Understanding the Behaviour of Tufted Sandwich Structures in Edgewise Compression

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Overview

1. Background
2. Single Tuft Testing
3. Tuft Interaction
4. Future Work

Tufted sandwich panel.
What is Tufting?

- Method of through thickness reinforcement.
- Advantages over stitching:
  - Tooling flexibility
  - Mechanical Properties
  - Cost (over 3D weaving)

- Applied to sandwich structures.
- Improves the interface between skin and core.
- Greater energy absorption capability.

Tufted sandwich panel.
Single Tuft Testing

• Aim to characterise effect of process variables:
  – Chosen variables were loop lengths and number of threads.
• Coupon designed to test single tuft in edgewise compression.

Tuft loops formed on back face.  
Single tuft coupon design.
Testing Results

- Energy absorption results showed little effect of loop size, some effect of adding multiple tufts.

![Chart showing single tuft testing results](chart.png)

*Single tuft testing results.* (SEA – Specific Energy Absorption)
Tuft Interaction

- Resin columns formed around tufts due to needle size.
- Testing revealed detachment and drifting of columns after failure.

Test developed to observe tuft motion during crushing.
- Showed clear drifting and stacking of the resin columns.

Drifting behaviour of columns during crushing.

Failed sample after core removed.
Future Work

- Further analysis of column failure:
  - Investigate how column interactions affect global failure.

- Develop modelling approach for tufted sandwich structures:
  - Predict failure – improve design.

*Large panel demonstrator in collaboration with TU Delft and BMW.*
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