

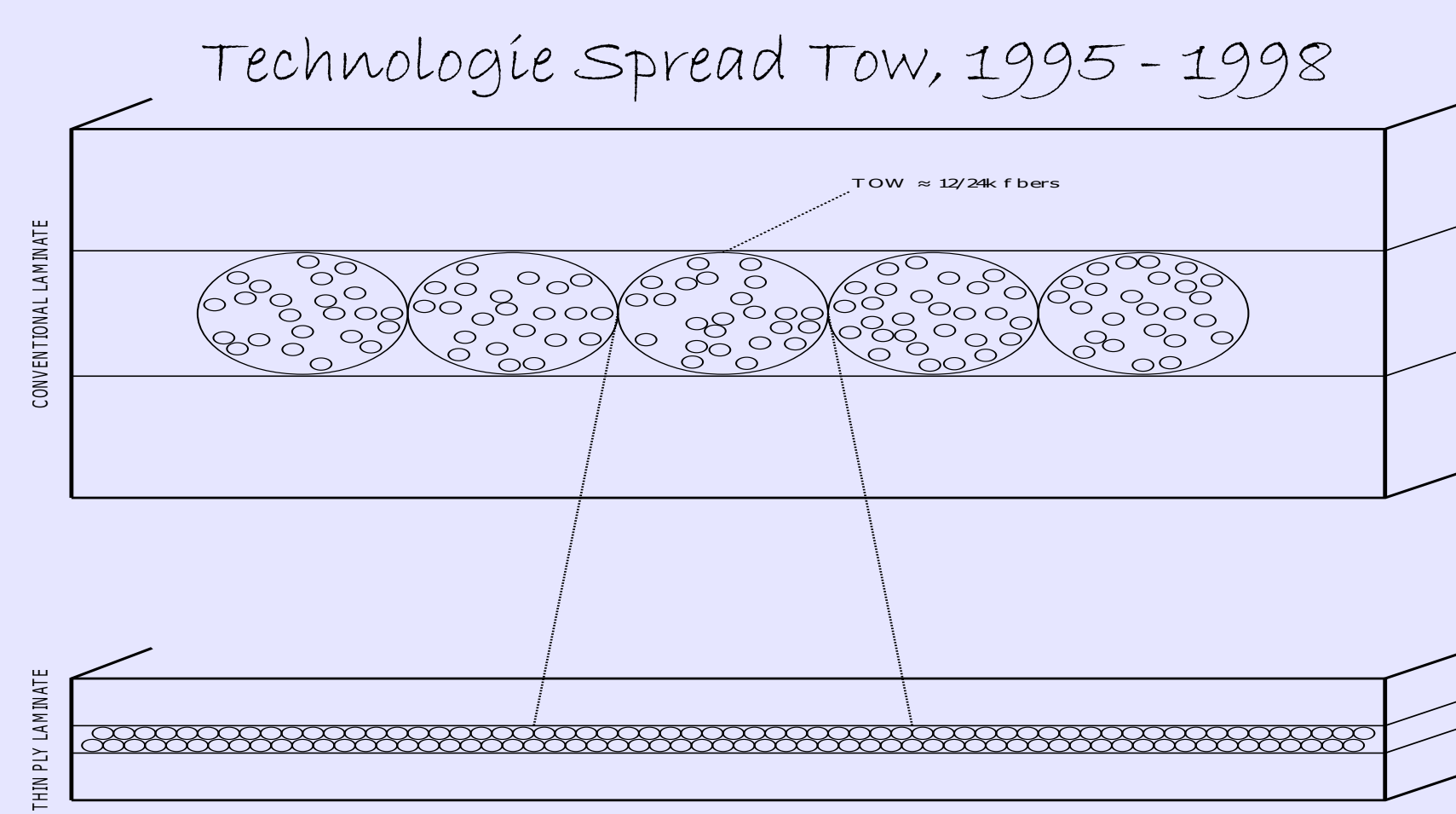
Modèles micromécaniques du dommage intra-laminaire dans les stratifiés avec couches fines

