Modèles micromécaniques du dommage intra-laminaire dans les stratifiés avec couches fines

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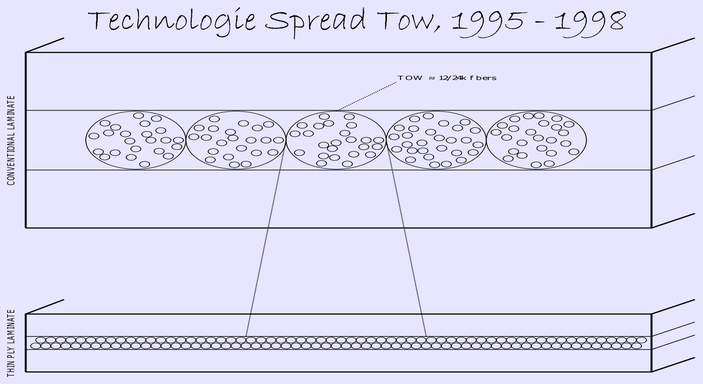
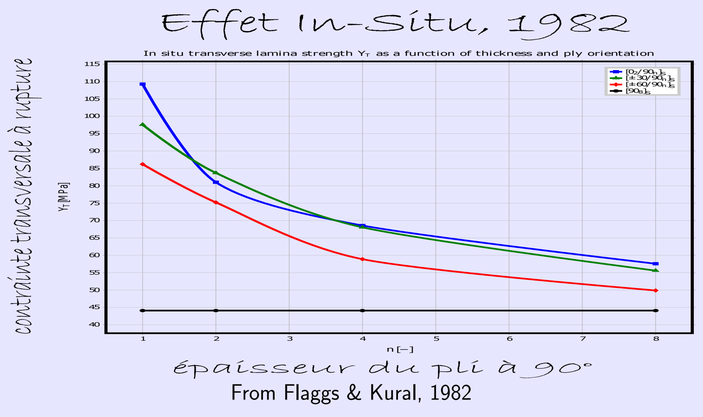
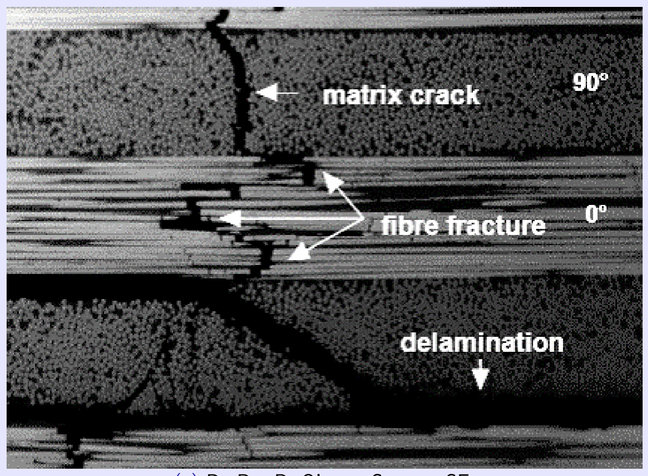
L'industrie aérospatiale face aux défis du futur : perspectives et enjeux

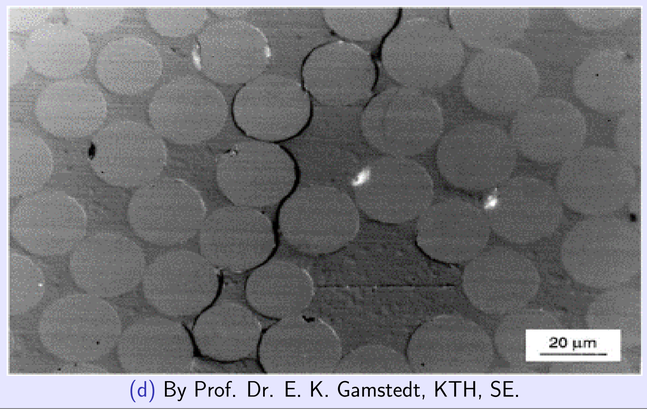




From Flaggs & Kural, 1982



(c) By Dr. R. Olsson, Swerea, SE.



(d) By Prof. Dr. E. K. Gamstedt, KTH, SE.

