Experimental characterisation of TTR as an in-plane defect

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Previous research at Bristol has focused on characterising the traction-separation behaviour, including the effect of mode-mixity, multiple cracks and embedded length. The next stage is to assess their behaviour in an ‘in-service’ context. The introduction of fibre waviness close to the z-pins is the most obvious micro-structural change which occurs as the fibres are forced aside during insertion. Therefore, this study focuses on the in-plane behaviour of laminates with z-pins considered a ‘defect’.

Introduction

- Z-pin induces many features into the laminate micro structural architecture which can be considered as defects.
- Development work for manufacture of single-pin and array samples has been carried out at the NCC.
- Tension as well as compression testing have been done on single and double pinned samples with varied areal densities (0.25%, 0.5%, 1% & 2%) to define the relationship between pin density and in-plane properties.

Specimen Manufacture

In-plane tension
- IM7/8552
- Lay-up (+45, 90, -45, 0)6s
- 48 plies (CPT = 0.125mm)
- nominal thickness 6mm

In-plane compression
- IM7/8552
- Lay-up (+45, 90, -45, 0)6s
- 48 plies (CPT=0.125mm)
- nominal thickness 6mm

Results and Discussion

Summary of IM7/8552 compression tests with failure in z-pin section ONLY

(SL & DL represent single and double lines of z-pins with respective percentages)

Summary of IM7/8552 tensile tests with failure in z-pin section ONLY

(All three specimens with Single line of 0.5% z-pins failed away from z-pins section, hence excluded)

Single and double z-pinned specimens have been tested under tension and compression loading but experimental data show z-pin has almost caused no strength knock-down. This might be because only single and double line of z-pins were used. Future work might include increasing the number of z-pins rows to verify if the pins cause any strength reduction.

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