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

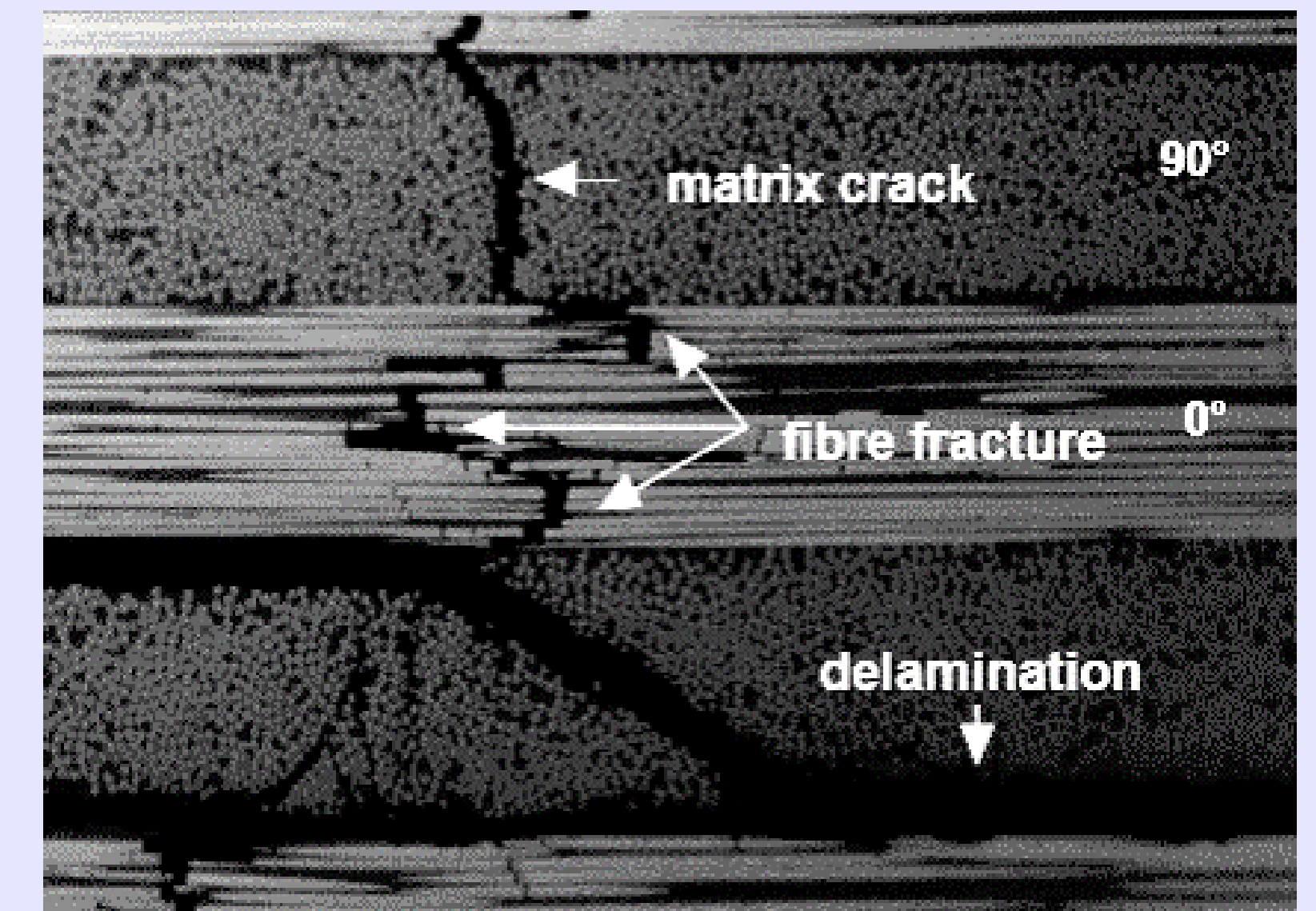
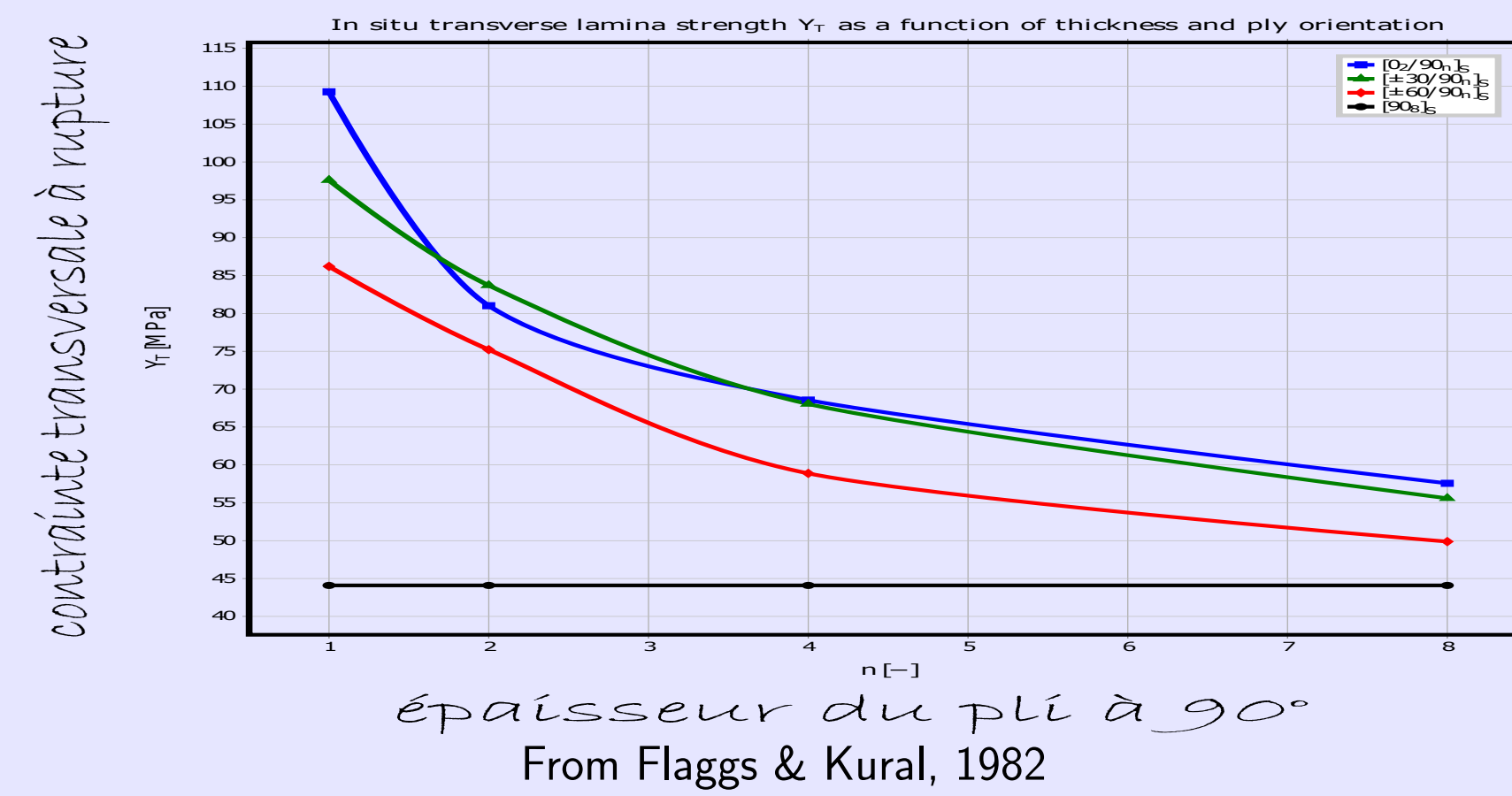