Objectifs & Approche

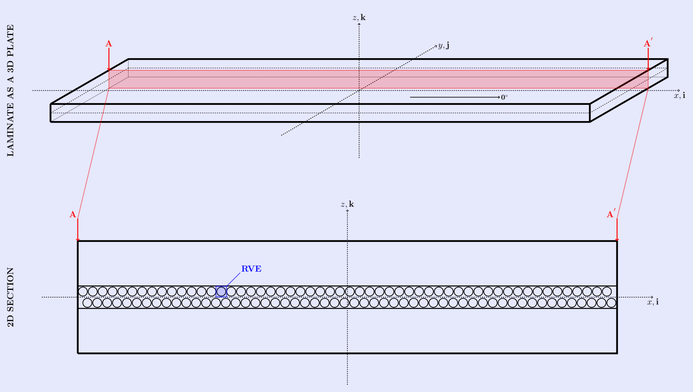
Que-est qu'on veut atteindre ?

$$G_{*c} = G_{*c}\left(\theta_{debond}, \Delta\theta_{debond}, E_{(..)}, \nu_{(..)}, G_{()}, VF_f, t_{ply}, \frac{t_{ply}}{t_{bounding\ \ plies}}\right)$$

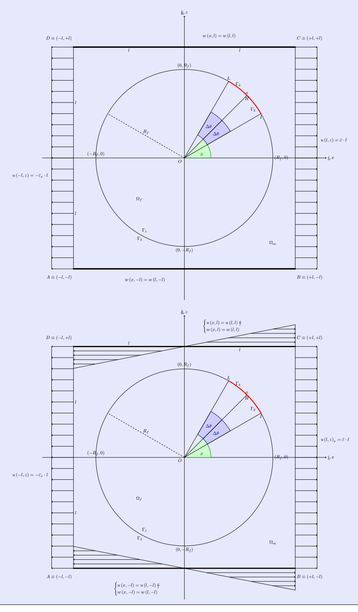
Comment on veut l'atteindre ?

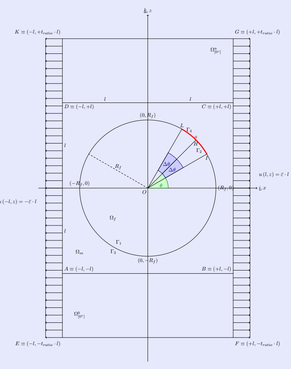
Méthode des éléments finis (MEF)

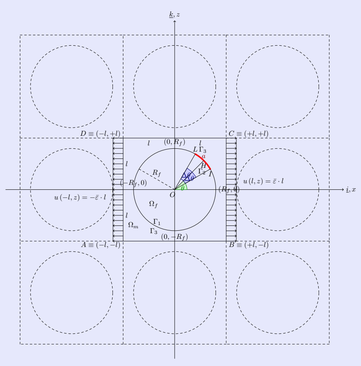
Conception des modéles de Volumes Élémentaire Représentatif (VER) á l'échelle microscopique

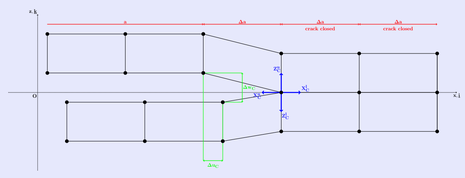


- ✓ Espace 2D
- ✓ Solide élastique linéaire
- ✓ Piloté en déplacement
- ✓ Conditions aux limites de Dirichlet
- ✓ Mécanique linéaire élastique de la rupture
- ✓ Interactions de contact

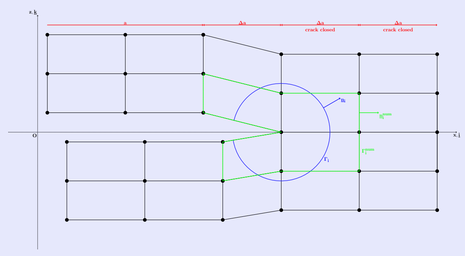






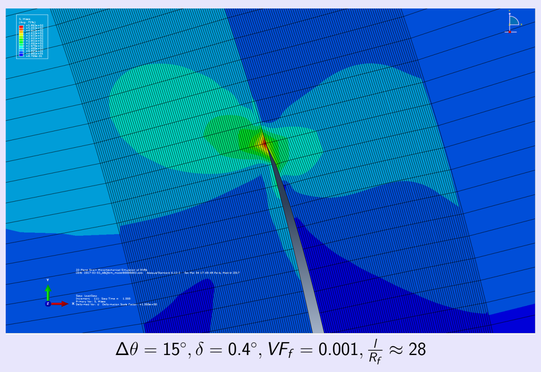


VCCT: $G_I = \frac{Z_C \Delta w_C}{2B\Delta a} \quad G_{II} = \frac{X_C \Delta u_C}{2B\Delta a}$

