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RECENT DEVELOPMENT OF THE FAST MULTIPOLE BOUNDARY ELEMENT METHOD FOR SOLVING LARGE-SCALE ACOUSTIC WAVE PROBLEMS

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ABSTRACT

In this talk, we will summarize the recent development of the fast multipole boundary element method (BEM) for acoustic wave problems in both 2-D and 3-D domains, including 3-D half-space problems.

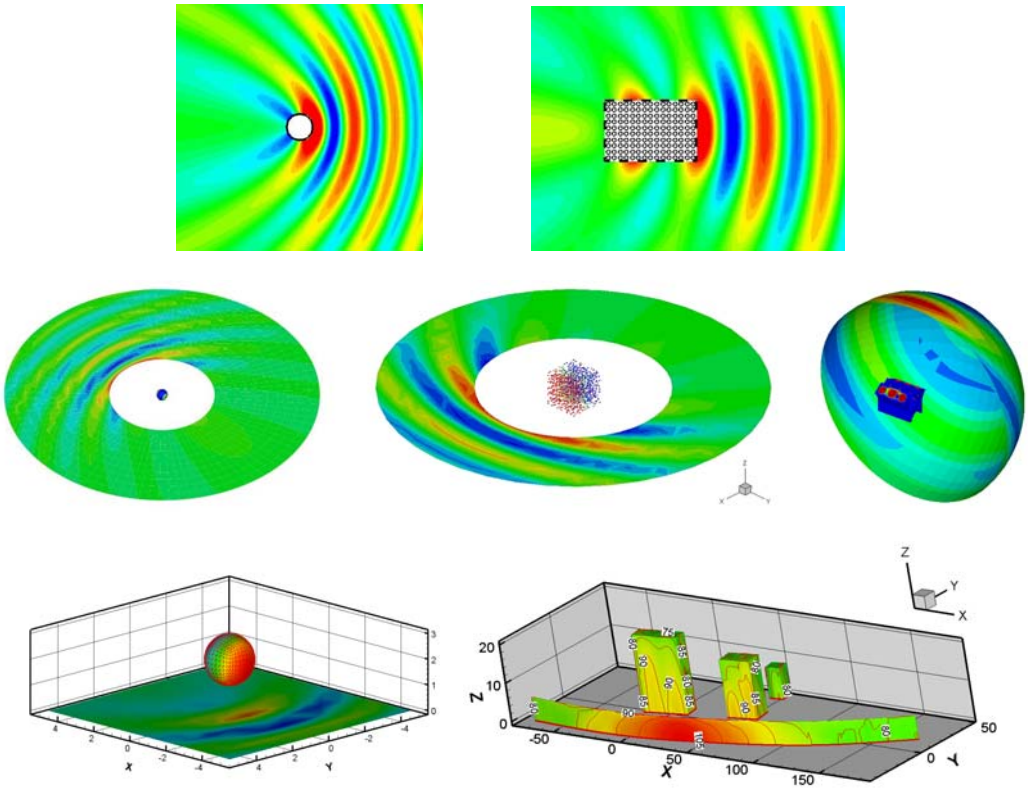
First, we will present the fast multipole BEM formulation for 2-D acoustic wave problems based on a dual boundary integral equation (BIE) formulation [1]. Concise and symmetric fast multipole formulations will be introduced for both 2-D conventional and hypersingular BIEs.

Second, we will introduce some improvements on the adaptive fast multipole BEM for 3-D full-space acoustic wave problems based on the earlier work [2]. The improvements include adaptive tree structures, error estimates for determining the numbers of expansion terms, refined interaction lists, and others in the fast multipole BEM.

Third, we will present an adaptive fast multipole BEM for 3-D half-space acoustic wave problems [3]. Instead of using a tree structure that contains both real model and its mirror image, the half-space Green's function is employed and the same tree structure that is used in the full-space domain is adopted. This procedure simplifies the implementation and significantly reduces the memory cost for half-space problems.

Examples involving 2-D radiation and scattering, 3-D radiation and scattering in full- and half-space domains solved by the developed 2-D and 3-D fast multipole BEM codes respectively will be presented. The accuracy and efficiency of the numerical results presented clearly show the potentials of the fast multipole BEM for solving acoustic wave problems, in both 2-D and 3-D, and in both full- and half-space domains.

Details of the formulations and implementations of the developed fast multipole BEM for 2-D full-space, and 3-D full- and half-space acoustic wave problems can be found in the references listed below.



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