poïds

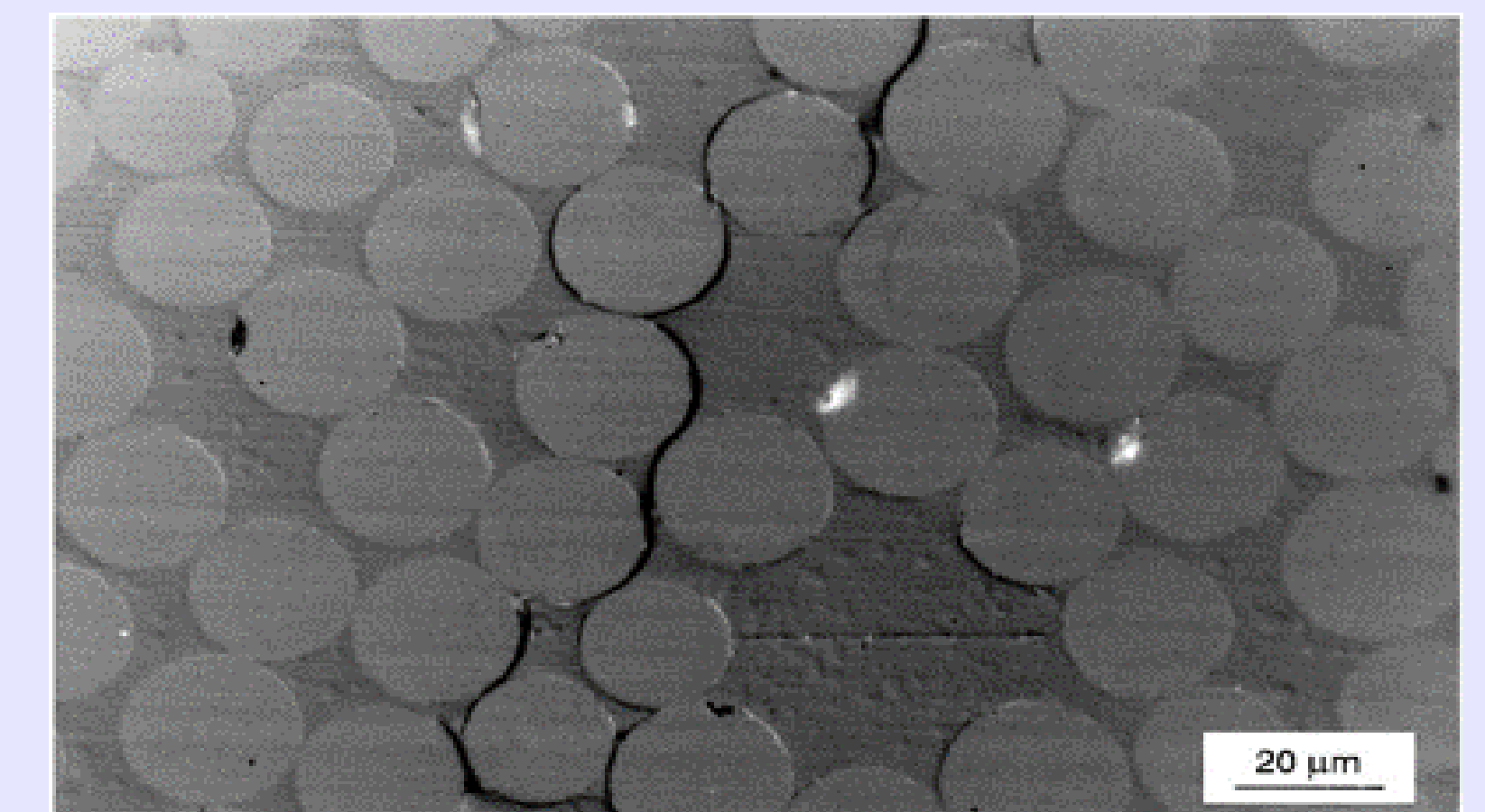
+ résistance



Effet In-Situ, 1982



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



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

Objectifs & Approche

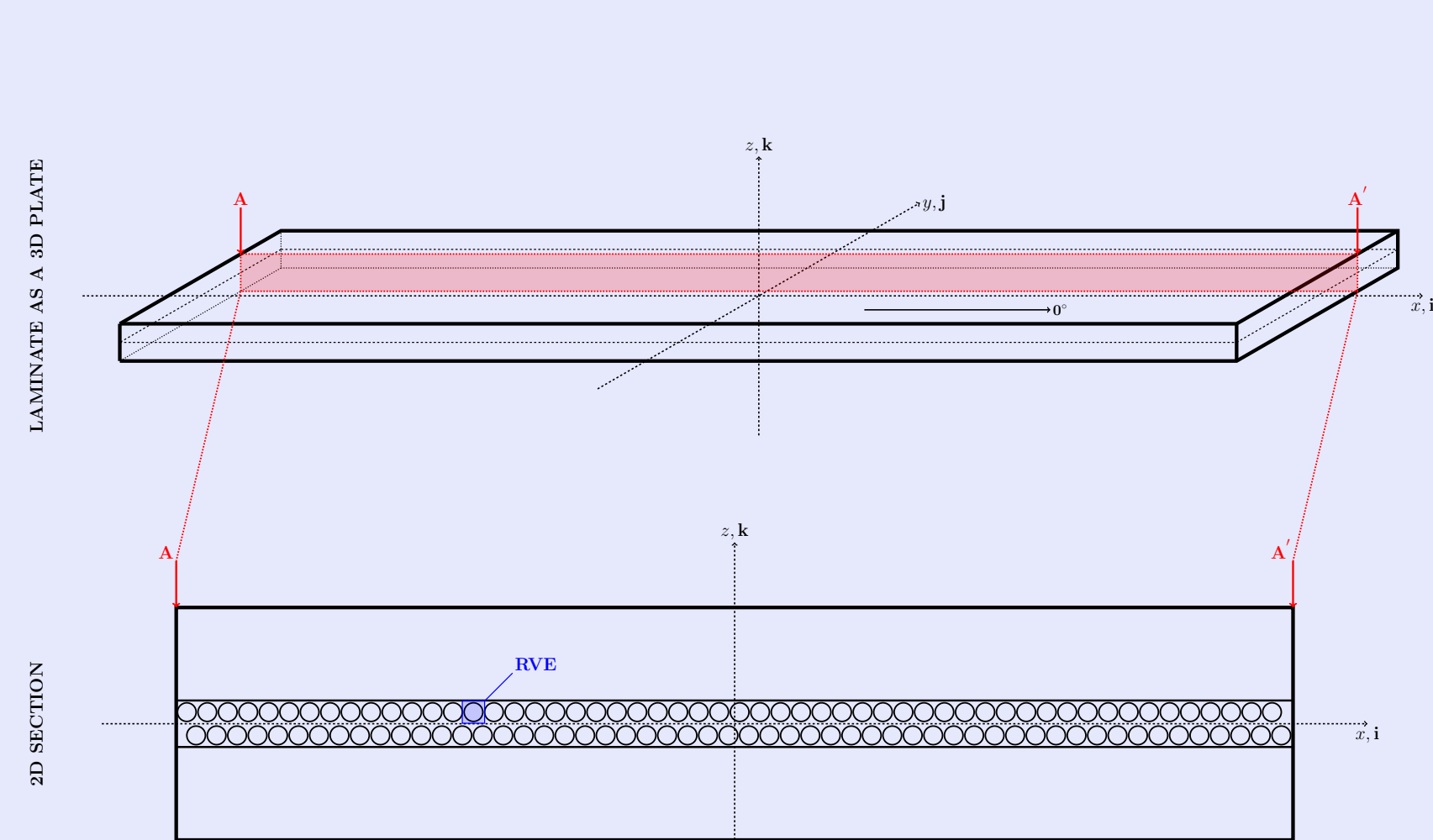
Que-est qu'on veut atteindre ?

