

Application of photoelasticity to determine mode one and mode two orthotropic stress intensity factors.

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RETROSPECTI

Application of photoelasticity to mode one and mode two orthotropic stress intensity factors

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Engineering Science and Mechanics

Abstract

With the advancement of technology and application of orthotropic materials in industry, the development of an experimental technique to determine stress intensity factors in orthotropic materials was needed. This paper presents a new experimental method of combining orthotropic photoelasticity with linear elastic fracture mechanics laws are developed. A new set of equations is developed by combining orthotropic photoelasticity laws and orthotropic stress intensity factor formulas. These equations along with half-fringe photoelasticity

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determine the stress intensity factors. To model orthotropic n
fiberglass/ epoxy composites, made at IITRI are used. Compact
strip with a slanted edge crack are employed to determine mo
stress intensity factors. The optical and mechanical properties
determined by the use of tension specimens. A microcomput
and analyze the experimental data, and a finite element soluti
experimental results. Solid SAP, a finite element program cap
orthotropic materials is utilized for the finite element solution
show that photoelasticity can be used effectively in the determ
intensity factors. However, problems arise from the low sensi
the case where the cracks are parallel with the fibers in unidir
Further studies at higher loads, which are difficult because of
crack tip plasticity effects, need to be undertaken. In the case
photoelasticity is not as effective in determining stress intensit
mode one case.

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