A new fast direct solver for the BEM

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Abstract

A new fast direct linear equation solver for the boundary element method (BEM) will be presented in this talk. The idea of the new fast direct solver stems from the concept of the hierarchical off-diagonal low-rank matrix. The hierarchical off-diagonal low-rank matrix can be decomposed into the multiplication of several diagonal block matrices. The inverse of the hierarchical off-diagonal low-rank matrix can be calculated efficiently with the Sherman-Morrison-Woodbury formula. In this paper, a more general and efficient approach to approximate the coefficient matrix of the BEM with the hierarchical off-diagonal low-rank matrix is proposed. Compared to the current fast direct solver based on the hierarchical off-diagonal low-rank matrix, the proposed method is suitable for solving general 3-D boundary element models. Several numerical examples of 3-D potential problems with the total number of unknowns up to above 200,000 will be presented. The results show that the new fast direct solver can be applied to solve large 3-D BEM models accurately and with better efficiency compared with the conventional BEM.

Reference:

S. Huang and Y. J. Liu, "A new fast direct solver for the boundary element method," *Computational Mechanics*, **in press** (2017).