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

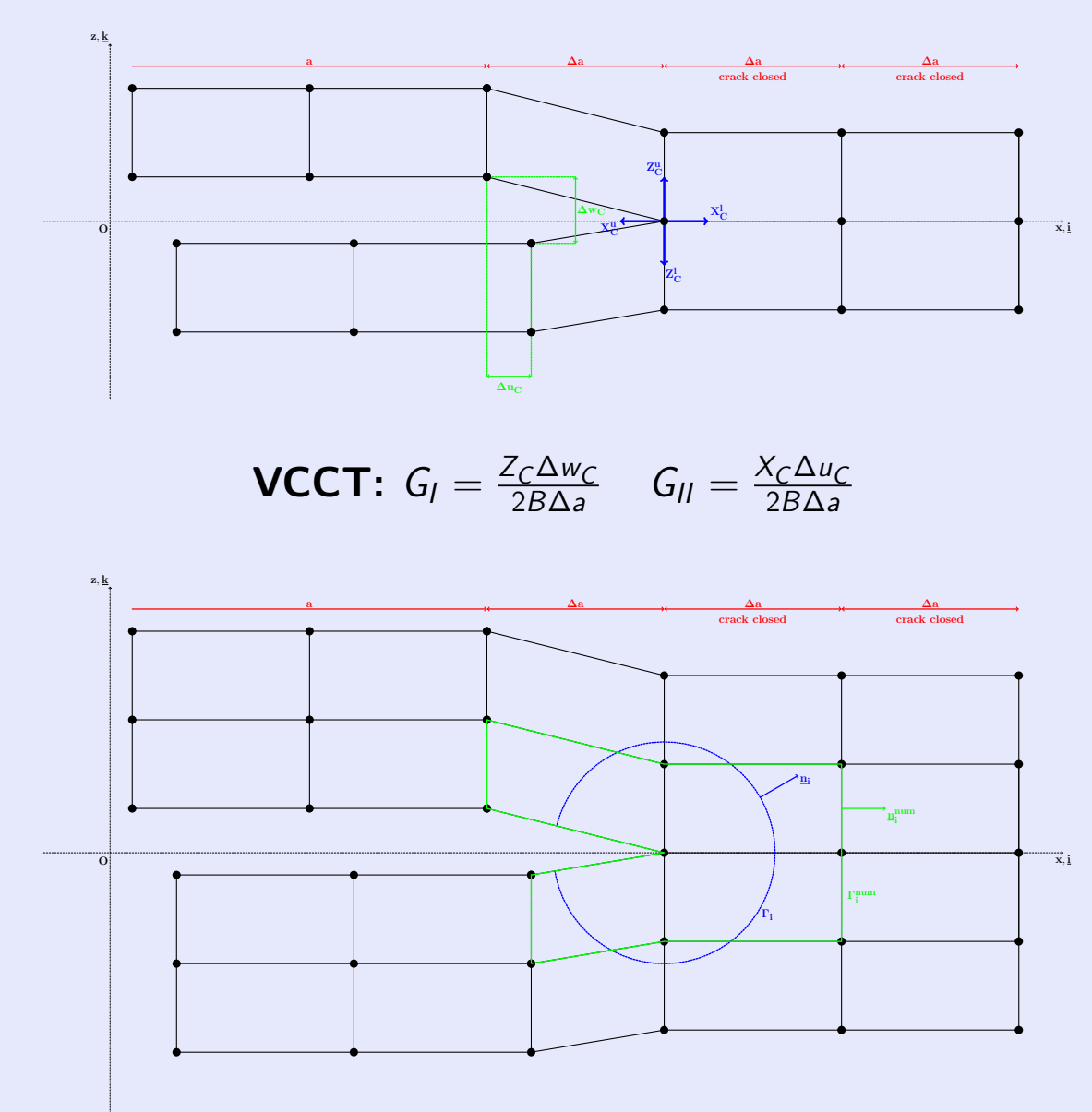
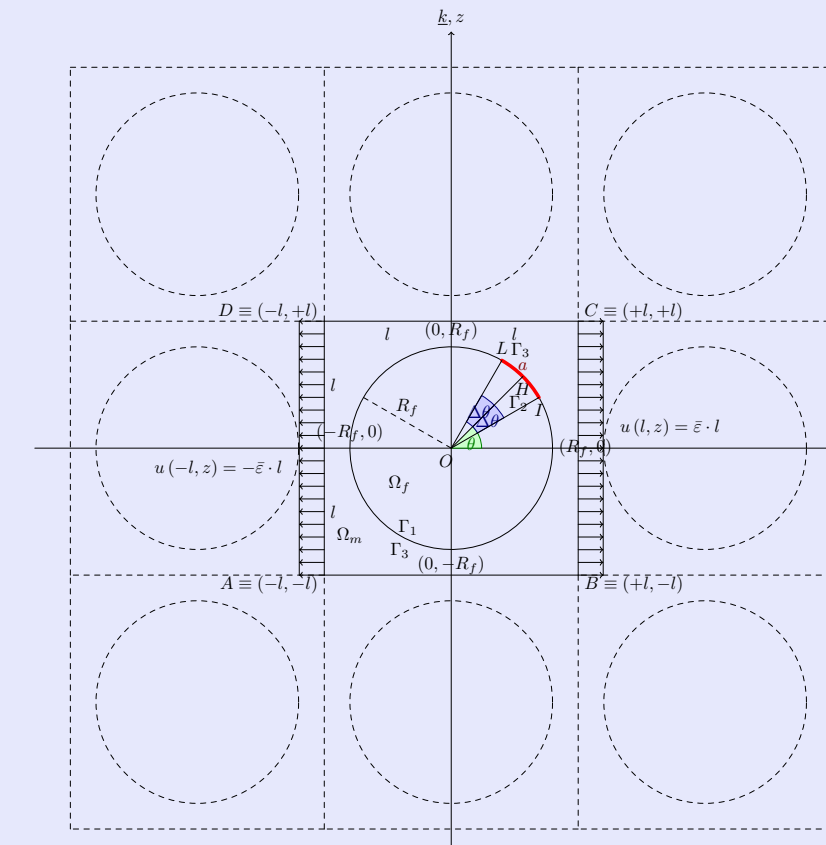
