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Optical measurement method to estimate the tension cohesive law of adhesive joints in natural fibre composites

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Adhesive bonding has become more efficient in the last few decades due to the developments in adhesives technology, giving higher peel and shear strengths, and allowable ductility. On the other hand, natural fibre composites have recently gained interest and application, for instance in the construction industry, due to the low cost and density. Thus, it is important to predict the fracture behavior of joints between these materials, to assess the feasibility of joining during the fabrication process or joining cured parts of a structure. In this work, the tensile behaviour of adhesive joints between natural fibre composites adherends is studied, considering a ductile epoxy adhesive. The experimental work consists on the fracture characterization of the bond by the *J*-integral technique [1], to accurately account for the adhesive ductility. An optical measurement method is used for the evaluation of crack tip opening and adherends rotation at the crack tip during the test, supported by a Matlab sub-routine for the automated extraction of the required analysis parameters. The Finite Element analysis is dedicated to the definition of the traction cohesive law of the adhesive bond by a direct method, based on the differentiation of the fracture energy vs. crack tip opening data [2]. As output of this work, complete fracture data is provided in traction for the subsequent strength prediction of joints in natural fibre composites.

[1] T. Andersson and U. Stigh, Int. J. Sol. Struct. 41, 413 (2004).
[2] Y. Zhu, K.M. Liechti and K. Ravi-Chandar, Int. J. Sol. Struct. 46, 31 (2009).