

A multi-level damage model for particle reinforced composites considering conditional probability

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ABSTRACT

Damage mechanisms and accumulation in particle reinforced composites are complicated evolutionary phenomena (Groves et al, 1987; Meraghni and Benzeggagh, 1995). Interfacial debonding is one of the most important factors affecting the behavior of the composites. The Weibull model is one of the most widely utilized evolutionary damage models for failure and reliability modelling of the composites (Blischke and Murthy, 2003). In this study, we propose a multi-level damage model (See Lee and Pyo, 2007a, 2007b, 2007c) considering the conditional probability to predict the damage behavior of particle reinforced composites. In particular, the concept of the conditional probability (Blischke and Murthy, 2003) is incorporated into the Weibull model. By using the modified Weibull model, we conduct a series of numerical simulations on the particle reinforced composites having multi-level damage. A parametric study on the Weibull parameters is also conducted to investigate the model sensitivity to the parameters.

REFERENCES

- [1] Blischke, W.R., Murthy, D.N.P., *Case Studies in Reliability and Maintenance*, Wiley Interscience, 2003.
- [2] Groves, S.E., Harris, C.E., Highsmith, A.L., Allen, D.H., and Norvell, R.G., "An experimental and analytical treatment of matrix cracking in cross-ply laminates," *Exp. Mech.*, Vol. **27**, pp. 73-79, (1987)
- [3] Lee, H.K. and Pyo, S.H., "Micromechanics-based elastic damage modelling of particulate composites with weakened interfaces," *Int. J. Solids. Struct.*, Vol. **44**, pp. 8390-8406, (2007a)
- [4] Lee, H.K. and Pyo, S.H., "Multi-level modelling of effective elastic behaviour and

progressive weakened interface in particulate composites,” *Compos. Sci. Technol.*, in press, (2007b)

- [5] Lee, H.K. and Pyo, S.H., “An elastoplastic multi-level damage model for ductile matrix composites considering evolutionary weakened interface,” *Int. J. Solids. Struct.*, in press, (2007c)
- [6] Meraghni, F. and Benzeggagh, M.L., “Micromechanical modelling of matrix degradation in randomly discontinuous-fibre composites,” *Compos. Sci. Technol.*, Vol. **55**, pp. 171-186, (1995)