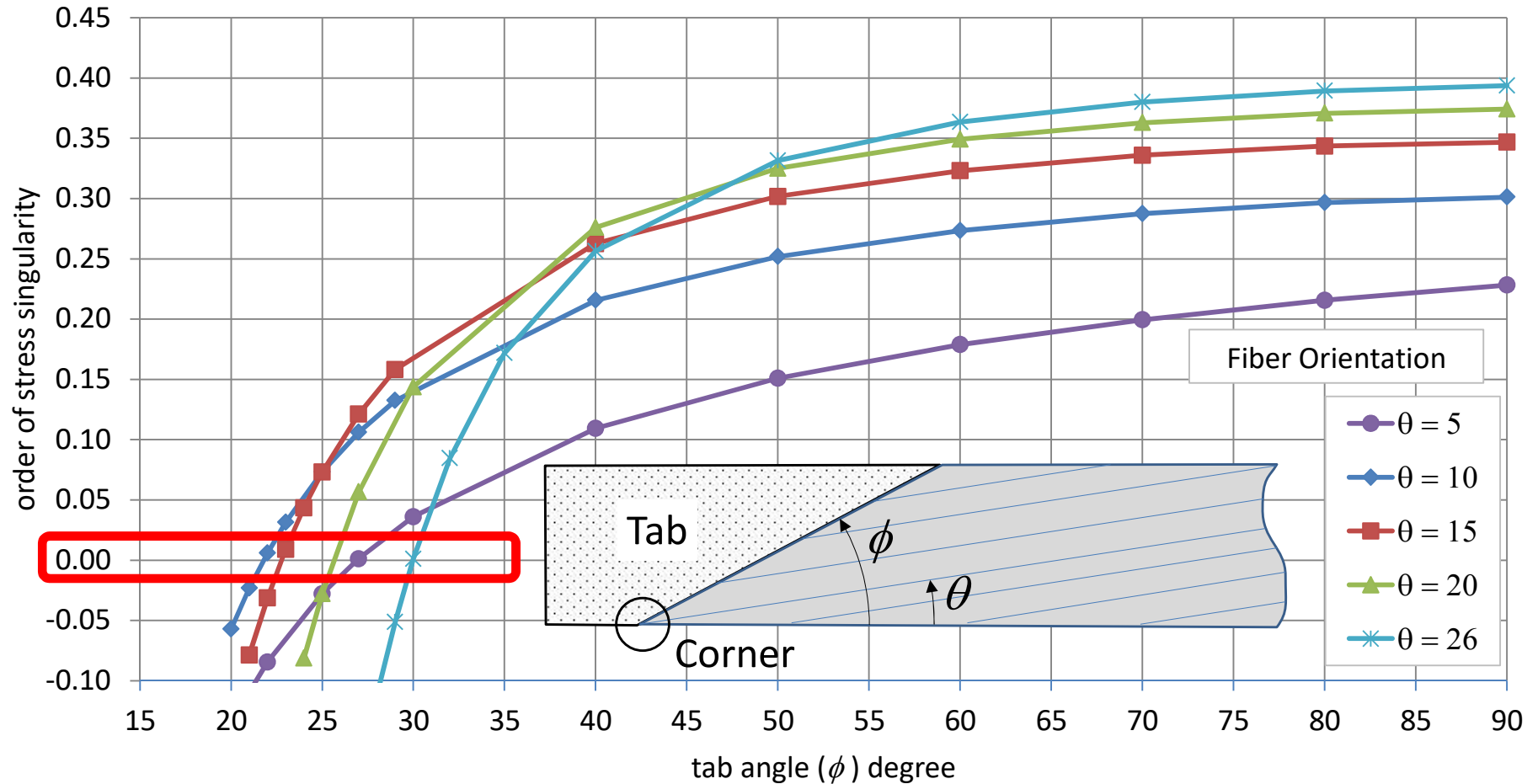


RATIO 15



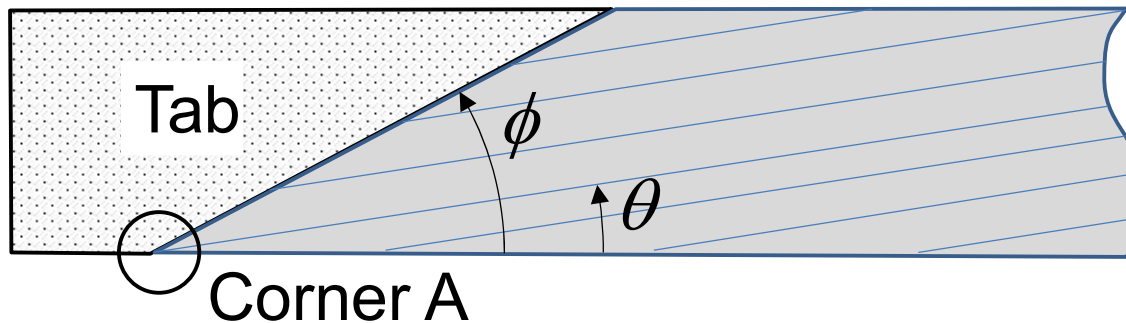
RATIO 20

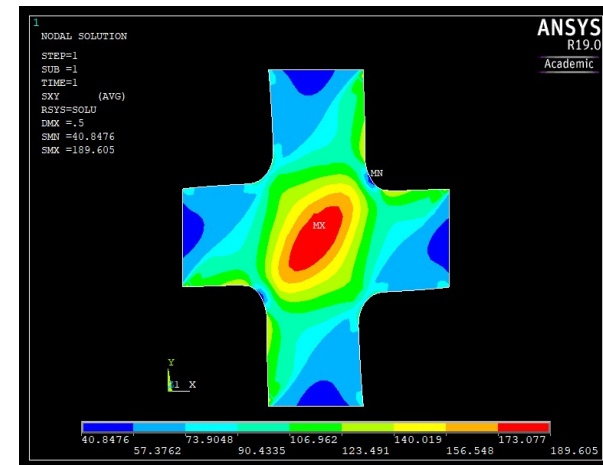
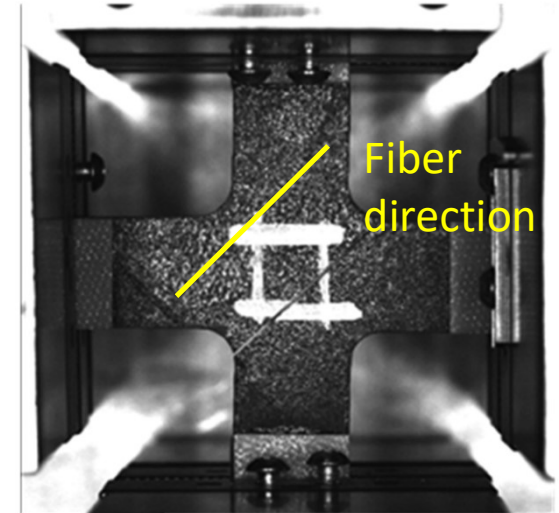
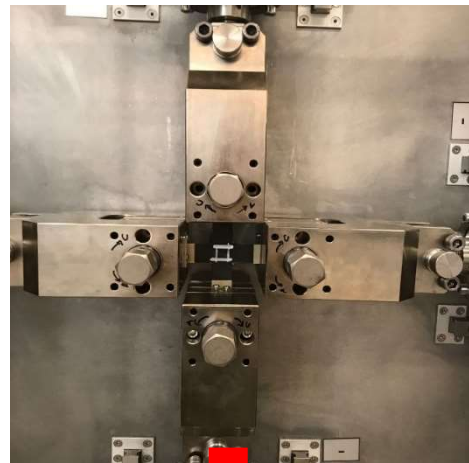




Optimal off-axis test configuration

θ (°)	ϕ $u_x = \text{cte}$ (°)	θ No singularity (°)	Difference (°)
5	29.6	27.0	-2.6
10	23.1	22.0	-1.1
15	24.2	22.5	-1.7
20	27.5	26.0	-1.5





J.C. Marín, J. Cañas, F. París, J. Morton. Determination of G_{12} by means of the off-axis tension test. Part I: review of gripping systems correction factors, [Compos. Part A, 33: 1, 87-101. 2002.](#)

J.C. Marín, J. Cañas, F. París, J. Morton. Determination of G_{12} by means of the off-axis tension test. Part II: A self-consistent approach to the application of correction factors, [Compos. Part A, 33: 1, 101-111. 2002.](#)

J.C. Marín, J. Justo, A. Barroso, J. Cañas, F. París. On the optimal choice of fibre orientation angle in off-axis tensile test using oblique end-tabs: Theoretical and experimental studies, [Compos. Sci. Technol., 2019 178, 11-25.](#)

A. Barroso, J.C. Marín, V. Mantic, F. París. Premature failures in standard test specimens with composite materials induced by stress singularities in adhesive joints. [Int. J. of Adhesion & Adhesives 97 \(2020\) 102478.](#)

J.C. Marín, A. Barroso (2021) Comparison of the shear behavior in graphite-epoxy composites evaluated by means of biaxial test and off-axis tension test, [Sci. Eng. Compos. Mater., 2021, 28: 1.](#)



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