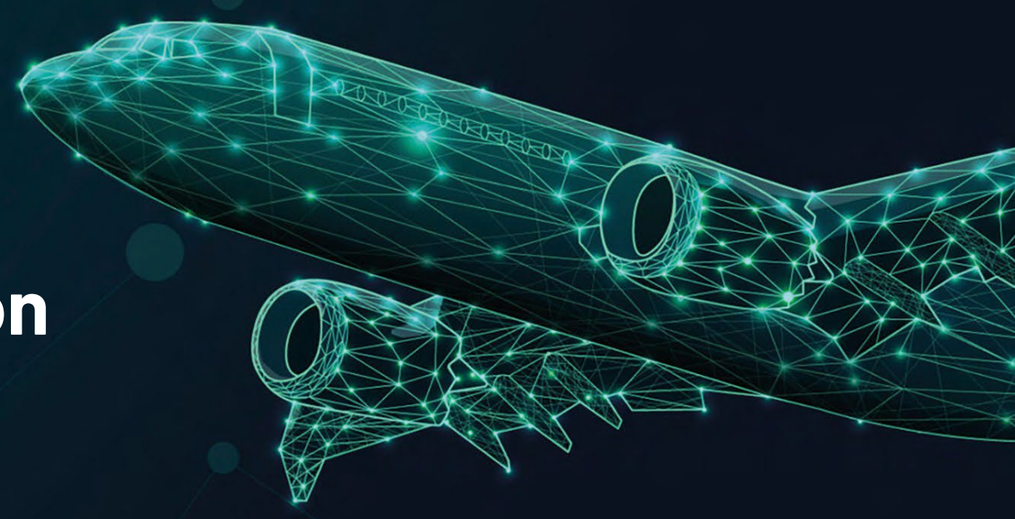
D-standart
for Durability Modelling of Composites



Effect of Fibre Orientation on Delamination Growth Rate in Quasi-static and Fatigue

F.M. Monticeli, Y. Mosleh, J.A. Pascoe

MOTIVATION & RESEARCH QUESTIONS

The delamination growth rate under fatigue depends on the fibre orientation at the adjacent plies. To give the designer maximum freedom, we do not want to restrict the fibre orientations that can be chosen.

How can we characterise the delamination growth rate without having to test all possible fibre orientation configurations?

Can we make use of existing test methods to characterise multidirectional interfaces?

QUASI-STATIC CHARACTERIZATION

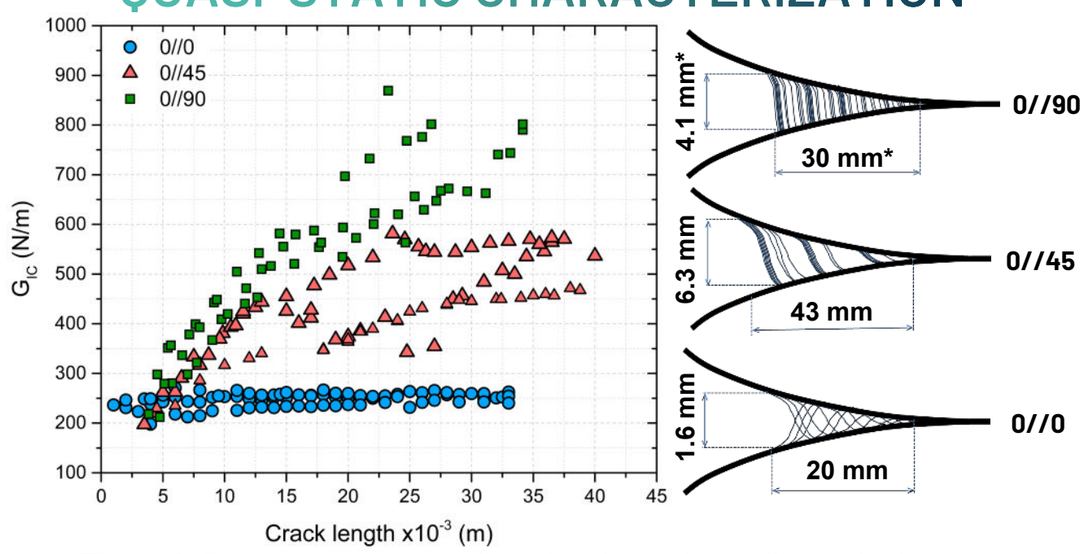
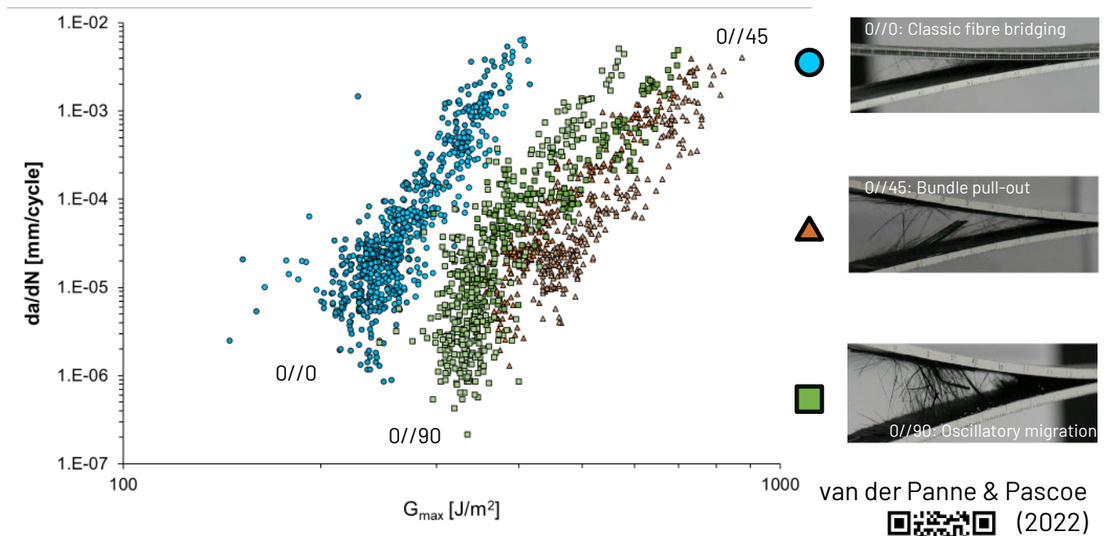


