Considerations on getting the Shear Strength in Composites

A. Barroso, J.C. Marín, F. París
Previous WS (compression)  Iosipescu  Off-axis
MOTIVATION

Tab angle coincides with a $u_x=$cte line

Undeformed    Deformed    Grip constraints    Oblique tabs
Potential failures starting at bonded tab corners

Corner B

Tab inclination \( \phi (u_x=\text{cte}) \) depends on fibre orientation \( \theta \)

Corner A

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

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.
SINGULARITIES IN OFF-AXIS TEST

Order of stress singularity vs tab angle (φ) degree for different fiber orientations:
- θ = 5
- θ = 10
- θ = 15
- θ = 20
- θ = 26

- Corner

- Tab
Optimal off-axis test configuration

<table>
<thead>
<tr>
<th>$\theta$ (°)</th>
<th>$\phi$ $u_x=$cte (°)</th>
<th>$\theta$ No singularity (°)</th>
<th>Difference (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>29.6</td>
<td>27.0</td>
<td>-2.6</td>
</tr>
<tr>
<td><strong>10</strong></td>
<td><strong>23.1</strong></td>
<td><strong>22.0</strong></td>
<td><strong>-1.1</strong></td>
</tr>
<tr>
<td>15</td>
<td>24.2</td>
<td>22.5</td>
<td>-1.7</td>
</tr>
<tr>
<td>20</td>
<td>27.5</td>
<td>26.0</td>
<td>-1.5</td>
</tr>
</tbody>
</table>
BIAXIAL TENSION-COMPRESSION TEST

Fiber direction


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