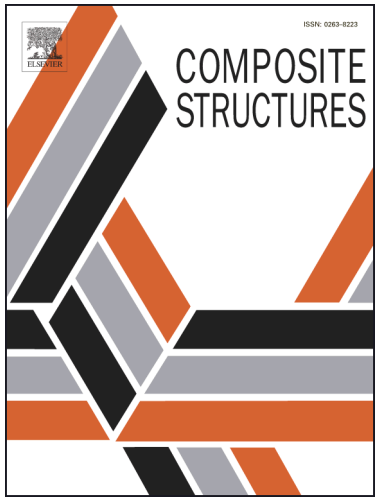

Numerical evaluation of the ENF and 4ENF tests for the shear toughness estimation of adhesive joints

A.J.S. Leal, R.D.S.G. Campilho

PII: S0263-8223(17)34107-7
DOI: https://doi.org/10.1016/j.compstruct.2018.01.107
Reference: COST 9347

To appear in: *Composite Structures*

Received Date: 6 December 2017
Revised Date: 29 January 2018
Accepted Date: 31 January 2018

Please cite this article as: Leal, A.J.S., Campilho, R.D.S.G., Numerical evaluation of the ENF and 4ENF tests for the shear toughness estimation of adhesive joints, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.01.107

Numerical evaluation of the ENF and 4ENF tests for the shear toughness estimation of adhesive joints

A.J.S. Leal[*], R.D.S.G. Campilho[*,**1]

* Departamento de Engenharia Mecânica, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4200-072 Porto, Portugal

** INEGI – Pólo FEUP, Rua Dr. Roberto Frias, 400, 4200-465 Porto, Portugal

Abstract

Adhesive bonding is widespread in several fields, ranging from construction, packaging, automotive industry, aeronautics and medical applications. As a result, it becomes increasingly necessary to reliably estimate their mechanical behaviour. Modern strength prediction techniques such as Cohesive Zone Modelling (CZM) are based on energetic principles. In the context of CZM, the shear fracture toughness (G_{IIC}) is one of the most influential parameters for the strength prediction. This work aims to make a numerical evaluation of the End Notched Flexure (ENF) and Four-Point End Notched Flexure (4ENF) tests to determine G_{IIC} and to provide shear CZM laws for further application in design. Three adhesives were tested: Araldite® AV138, Araldite® 2015 and SikaForce® 7752. An inverse technique was used to obtain the shear CZM laws of the three adhesives. A parameter sensitivity study was also performed to assess the influence of varying G_{IIC} and the cohesive shear strength (t_s^0). It was concluded that the G_{IIC} values for each adhesive obtained by the ENF and 4ENF tests are in good agreement. The inverse method enabled obtaining unique shear CZM laws for both ENF and 4ENF tests, which revealed a good agreement between these test configurations.

Keywords: Adhesive joint; cohesive zone modelling; fracture toughness; cohesive strength; Finite Element Method.

1 – Introduction

In modern structures, the use of adhesive bonding joints has increased when comparing with other traditional methods. As a result, and to increase the confidence in this joining method, it is important to accurately predict the mechanical strength of bonded structures. Design approaches such as fracture and damage mechanics present

[1] Corresponding author. Phone:+351939526892; Fax:+351228321159; Email:raulcampilho@gmail.com