

**A Convolution Quadrature Boundary Element Analysis of
Elastic Wave Interaction with a Crack**

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This paper presents a convolution quadrature boundary element method (CQ-BEM) for transient analysis of elastic wave scattering by a crack. The proposed time-domain boundary element formulation is based on the implicit Runge-Kutta convolution quadrature method (IRK-CQM). The IRK-CQM is applied to the time-discretization of boundary integral equations. The proposed method has the following advantages: 1) high precision solutions are obtained if we use small time increments which are not allowed in the conventional time-domain BEM, and 2) only scatterer surfaces need to be meshed. In this research, the scattering problems of an incident plane wave by a crack in an isotropic material are solved to verify the accuracy and computational efficiency of the proposed method. In addition, simulation of non-linear ultrasonic waves is demonstrated to validate the effectiveness of the proposed method for elastic wave scattering problems.

Keywords: Time-domain boundary element method, Convolution quadrature method, Elastic wave scattering, Crack