Estimates of the coefficients in the BEM matrices for 3-D potential problems

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Abstract

Estimates of the orders of magnitudes of the coefficients in matrices of the boundary element method (BEM) for 3-D potential problems will be presented in this talk. For 3-D potential BEM, the kernels are functions of $1/r$ or its derivatives, where r is the distance between the source and field points. The coefficients in the off-diagonal locations in the BEM matrices should vanish as r increases. Therefore, these coefficients can be ignored in calculation of the coefficients when r is large. This is especially true for problems with at least one large length scale and for large-scale BEM models. The estimates provided in this talk will give quantitative estimates which can help one decide when to drop the calculations of the coefficients in the BEM matrices, depending on the tolerance and element size. Ignoring some of the coefficients in the BEM equations can potentially further improve the computational efficiencies of the BEM solutions, even with the fast multipole method (FMM) and adaptive cross approximation (ACA) method, with very little loss of accuracy. Numerical examples using an ACA BEM solver employing these estimates will be given in this talk, which demonstrate the usefulness of these estimates.