Paper ID: 10593
oral

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

Author: Prof. Harijono Djojodihardjo
Universitas Al Azhar Indonesia, Indonesia, harijono@djojodihardjo.com

FAST MULTIPOLE BOUNDARY ELEMENT SCHEME DEVELOPMENT AND INTEGRATION TO BE-FE ACOUSTIC-STRUCTURAL COUPLING

Abstract

In the light of rapid progress in Fast Multipole Algorithm Boundary Element Method (FMBEM), the series of work carried out by the author for unified FMBEM-FEM Acoustic-Structural Coupling has been reformulated in a previous work. The series of work addressed the acoustic structural coupling using BEM for the acoustic field and FEM for the structural dynamic problem, which has the potential to be coupled further with aerodynamic interaction, which utilizes indirect BEM. The present work then proceeds with computational scheme development following the algorithm elaborated there. The work is focused on several issues which needs particular care in the treatment. The main issue is the establishment of a workable in-house computational scheme which incorporate selected efficient algorithm developed in recent years. In addition, some adaptation is introduced to allow its utilization using notebook computer and in-house developed routine based on MATLAB©®. To allow the treatment of large matrices, to increase accuracy and reduce computational time, as well as to reduce computational complexity and memory requirements, Fast Multipole BEM (FMBEM) is applied, formulated and developed based on the fast multipole algorithm. In the development that follows, the computational scheme for the Fast Mutipole Boundary Element Method for Acoustic Field is synthesized and elaborated following practical instructive approaches developed by Epton and Dembart, Yoshida, Sakuma and Yasuda, Liu and Nishimura, Shen and Liu as well as the comprehensive treatment of Liu. For this purpose, the work started with BEM formulation for the Helmholtz problem in basic form (BF). Then the application of FM-BEM technique is developed. The new adaptive FMBEM algorithm is then elaborated. The work is concentrated on developing a workable and simple but robust computational routine with the objective to demonstrate effectiveness in solving generic problems. The next issue is the numerical treatment to overcome the appearance of irregular or fictitious frequencies was carried out by using a Schenk's method of Combined Helmholtz Interior Integral Equation Formulation in the FMBEM regularization scheme, which is chosen for its simplicity and computational efficiency; its applicability is investigated and validated through application to generic cases. Then the integration of the Fast Multiple Algorithm BEM to acoustic-Structural Coupling is formulated in the framework developed earlier by the author and followed by computational scheme elaboration. New results are presented and discussed.