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

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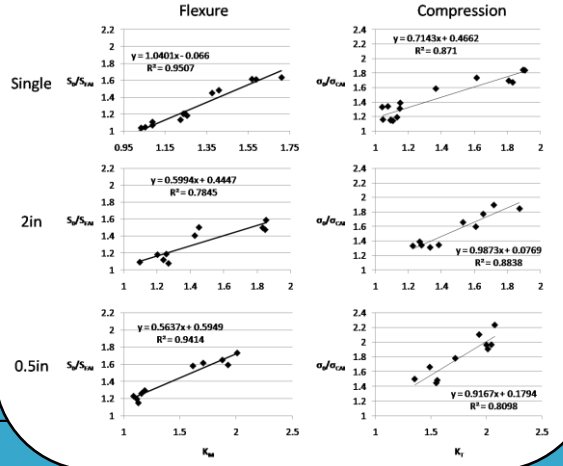
OBJECTIVES

- 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

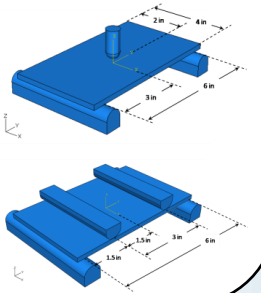
	Incident Energy
Low	12.56 N-m
Middle	18.90 N-m
High	25.33 N-m

Drop-Weight Impact

- Two edges simply-supp
- 6in supp span

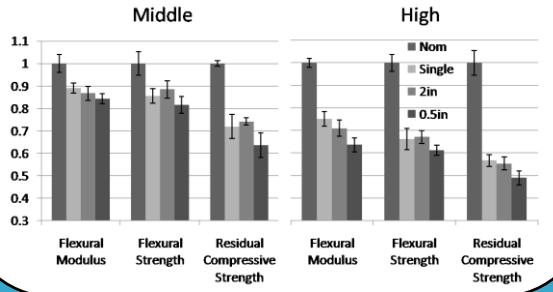
4-pt FAI

- 3in load span, 6in supp span
- Max stress over damaged area btwn loading noses
- 0.3in/min displ rate



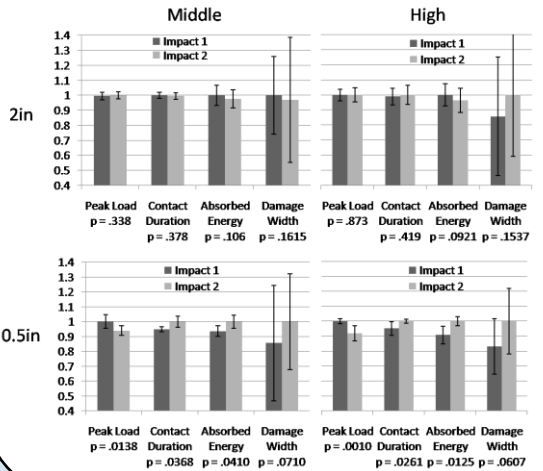
DAMAGED PROPERTIES

- 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



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

ACKNOWLEDGEMENTS

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