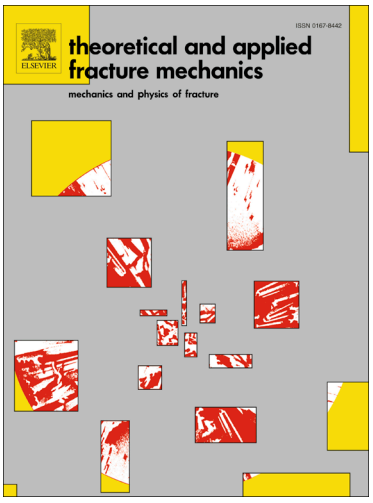


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# The stress intensity factor and propagation of an inclined crack in the central layer of a composite laminate under tension

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**Abstract**

Intra-laminar cracks are usually the initial damage of fibre-reinforced composite laminates. While transverse cracks that are perpendicular to the interfaces in composite laminates are extensively studied, inclined cracks, which may occur in these laminates, are less investigated. In this paper, the stress intensity factor of an inclined crack embedded in the central layer of an angle-ply laminate is solved by the Fourier transform method, and the propagation of the crack is examined based on the generalized maximum tangential stress criterion. It is shown that the ply angle of the outer constraining sublaminates and the crack inclination angle significantly influence the stress intensity factor. The propagation direction of the crack is primarily determined by the inclination angle. Due to the constraining effect, the crack perpendicular to the interfaces does not always correspond to the minimum critical propagation stress; instead, an inclined crack when its tips are close to the interfaces may correspond to a minimum propagation stress for graphite/epoxy laminates. For the glass/epoxy material system, the crack perpendicular to the interfaces is always in the most dangerous state. This work reveals some features of crack propagation in composite laminates that are different from those of a crack in a homogeneous material. The results provide an in-depth understanding and more accurate prediction of the damage process of composite laminates.

*Keywords:*

Stress intensity factor, crack propagation, mixed I-II mode, angle-ply composite laminate, Fourier transform, maximum tangential stress criterion

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