Fatigue failure in fibre-dominated CFRP composite laminates

Fabrizio PAGANO
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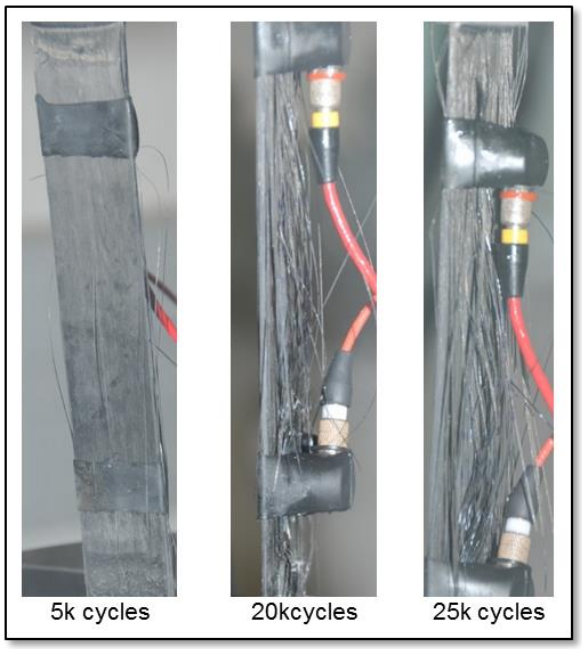
Industrial Partner: ONERA
Supervisors: Alain Thionnet (ENSMP), Myriam Kaminski (ONERA)



UD $[0^o]_4$ T700/M21 : fatigue damage
R=0,1 ; σ_{MAX} = 90% σ_R ; f = 5 Hz

- CFRP composites
- Tension-tension fatigue
- Fibre breaks evolution
- Failure of the 0° plies

Abstract:

Carbon fibres reinforced plastic (CFRP) composite materials are being introduced in primary load-bearing structures. Reducing design margins for static loadings increases the stress state into the laminate. Under repeated loadings, these severe stresses may affect the lifetime of composite materials, inducing fatigue degradation and consequent premature failures.

For most multidirectional composite laminates, the longitudinal plies govern the fatigue life performance of the laminate. The fibres give almost the entire contribution of the stiffness and strength of the ply. Thus, the failure of the 0° plies, which are essentially driven by the fibres behaviour, causes the final failure of the laminate.

The objective of this work is to study the fatigue evolution of fibre breaks inside the longitudinal plies of unidirectional and multidirectional laminates subjected to cyclic tension load, and the consequent fatigue failure of the laminate. Tension-tension low cycle fatigue tests are realized on different stacking sequences of a CFRP. The damages evolution is then analysed in both on-axis and off-axis plies and their interaction in terms of stress transfer mechanisms are followed.