

MODELLING DAMAGE GROWTH AND FAILURE IN ELASTIC MATERIALS WITH RANDOM DEFECT DISTRIBUTIONS

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ABSTRACT

Failure in materials under cyclic loading occurs by the growth and propagation of cracks. If they are sufficiently numerous, the cracks can be considered to be continuously distributed in the material. In this paper, a mathematical model is proposed to predict failure in materials with defects in the form of randomly distributed pores. The model includes anisotropic damage accumulation, the effects of crack closure and the coupling of elasticity with damage. Defects are modelled as pre-existing isotropic damage. A numerical implementation of the model is used to predict failure in specimens with both high and low defect densities, under a cyclical load. Comparison of the predicted failure time with the experimental values shows that the approach captures the variability found in the failure of the specimens. Therefore the model provides a computational scheme that can be used to predict the variability in the failure of load-bearing structures operating under cyclical loads.