

Development of Non-Conventional Composite Materials

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Focus Material: Composites

Focus of the Presentation: *(iv) Structure-material integration and design.*

Abstract

The need to understand the failure mechanisms in composite materials at the micro level has gained additional importance due to the increasing need to develop high performance materials for more demanding applications. This understanding makes it possible to develop new materials by recurring to hybridization, either fibre hybridization [1] or ply hybridization [2].

In this work a micromechanical model that takes into account the statistical nature of fibre strength and the fibre waviness present in composite materials is developed and used to determine the failure behaviour of hybrid and non-hybrid composite materials. The model is able to capture failure mechanisms in the three main components of a composite material: fibres, matrix and fibre-matrix interface. This study is performed for multiple load scenarios, with focus on the longitudinal tensile and compressive failure of these materials. The effect of transverse stresses in these types of failure is also assessed to better understand its effects on the failure mechanisms.

References

[1] Tavares, Rodrigo P., et al. "Mechanics of hybrid polymer composites: analytical and computational study." *Computational Mechanics* (2016): 1-17.

[2] Furtado, C., et al. "Selective ply-level hybridisation for improved notched response of composite laminates." *Composite Structures* 145 (2016): 1-14.