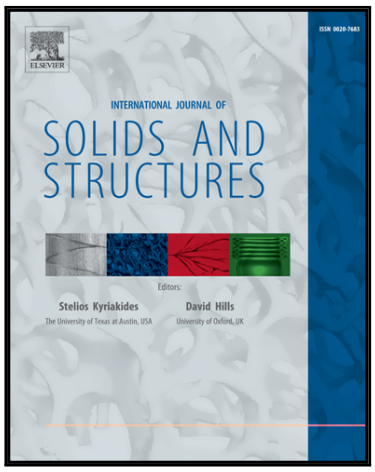


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# Dynamic Dual Boundary Element Analyses for Cracked Mindlin Plates

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**Abstract**

In this paper, a new dual boundary element formulation is presented for dynamic crack problems in Mindlin plates. The displacement and traction boundary integral equations are derived in the Laplace frequency domain to allow for a boundary-only formulation. The cracked plate is modelled with the dual boundary element method and dynamic plate bending stress intensity factors are evaluated. Four benchmark examples are presented including mode I and mixed mode deformation. Such stress intensity factors obtained are shown to be in excellent agreement with finite element results as well as published results.

*Keywords*: Dynamic stress intensity factor; Mindlin plates; Boundary element method (BEM); Dual boundary element method; Fracture mechanics

## 1. Introduction

Dynamic fracture mechanics is concerned with crack propagation in materials when inertial effects influence the behaviour of the crack such as structures subjected to impact loads. The inertial effects cannot be disregarded as stress fields in the vicinity of the crack tip change rapidly. As in the quasi-static fracture mechanics problems, the dynamic stress intensity factor (DSIF) is the key fracture parameter controlling the crack propagation behaviours, including the onset of crack extension, propagation speed, path and arrest.

Freund [1] noted the difficulty in measuring DSIFs directly in the required short time period experimentally, so numerical analysis has since played an important role in dynamic fracture mechanics [2]. However, most of the research reported so far are related to two- and three-dimensional problems. The application of dynamic fracture mechanics to plate structures is important in many fields including aeronautics and civil engineering. Different approximate theories have been constructed to deal with plates subjected to different types of loads. Tension and bending are two common loads applied to plates. When a plate is subjected to tension, the problem can be simplified into a plane stress problem. When bending is applied to a plate, the