Three-dimensional scaled boundary finite element method for transient analysis

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Three-dimensional problems are evaluated in the time domain using the scaled boundary finite element method (SBFEM) and verified with the conventional finite element method (FEM). SBFEM is a semi-analytical technique which only discretizes the boundary of a few subdomains. Continued-fraction expansions are utilised to obtain the higher order stiffness and mass matrices. Comparatively, SBFEM requires significantly less degrees of freedom (DOFs) for similar accuracy and allows simple meshing refinement for convergence study. SBFEM is especially beneficial for 3D problems with stress singularities that are often computationally expensive for the FEM. SBFEM is generally found to be efficient for transient analysis as the benefit of having reduced DOFs is accumulated proportionally with the number of time steps performed. Higher order elements can also be seamlessly employed to further improve the efficiency and accuracy of SBFEM.

Keywords: scaled boundary finite element method, 3D transient analysis, continued fractions