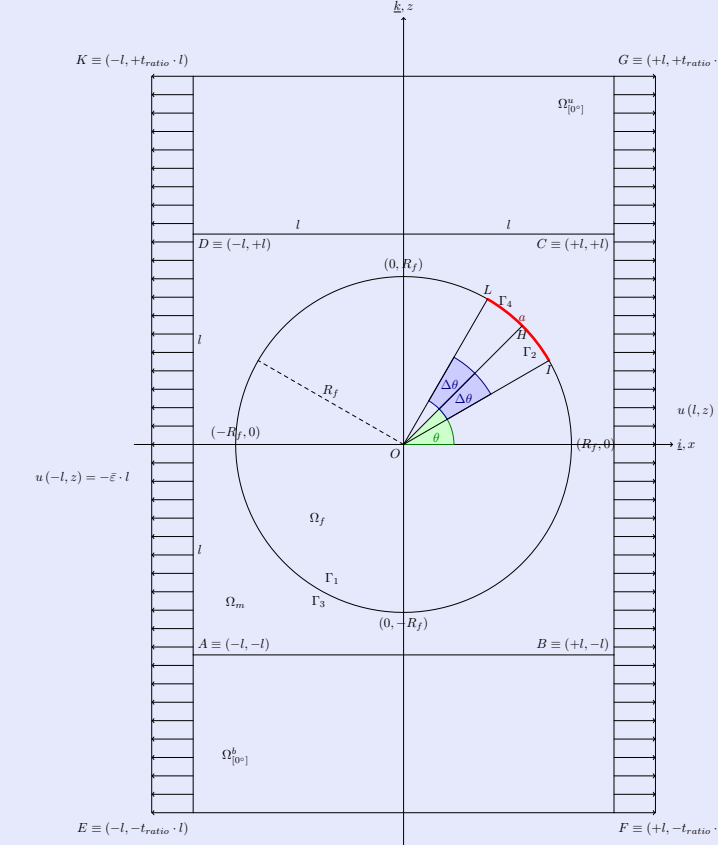
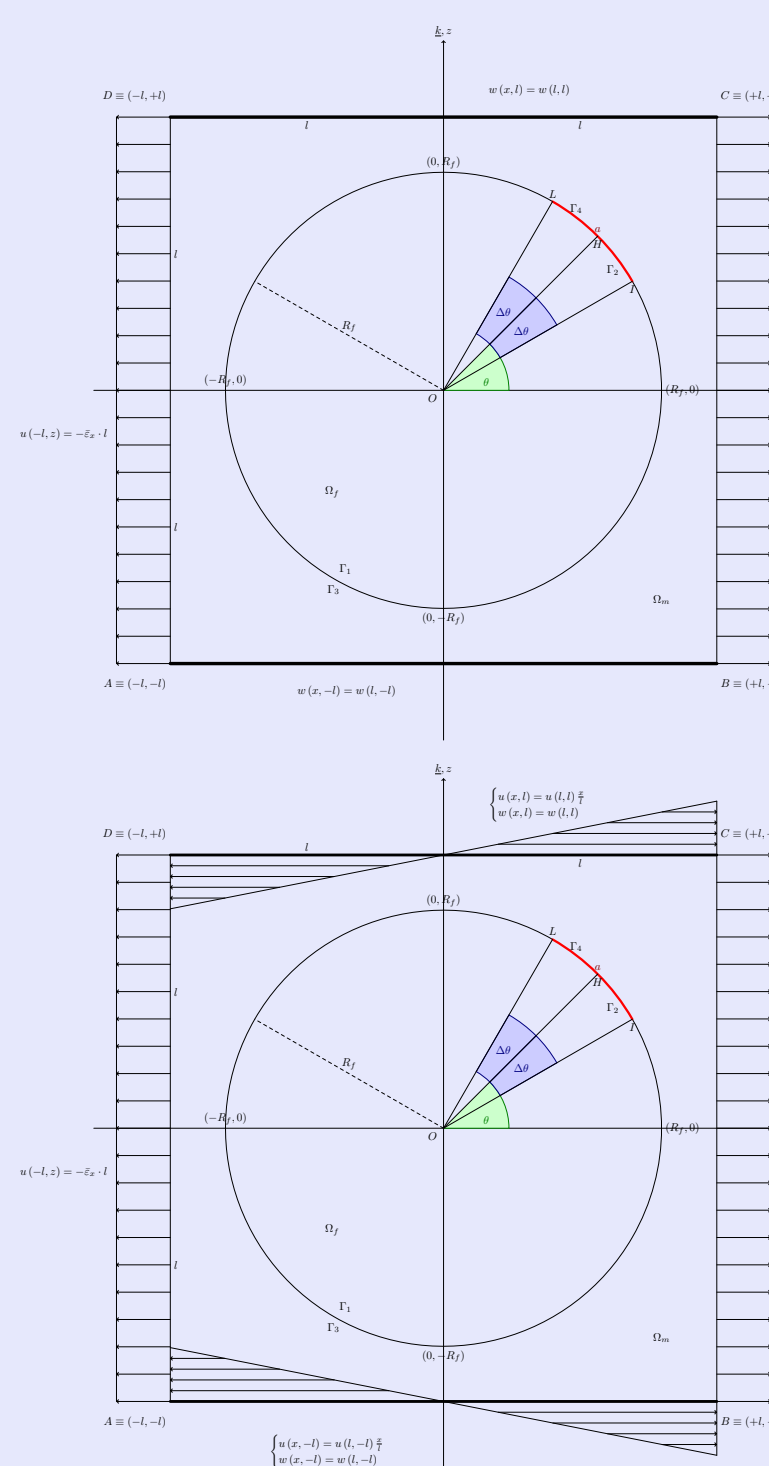
Comment on veut l'atteindre ?

