A Coupled FEM-SBFEM Approach for Soil-Structure-Interaction Analysis Using Non Matching Meshes at the Nearfield Farfield Interface

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ABSTRACT

Buildings are grounded in the surrounding soil, so that soil and structure interact with each other. Consequently the soil induced vibrations are transmitted to the structures. Neighbouring buildings and structures interact with each other, as they are connected by the soil. Nowadays numerical simulation of soil structure interaction is of great interest and is applied to very different problems. These include for example the construction of reliable earthquake-resistant structures in seismic active areas, and also to increase the comfort of buildings by decoupling them from surrounding emissions like vibrations induced by traffic of machine foundations.

To analyse soil-structure-interaction and taking unbounded domains into account a numerical implementation of a coupled finite element method[1] and scaled boundary finite element method[2] approach is used. This approach fulfills the Sommerfeld radiation condition exactly. The finite element method is used to discretise the near field, containing structures and its surrounding soil. The coupled infinite half-space the so called far field is realised by the scaled boundary finite element method. Both methods are coupled at a common interface, where near field, far field informations like nodal velocities and nodal forces are exchanged.

Since computation of far field information needs more effort and compute time than computing the near field two different mesh resolutions are used. The elements in the near field are much smaller than those of the far field. This reduces the effort of far field computation. In order to exchange nodal information at the interface between the two meshes with non matching nodes mapping algorithms are used to interpolate the given information.

REFERENCES

[1] O.C. Zienkiewicz and R.C. Taylor, *The finite element method*, 4th Edition, Vol. 1, McGraw Hill, 1989.

[2] J. Wolf and C. Song Finite-Element Modelling of Unbounded Media, John Wiley & Sons, Chichester, 1996.