Elasto-dynamic analysis for semi-infinite media with using finite element method

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Abstract

The dynamic interaction between soil and structures has nowadays been recognized as one of important factors in dynamic response of structures. In study of such an interaction effect the dynamic behavior of soil plays a prominent role. The soil is usually modeled as an unbounded domain with elastic behavior. Although several numerical solution technique can be found in literature, a solution technique based on pure finite element method, without use of artificial boundary conditions, is still of importance.

In this thesis a method, based on pure FEM, has been introduced for calculation of impedance functions of rigid footings on elastic half planes. The method employs a sort of discrete Green's function obtained in FEM sense. The Green's function is evaluated by assuming that the infinite domain is discretized into infinite number of similar square elements. The repeatability of the mesh pattern helps that the solution of the Green's function be written in a spectral form through which the decay and radiation conditions are satisfied.

Once the Green's functions are evaluated, similar to boundary integral methods, the finite element equations of the half space are written by superposition of the effects. Unlike the boundary integral method, there is no singularity in the solution and thus the superposition is written with no difficulty. Assembly of the relations with those of the footing leads to system of equations for the whole domain from which impedance functions of the footing are evaluated.

Several examples are solved to show the validity and accuracy of the formulation proposed.