Méthode des éléments finis (MEF)

Conception des modèles de Volumes Élémentaire Représentatif (VER) à l'échelle microscopique



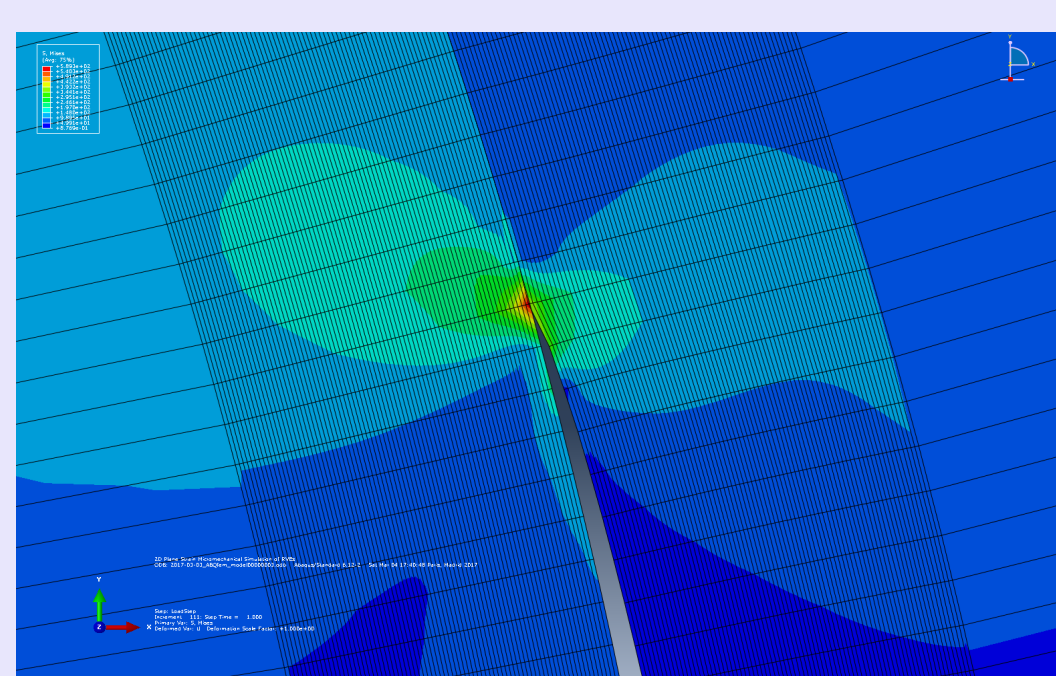
- ✓ Espace 2D
- ✓ Solide élastique linéaire
- ✓ Piloté en déplacement
- ✓ Conditions aux limites de Dirichlet
- ✓ Mécanique linéaire élastique de la rupture
- ✓ Interactions de contact



