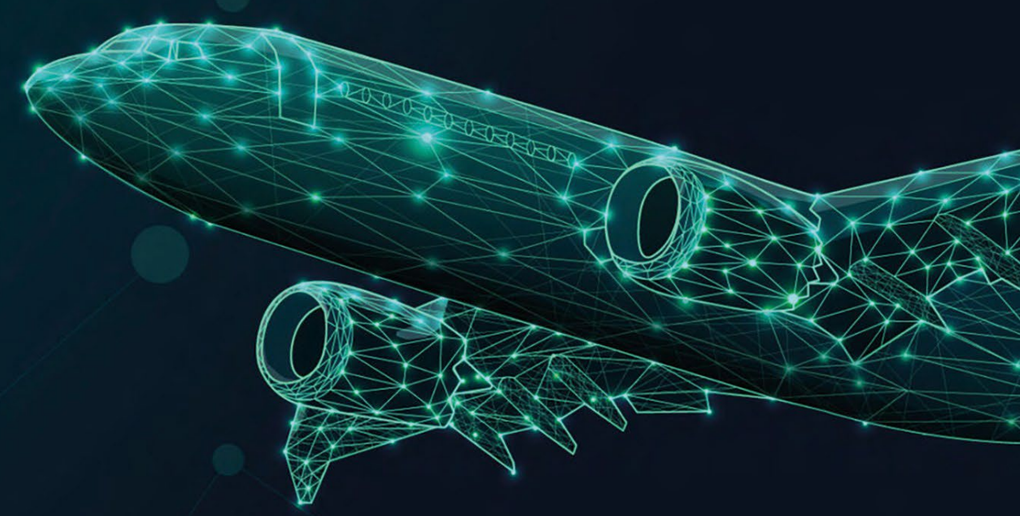
d-standart
for Durability Modelling of Composites

Towards Multiscale Modelling of Fatigue in Laminated Composites

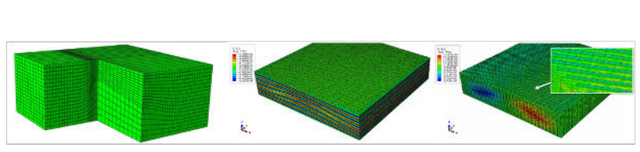
G. Cucu, B. El Said, G. Allegri



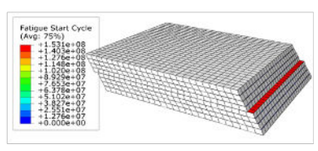
OBJECTIVES

- Enable simulation of fatigue on macro-scale laminated composite structures
- Build a database of high-fidelity ply-by-ply RVEs with varying layups, defects, loading
- Pre-compute responses of meso-scale RVEs under periodic boundary conditions and simplified cyclic loading
- Homogenise RVEs and combine into continuous responses for a given material system, to be sampled at runtime

HOMOGENISATION STRATEGY

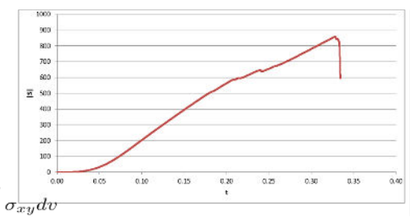


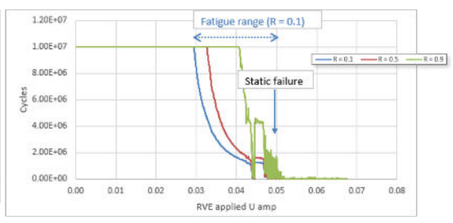
Parameterised RVE generation



Fatigue initiation/progression models with crack tip tracking

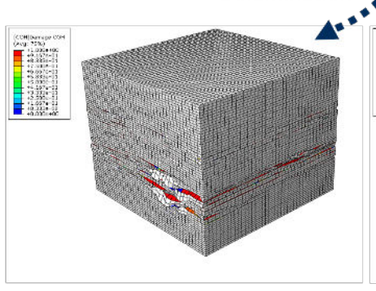
$$S_{xy} = \frac{1}{V}\int \sigma_{xy} dv$$



