From an experimental study of static and fatigue transverse matrix cracking in laminated composites towards damage prediction using an incremental model with an observable variable

Soutenance de thèse – Stacy PATTI
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Résumé

This Ph.D. thesis, conducted at ONERA with Paris-Saclay University and in collaboration with the University of Girona, consisted of conducting an experimental study on static and fatigue transverse matrix cracking in laminated composites in order to go towards damage prediction using an incremental model with an observable variable. During the experimental campaign, more than 70 highly instrumented tests were conducted under quasi-static tensile loading, but also constant amplitude and spectral fatigue loadings on a variety of stacking sequences, such as cross-ply, $[0/\pm45]s$, quasi-isotropic and quasi-double double laminates. These tests enabled a study of off-axis plies' cracking kinetics and the identification of a stacking sequence effect based on the influence of neighboring plies. This understanding of mechanisms influencing laminate cracking led to the development of an incremental damage model, allowing a description of complex loadings, and based on an observable variable, the crack density. An efficient and robust identification protocol of its parameters based on the master curve notion was also proposed in this work. Finally, the model's predictive abilities were satisfyingly assessed on experimental results and highlighted the limits of local modeling approaches.

Mots clés

Fatigue, laminated composites,matrix cracking, damage model