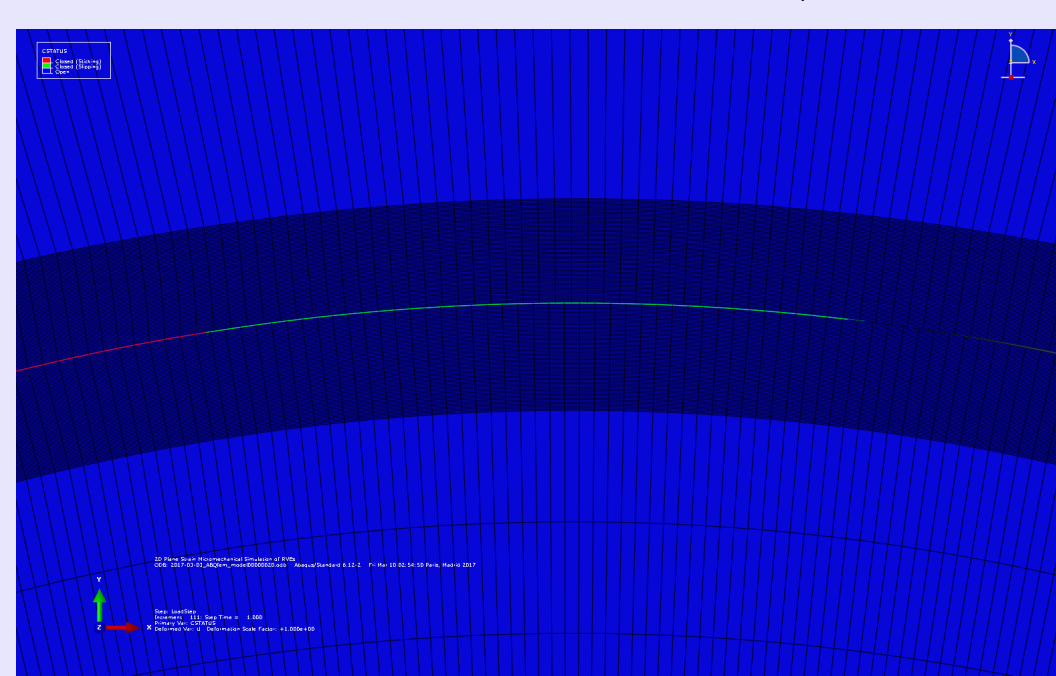
$$VCCT: G_I = \frac{Z_C \Delta w_C}{2B \Delta a} \quad G_{II} = \frac{X_C \Delta u_C}{2B \Delta a}$$

$$J\text{-Integral: } J_I = \lim_{\varepsilon \rightarrow 0} \int_{\Gamma_\varepsilon} \left(W(\Gamma) n_I - n_j \sigma_{jk} \frac{\partial u_k(\Gamma, x)}{\partial x_j} \right) d\Gamma$$

