Impact and Post-Impact Response of a Composite Material to Multiple Non-Coincident Impacts

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**OBJECTIVES**

- Develop multiple non-coincident impact method to study effects of impact proximity on damage tolerance
- Develop Flexure after Impact (FAI) method as alternative damage tolerance test
- Develop simple finite element model that uses experimental data to predict residual strength

**STRENGTH PREDICTIONS**

- Plate modeled in ABAQUS w/ inhomogeneous elliptical inclusion
- Inclusion stiffness and dimensions produce unique stress concentration ($K_M$, $K_T$)
- Predictions consistent and reasonably accurate

**EXPERIMENTAL SETUP**

<table>
<thead>
<tr>
<th>Incident Energy</th>
<th>Drop-Weight Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>12.56 N-m</td>
</tr>
<tr>
<td>Middle</td>
<td>18.90 N-m</td>
</tr>
<tr>
<td>High</td>
<td>25.33 N-m</td>
</tr>
</tbody>
</table>

**MULTIPLE IMPACT**

- 2in and 0.5in impact separation distances
- 2in impacts do not influence one another
- 0.5in impacts display increased energy absorption and damage

**SAMPLES**

- 24oz/yd plane-weave S-2 glass fiber mat
- CCMFCS2 two-part epoxy resin
- Symmetric, cross-ply layup [0°,90°,90°,0°]_S
- 4in wide x 0.225in thick

**STRENGTH PREDICTIONS**

- Flex props less sensitive than compressive
- Flex props distinctly sensitivity to impact energy
- 2in display no strength loss from single impact
- 0.5in impacts display reduction for all props

**ACKNOWLEDGEMENTS**

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