OPTIMAL COMPOSITE PANEL CHARACTERISTICS FOR BLAST SENARIOS

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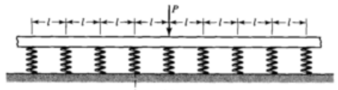
PREVIOUS WORK

- Stitched composites
  - Mouritz - 2001
  - Work done showed that stitching improved the blast resistance of the laminates
  - Reduced flexural properties and lack of design variety led to the selection of a different panel type
- Fiber-metal laminates
  - Abdullah et al - 2006 & Langdon et al - 2006
  - Performed very well in ballistic and localized blast testing
  - Lack of design variety led to the selection of a different panel type
- Sandwich composites
  - Excellent flexural properties and limitless design options led to the selection of these panel types

GEOMETRIC DESIGN ASSUMPTIONS

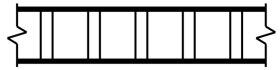
- Top facesheet of panel modeled as a beam on an elastic foundation



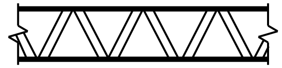
- Uniformly distributed load with finite length
- Infinitely long panel
- Stiffeners treated as simply supported
- Unit width of the panel
- Each stiffener retains strength after reaching maximum capacity
- The panels share the same material properties in both the facesheets and stiffeners

POSSIBLE CORE GEOMETRIES

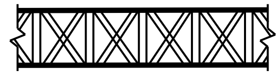
- Straight -



- Angled -



- Combination –



- Using the assumptions, the loads in each of the stiffeners was determined
- With the loads known, magnitudes of the distributed load were able to be calculated for each stiffener failure
  - These values were taken to be strengths

DESIGN STRENGTHS

# of Failed Stiffeners	Straight Design	Angled Design	Combination Design
1	8.397E-05	7.405E-05	1.162E-04
3	8.436E-05	7.408E-05	1.171E-04
5	8.529E-05	7.434E-05	1.192E-04
7	8.706E-05	7.518E-05	1.225E-04
9	9.014E-05	7.717E-05	1.277E-04
11	9.512E-05	8.103E-05	1.350E-04
13	1.026E-04	8.750E-05	1.452E-04

(Units - length*E)

- Combination design clearly the strongest
- Angled design was the weakest

NORMALIZED STRENGTH

# of Failed Stiffeners	Straight Design	Angled Design	Combination Design
1	5.598E-05	2.138E-05	2.276E-05
3	5.624E-05	2.139E-05	2.294E-05
5	5.686E-05	2.146E-05	2.335E-05
7	5.804E-05	2.170E-05	2.399E-05
9	6.009E-05	2.228E-05	2.501E-05
11	6.341E-05	2.339E-05	2.644E-05
13	6.840E-05	2.526E-05	2.844E-05

(Units – length*E/weight)

- Normalized strength was determined by dividing the original strengths by the panel's weight
- Straight design clearly the best

STRENGTH TRENDS

Stiffeners Failed	% Gain of Strength
1	
3	0.830
5	1.732
7	2.831
9	4.182
11	5.785
13	7.510

- As more panels fail, the increase in strength gets larger. This trend is seen in all three designs
  - This is attributed to the assumption that each stiffener retains its strength after reaching maximum capacity.

FUTURE WORK

- We would like to make more accurate assumptions for the load distribution into the stiffeners and have a more realistic distributed load over the top facesheet.
  - This could be achieved through the use of computer software

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