DDM과 경계요소법을 이용한 동탄성 해석

Transient Elastodynamic Analysis By BEM Using DDM

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ABSTRACT

This paper deals with BEM analysis of transient elastodynamic problems using domain decomposition method and particular integrals. The particular method is used to approximate the acceleration term in the governing equation. The domain decomposition method is examined to consider multi-region problems. The domain of the original problem is subdivided into sub-regions, which are modeled by the particular integral BEM. The iterative coupling employing Schwarz algorithm is used for the successive update of the interface boundary conditions until convergence is achieved. The numerical results, compared with those by ABAQUS, demonstrate the validity of the present formulation.

keywords : Boundary Element Method, Elastodynamic, Domain decomposition, Particular integrals

1. Introduction

The boundary element method (BEM) has been widely accepted as a powerful numerical method for solving transient elastodynamic problems. Because of acceleration term in the governing equation, the direct application of the BEM to the transient elastodynamic problems generates domain integrals in addition to the usual surface integrals. In order to eliminate the volume integration problem, three methods have been generally proposed: the time-domain formulation, the volume integral conversion method, and the particular integral method (Owatsiriwong et al., 2009). However, the previous efforts focused mainly on the single-region problems. The extension to a multi-region form is needed to show the applicability of the method to a large scale practical problems. With aid of the domain decomposition method (DDM), applications of transient elastodynamic analysis by BEM can be extended to the problems involving piecewise inhomogeneities and multi-part assembly. This paper deals with the elastodynamic analysis by BEM using the DDM and particular integrals.

2. Domain decomposition method

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The DDM can be used for solving partial differential equation of two or more sub-domains. Various types of algorithm are possible depending on the method of prescribing or relaxing the common sub-domain interface. For example, applying DDM, the problem domain is subdivided into two regions. The equilibrium and compatibility conditions must be satisfied along the boundary interface (Fig. 1).

3. Numerical Example

The example presents seismic analysis of a concrete gravity dam with considering foundation-dam interaction. The model under plane strain condition is divided into two sub-regions with different material properties of concrete and rock (Fig. 2). The sinesweep ground acceleration is prescribed in the horizontal direction. The displacement at dam crest relative to dam base is depicted in Fig. 3. Good agreement with the results by ABAQUS can be seen.

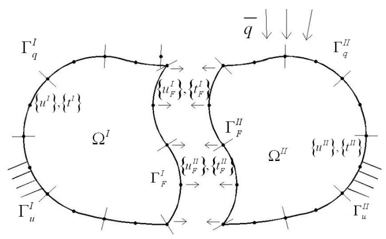

Fig 1 A problem domain decomposed into two regions

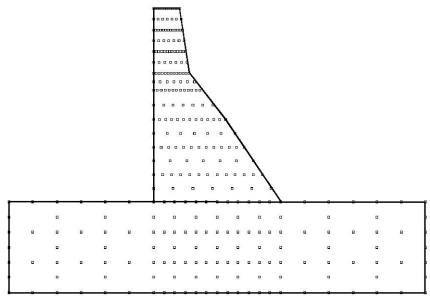

Fig 2 Modeling mesh

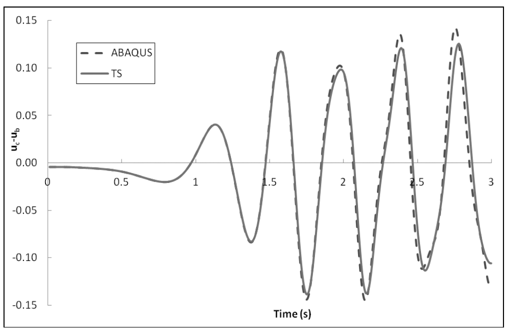

Fig 3 Horizontal crest displacement relative to dam base

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Reference

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