# LONGITUDINAL DEBONDING IN UNIDIRECTIONAL COMPOSITES: A NUMERICAL STUDY OF THE EFFECT OF INTERFACIAL PROPERTIES

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Fibre-matrix longitudinal debonding, governed by the interfacial shear strength and fracture toughness, alters the stress transfer mechanism in the composite by changing the stress field around the broken fiber [1]. In a majority of the fibre-matrix debonding finite element models in the literature, as in [2], the debonded length has been imposed based on the experimentally measured lengths. The simplified models typically treat the matrix as a linear elastic material and/or exclude the effects of interfacial friction and thermal residual stresses on the stress behavior of the constituents. The current work develops high-fidelity debonding models, which include the main relevant phenomena occurring in reality to perform a numerical parametric study of the interfacial properties in carbon fibre/epoxy systems in single-fiber (Figure 1a) and multi-fibre composites (Figure 1b-c). Numerical results show that the thermal residual stresses constrain the debond propagation and the interfacial friction has a significant influence on how the axial load in the broken fibre recovers (Figure 1d). Figure 1e shows the effect of fracture toughness on the stress profile for the broken fibre in the single-fibre model. It is concluded that, within the range of reported interfacial properties, for large friction coefficients ($\mu > 0.4$) or high interfacial fracture toughnesses ($G_{II}^{c} > 0.1\ N/mm$) no debonding will be developed.

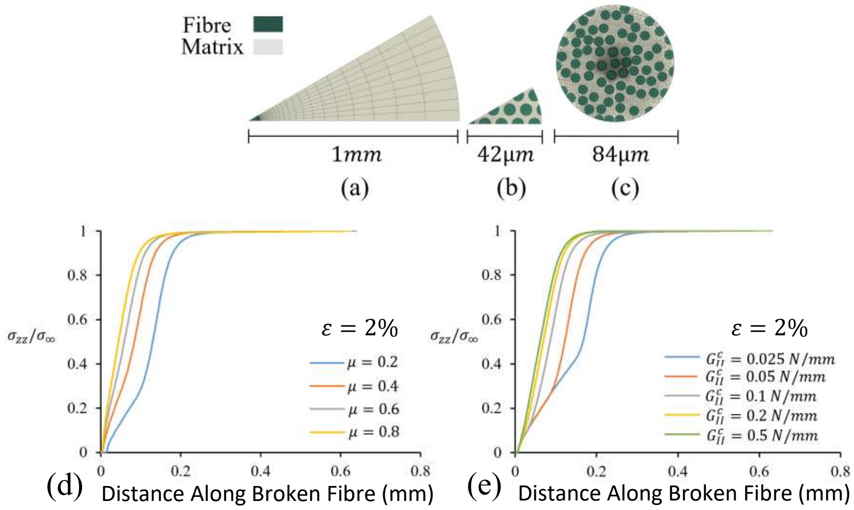


Figure 1. Cross-section of (a) single-fibre and multi-fibre models in (b) hexagonal and (c) random fibre packings with a single broken fibre in the centre; effect of varying (d) friction coefficient and (e) fracture toughness on recovered normalized stress along the broken fibre.

## References

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