Similarity laws of the fiber-matrix interface crack in polymer composites

Luca Di Stasio[a,b], Janis Varna[a] and Zoubir Ayadi[b]

[a]Luleå University of Technology, University Campus, SE-97187 Luleå, Sweden
[b]Université de Lorraine, EEIGM, IJL, 6 Rue Bastien Lepage, F-54010 Nancy, France

ARTICLE INFO

Keywords:
Fiber Reinforced Polymer Composite (FRPC)
Debonding
Similarity
Dimensional analysis
Linear Elastic Fracture Mechanics (LEFM)

ABSTRACT

This template helps you to create a properly formatted LaTeX manuscript.
`\beginabstract ... \endabstract` and `\begin{keyword} ... \end{keyword}` which contain the abstract and keywords respectively.
Each keyword shall be separated by a `\sep` command.

1. Introduction

One of the most promising developments in Fiber Reinforced Polymer Composites (FRPCs) for advanced structural applications is currently represented by *thin-ply* laminates [1]. Constituted by extremely thin plies, with t_{90° as small as just $\sim 4-5$ fiber diameters, this family of laminates is characterized by its damage tolerance, in particular the capability of delaying to higher strains and even suppressing the onset and propagation of transverse cracks [2]. The recent experimental assessment of transverse cracks suppression in *thin-ply* laminates [3, 4, 5] validates the existence of a *ply-thickness* effect [5] at scales $10x$ smaller than those at which it was originally observed at the end of the 1970's [6].

2. Representative Volume Elements (RVEs)

3. Dimensional analysis

4. Similarity laws

5. Conclusions

References

[1] A. Kopp, S. Stappert, D. Mattsson, K. Olofsson, E. Marklund, G. Kurth, E. Mooij, E. Roorda, The aurora space launcher concept, CEAS Space Journal 10 (2017) 167–187.

[2] J. Cugnoni, R. Amacher, S. Kohler, J. Brunner, E. Kramer, C. Dransfeld, W. Smith, K. Scobbie, L. Sorensen, J. Botsis, Towards aerospace grade thin-ply composites: Effect of ply thickness, fibre, matrix and interlayer toughening on strength and damage tolerance, Composites Science and Technology 168 (2018) 467–477.

[3] H. Sasayama, K. Kawabe, S. Tomoda, I. Ohsawa, K. Kageyama, N. Ogata, Effect of lamina thickness on first ply failure in multidirectionally laminated composites, in: Proceedings of the 8^{th} Japan SAMPE Symposium, SAMPE, 2003.

[4] H. Saito, H. Takeuchi, I. Kimpara, Experimental evaluation of the damage growth restraining in 90Âř layer of thin-ply cfrp cross-ply laminates, Advanced Composite Materials 21 (2012) 57–66.

[5] R. Amacher, J. Cugnoni, J. Botsis, L. Sorensen, W. Smith, C. Dransfeld, Thin ply composites: Experimental characterization and modeling of size-effects, Composites Science and Technology 101 (2014) 121–132.

[6] J. E. Bailey, P. T. Curtis, A. Parvizi, On the transverse cracking and longitudinal splitting behaviour of glass and carbon fibre reinforced epoxy cross ply laminates and the effect of poisson and thermally generated strain, Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences 366 (1979) 599–623.

ORCID(s):