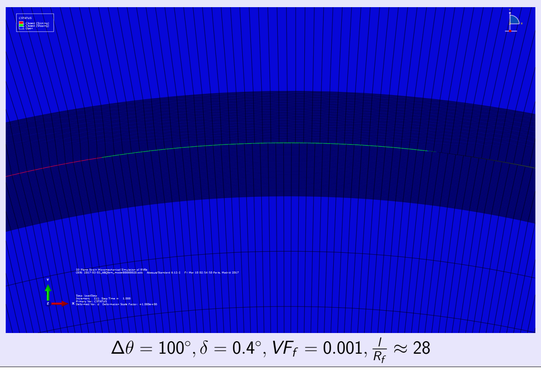


J-Integral: $J_i = \lim_{\varepsilon \to 0} \int_{\Gamma_\varepsilon} \left(W(\Gamma)\, n_i - n_j \sigma_{jk} \frac{\partial u_k(\Gamma, x_j)}{\partial x_i} \right) d\Gamma$

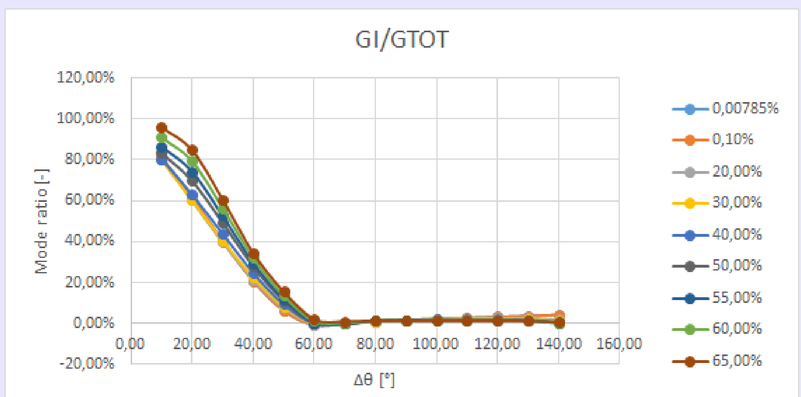
Résultats & Perspectives



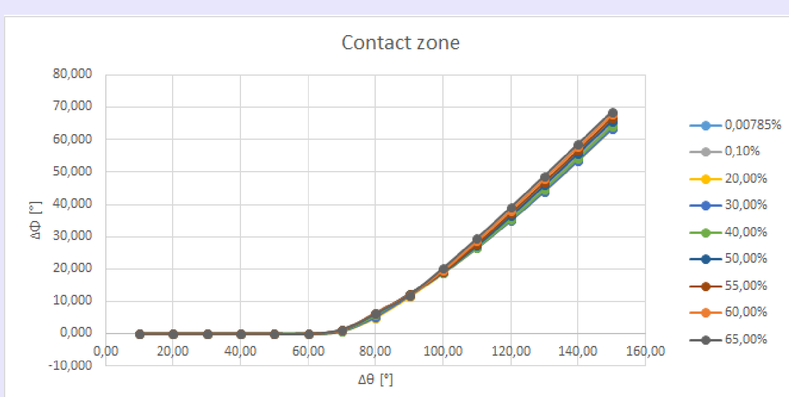
$\Delta\theta = 15°, \delta = 0.4°, VF_f = 0.001, \frac{l}{R_f} \approx 28$



$\Delta\theta = 100°, \delta = 0.4°, VF_f = 0.001, \frac{l}{R_f} \approx 28$



Mode ratio evolution in the free model.



Contact zone size evolution in the free model.

Remerciements

Le soutien financier de la Commission européenne dans le cadre du programme Eramus Mundus a permis la réalisation de ce travail.

Références

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