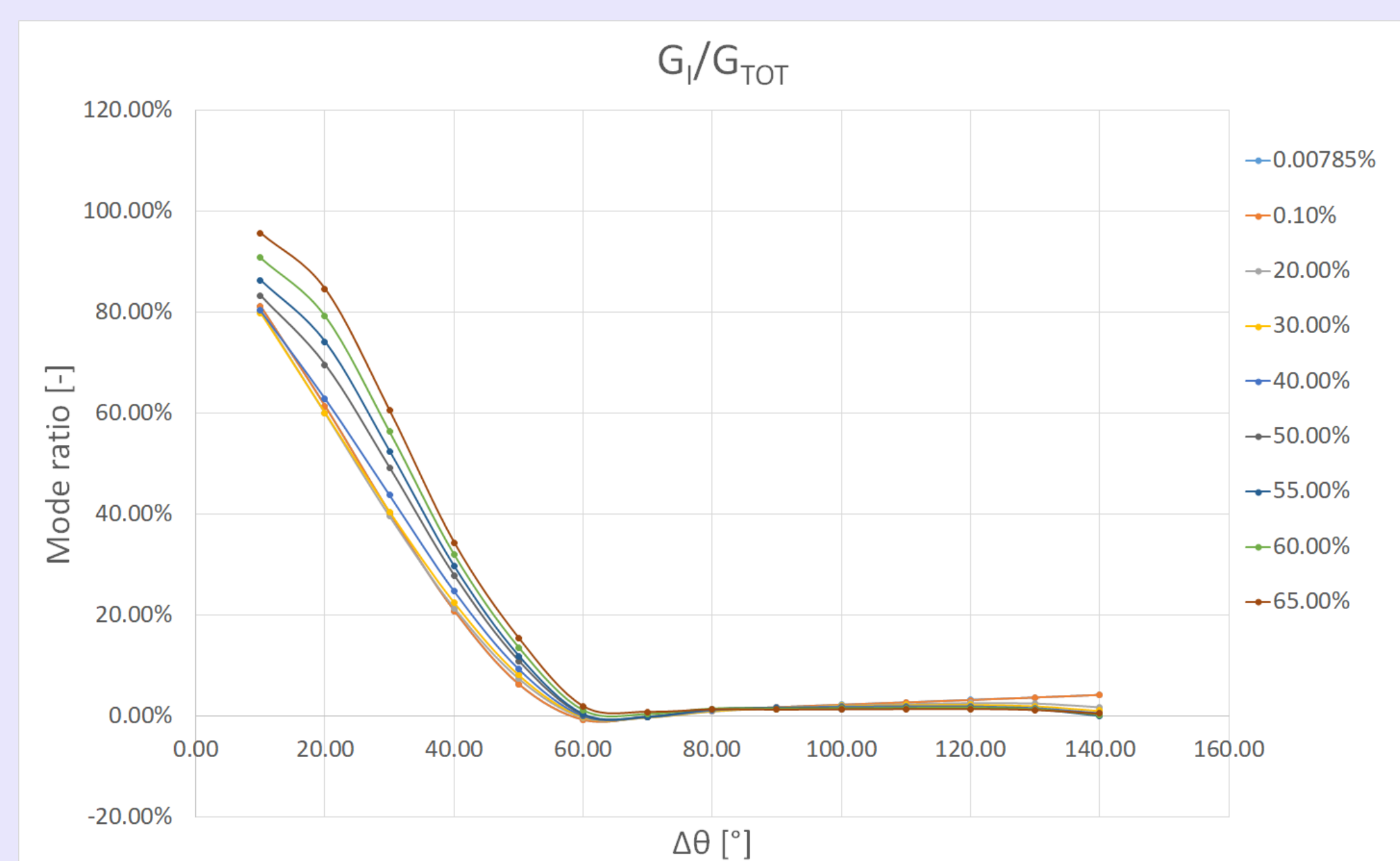
Résultats & Perspectives



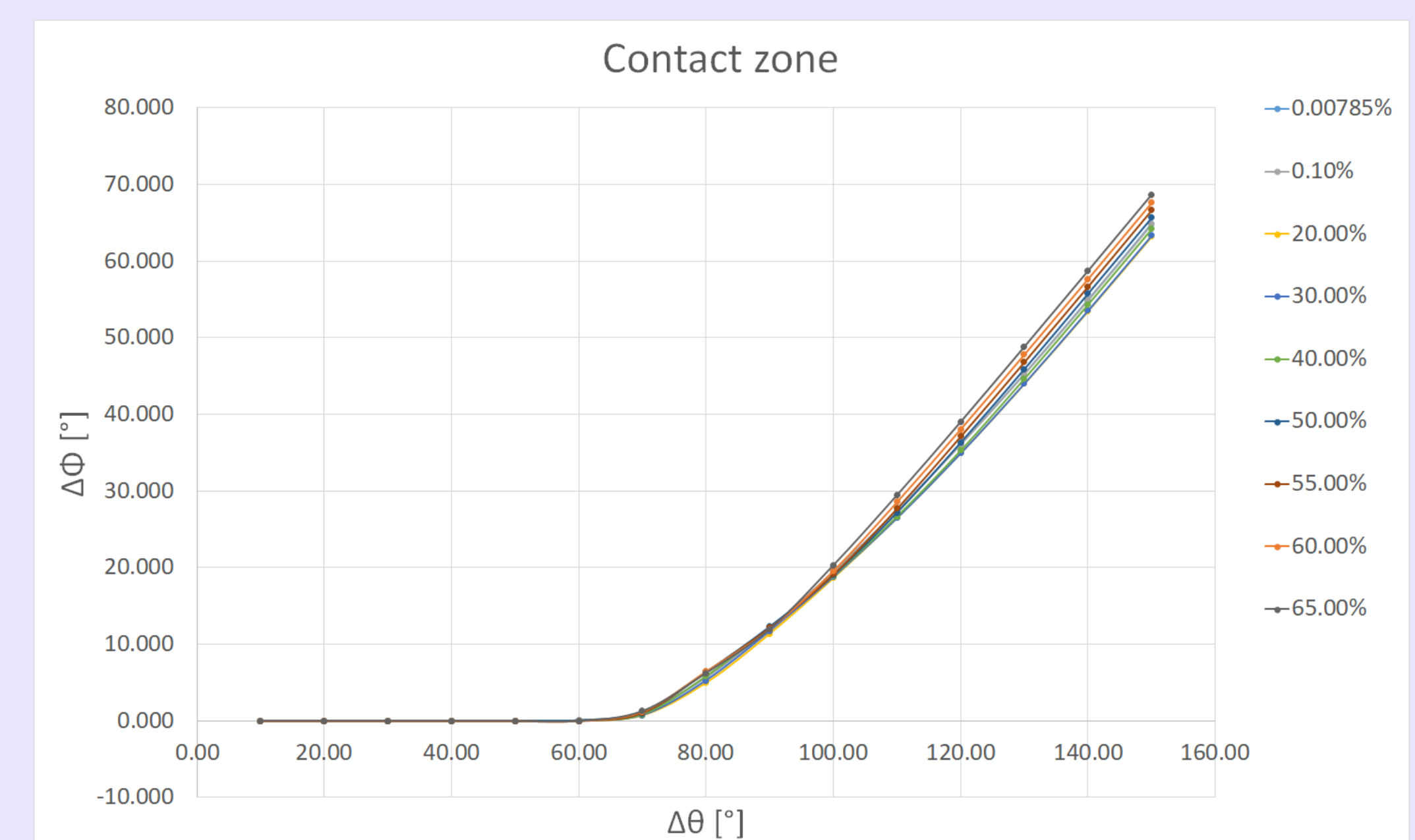
$$\Delta\theta = 15^\circ, \delta = 0.4^\circ, VF_f = 0.001, \frac{1}{R_f} \approx 28$$



$$\Delta\theta = 100^\circ, \delta = 0.4^\circ, VF_f = 0.001, \frac{1}{R_f} \approx 28$$



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 Erasmus Mundus a permis la réalisation de ce travail.

Références

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