

RESUMO N° 161

## **FAILURE ENVELOPE DETERMINATION IN FIBRE REINFORCED COMPOSITES USING ASYMPTOTIC HOMOGENIZATION TECHNIQUES**

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**Keywords:** Fibre Composites, Failure, Asymptotic Homogenization, Elastic Properties

The objective of this work is to apply asymptotic homogenization techniques to predict elastic properties and strengths in unidirectional fiber reinforced composites (Glass/Epoxy and Carbon/Epoxy). Considering the composite's microstructure, the homogenization permits the prediction of elastic properties. The homogenized elastic properties were compared to experimental data and to properties generated through RVE (representative volume element) analysis. The results from the numerical methods (asymptotic homogenization and RVE) showed good agreement for some elastic properties, but some large discrepancies were also found for some cases. Moreover, considering loads applied to the macro level, the asymptotic homogenization allows to obtain stresses at the micro level. Due to the micromechanical model employed, different failure criteria can be applied for fiber and matrix, and the component that fails for an applied external load can be detected. A modified von Mises failure criterion was applied for matrix and maximum stress failure criterion was used to predict fiber failure. A methodology to predict strength properties using asymptotic homogenization is presented in this paper. A comparison was made between strength properties calculated through asymptotic homogenization and RVE. Good agreement was found between them. Composite's strengths calculated through homogenization were compared to strengths experimentally obtained and some discrepancies were found between them. Also, numerical failure envelopes were compared to Puck & Schürmann failure envelopes.