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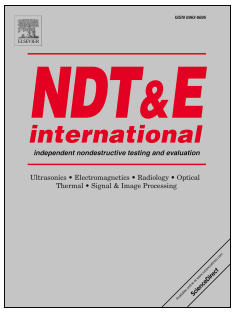

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M.E. Ibrahim, R.A. Smith, C.H. Wang

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Ultrasonic Detection and Sizing of Compressed Cracks in Glass- and Carbon-Fibre Reinforced Plastic Composites

M. E. Ibrahim[1,2*], R. A. Smith[3], and C. H. Wang[4]

[1] Maritime Division, Defence Science and Technology Group, 506 Lorimer St, Fishermans Bend VIC 3207 AUSTRALIA.

[2] School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Melbourne VIC 3001 AUSTRALIA

[3] Department of Mechanical Engineering, University of Bristol, Clifton, BS8 1TR, Bristol, UK

[4] School of Mechanical and Manufacturing Engineering, University of New South Wales, Sydney NSW 2052, Australia

*matthew.ibrahim@dst.defence.gov.au (corresponding author)

Abstract

Non-destructive evaluation of compressed cracks is a major challenge. A quantitative study of the effect of crack-tip closure on the pulse-echo ultrasonic sizing of delaminations in fibre-reinforced polymer-matrix composites (FRP) is presented. In particular, this study focuses on the interaction of ultrasound with a closed crack or kissing disbond, and their effect on the ultrasonic inspectability of FRP laminates consisting of carbon and glass plies. The compression of laminar cracks in these two different laminate types is clearly detectable via both pulse-echo and through-transmission ultrasonic measurements, but the reflected ultrasonic pulses in the two material types exhibit markedly different behaviour. The glass-fibre laminates show a drop in the reflected signal for crack openings up to approximately half the crack growth load, whereas the corresponding carbon-fibre laminates show the expected increase in the reflected signal as the crack opens. The origins of the observed effect of crack closure on the reflection and transmission of ultrasound are analysed in detail to ascertain possible mechanisms responsible for these effects.

Keywords