

## Damage and Failure in Composites

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The strategies for modelling failure in composites can be classified in two main general trends:

- Strategies based on continuum damage mechanics for characterisation of the state of damage associated to fibre rupture, matrix cracking, delamination, etc (e.g. [1-3]).
- Approaches aiming to replicate virtually the discontinuity associated to cracks, voids, etc (e.g. [4, 5]).

In this talk, recent developments on progressive damage modelling and computational fracture techniques undertaken at the University of Sheffield will be shown. Results include delamination of aerospace composite laminates and impact damage on cross-ply laminates.

### REFERENCES

- [1] J.L. Curiel Sosa, S. Phaneendra and J.J. Muñoz, Modelling of mixed damage on fibre reinforced composite laminates subjected to low velocity impact. *Int J Damage Mechanics*, Vol. **22**(3), pp. 356–374, 2013.
- [2] J.L. Curiel Sosa, Finite element analysis of progressive degradation versus failure stress criteria on reinforced composite materials subjected to impact loading, In *Advances in Composite Materials: Ecodesign and Manufacturing*, edited by B. Attaf. ISBN: 978-953-307-150-3, 2011.
- [3] J.L. Curiel Sosa, Modelling of the nonlinear interface in reinforced concrete. *Int. J. for Computational Methods in Engineering Science & Mechanics*, Vol. **11**(6), pp. 157-161, 2010.
- [4] J.L. Curiel Sosa and N. Karapurath, Delamination modelling of GLARE using the Extended Finite Element Method. *Composite Science Technology*, Vol. **72** (7), pp. 788-791, 2012.
- [5] B. Tafazzolimoghaddam, J.L. Curiel-Sosa, A. Blazquez, M. Mostafavi. About calculation of energy release rates in composites by finite elements. *Ongoing work - in preparation*