Figure 2. R-curve and the relation with visual size of fibre bridging zone

PRIOR RESEARCH AT TUD



van der Panne & Pascoe (2022)

Figure 1. Fibre orientation affects nature of toughening mechanisms and shifts Paris curve

FATIGUE PARIS CURVES

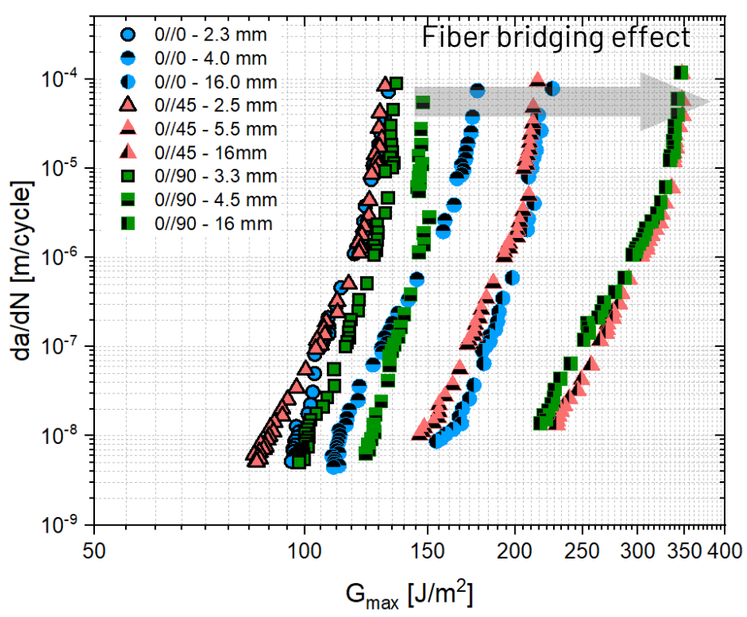


Figure 3. Paris curve for several fibre orientation considering the FBZ effect

D-STANDART APPROACH

- Make use of standard tests (DCB, ELS, ACP)
- Analysis via 'effective toughness' approach: effect of fibre orientation is modelled via shift of the Paris curve.
- Test only a limited number of fibre orientations and use statistical correlation or machine learning to cover other orientations.

CONCLUSIONS

The change in fibre orientation has a complex effect on the crack propagation characteristics due to different fracture mechanisms at each interface. Consequently, these mechanisms intricately shape the development of fibre bridges, inducing fluctuations in the correlation between crack propagation rate and strain energy in quasi-static and fatigue regime.

CONSORTIUM

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DISCOVER MORE

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