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Dynamic analysis of shear deformable plates using the Dual Reciprocity Method

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Abstract

The Dual Reciprocity Method is a popular mathematical technique to treat domain integrals in the boundary element method (BEM). This technique has been used to treat inertial integrals in the dynamic thin plate bending analysis using a direct formulation of the BEM based on the elastostatic fundamental solution of the problem. In this work, this approach was applied for the dynamic analysis of shear deformable plates based on the Reissner plate bending theory, considering the rotary inertia of the plate. Three kinds of problems: modal, harmonic and transient dynamic analysis, were analyzed. Numerical examples are presented to demonstrate the efficiency and accuracy of the proposed formulation.

Introduction

Dynamic plate bending problems appear on civil, mechanical, aerospatial, naval and electronics applications. The complexity involved in the dynamic response of plates turns these problems in a challenging one from mathematical point of view. In general, numerical methods represent the only way to obtain approximate solutions for dynamic analysis. However, the use of traditional methods based on domain discretization requires refined meshes since the length of the elements should be proportional to the size of the wavelength. This means a high number of degrees of freedom, which requires a significant computational effort.

Nowadays, BEM has emerged as an accurate and efficient numerical method for plate dynamic analysis [2], [20], [3], [9]. Boundary element solutions for dynamic plate problems are usually obtained by using three basic approaches: formulations based on elastodynamic fundamental solutions, formulations based on