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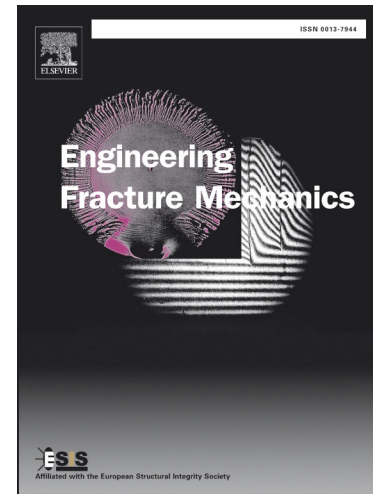
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# Comparative Study on Prediction of Fracture Toughness of CFRP Laminates from Size Effect Law of Open Hole Specimen Using Cohesive Zone Model

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## Abstract:

Carbon fibre reinforced polymer laminates (CFRPs) are widely used in the aerospace industry. However, the longitudinal fracture toughness of this composite material is a major factor that causes its failure. Here, physical linear and exponential softening laws are used to predict the fracture toughness of CFRPs. The model estimates the predicted strength of an open hole specimen of the material by using the cohesive law and the limiting value of the critical crack opening and unnotched strength obtained using a simple tension test. The critical crack opening is calculated based on a thickness formula. The model results are in good agreement with the experimental results, with errors of 6.33% and 11.29% for the linear and exponential cohesive laws, respectively.

**Keywords:** Cohesive law, Fracture processing zone, Size effect, Laminates

## List of nomenclatures

$E_x, E_y, G_{xy}, \nu_{xy}$	Elastic constant of composite laminates
$G_{IC}$	Surface release energy or may called fracture toughness
$K_{Ic}$	Fracture toughness
$K_S$	Remote stress intensity factor
$K_t$	Total stress intensity factor at crack tip
$K_\sigma$	Cohesive stress intensity factor
$S_n$	Nominal strength of composite structure
$Y_1$	Geometric correction factor for circular hole and finite width
$Y_2$	Geometric correction factor at partially loaded crack
$a_i$	Crack length at point (i)
$l_{FPZ}$	Length of fracture processing zone
$\beta_i$	Connecting function
$\delta_C$	Critical Crack opening displacement
$\delta_i$	Crack opening at pint (i) on crack face
$\epsilon_f$	Fracture strain in simple tension test

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