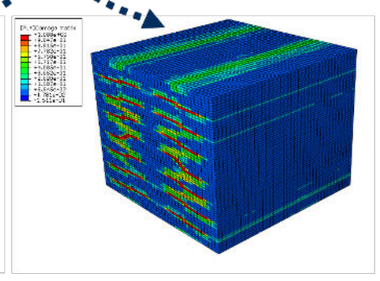


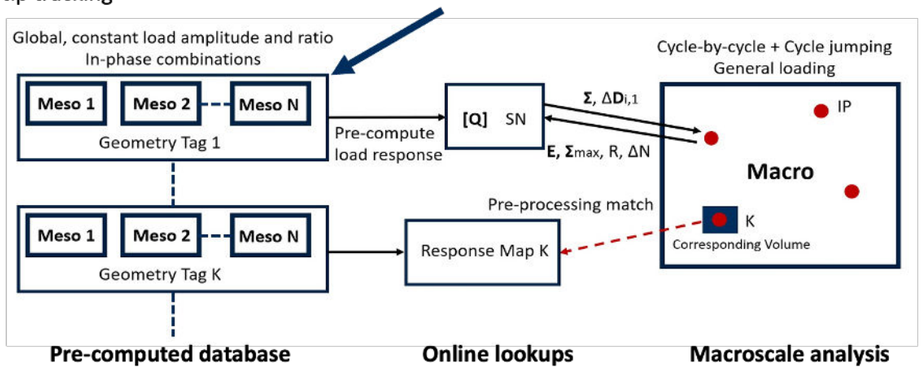
Automated stress/strain homogenisation and failure extraction

Delamination



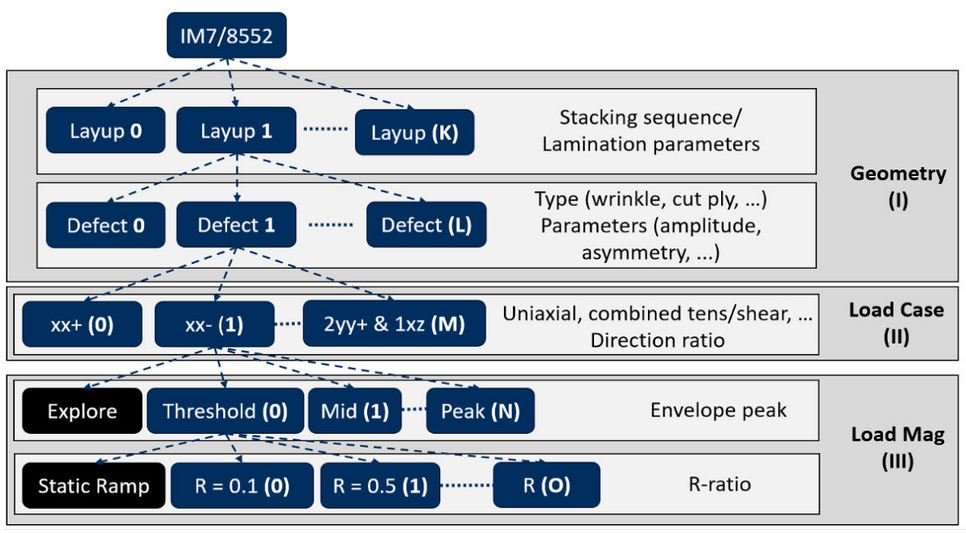
Ply damage



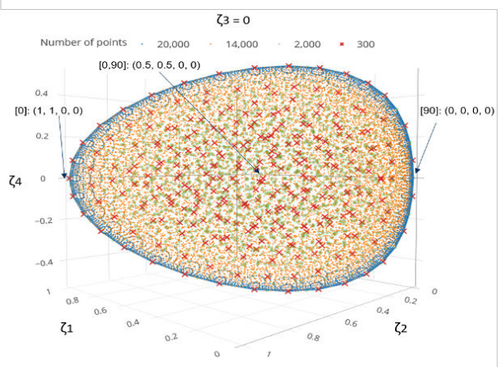


EXPLORATION OF MATERIAL RESPONSE

- Initial focus on meso progression --- macro initiation.
- Separate the multiscale framework from specific physical models. Allow swapping/combination of different models.
- Focus on interfaces, means of combining discrete responses, and means of generating the discrete inputs.



Model hierarchy



Feasible lamination parameters space (z1, z2, z3, z4). Projection with z3 = 0. Four levels of simplification (20,000 - blue to 300 points - red).

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Corresponding author:
giuliano.allegri@Bristol.ac.uk

Email:
contact@d-standart.eu

Coordinator:
Marco Nawijn, NLR

d-standart.eu

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