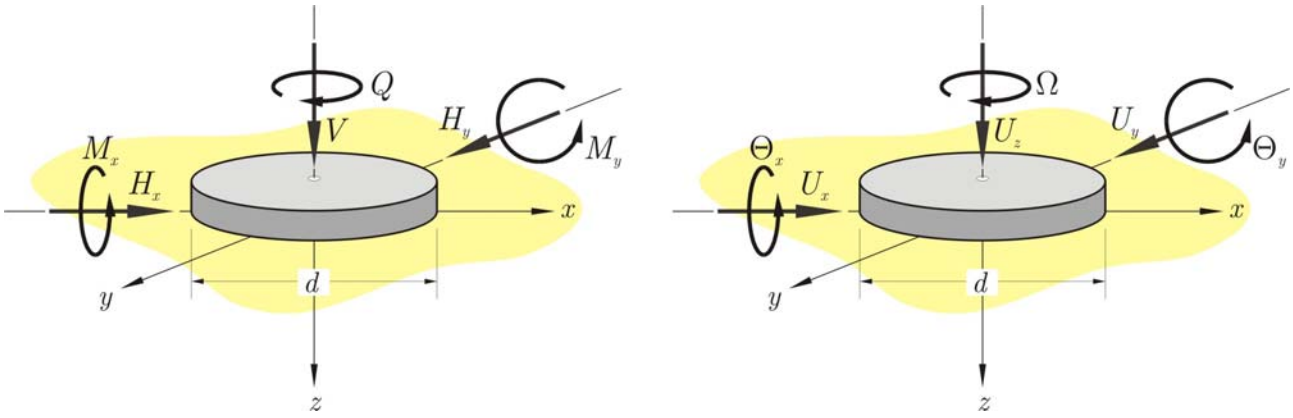
Seminar 3 - SOIL STRUCTURE INTERACTION UNDER DYNAMIC LOADING CONDITIONS



Summary.

In engineering practice, buildings are often designed considering the base of the structure as fixed to the ground, thus neglecting Soil–Structure Interaction (SSI) effects. Although this assumption can be considered reasonable for low–rise buildings on relatively stiff soils, the effect of SSI becomes prominent for heavy structures resting on relatively soft soils. Soil deformability may lead to an increased overall deformation of the system, with the accumulation of significant irreversible displacements, and to a different distribution of the internal forces, with a net reduction in the structural demand.

The most commonly used method to account for SSI effects is modeling the soil–foundation system with a series of (visco)elastic elements whose stiffness and damping coefficients are defined through equivalent springs and dashpots.

A number of alternative, more effective approaches have been extensively developed during recent years. Among these, the *macroelement* approach is particularly worth mentioning. It consists in lumping the response of the foundation–soil system into a single computational node, using a single inelastic constitutive equation written in terms of generalized loads and displacements. This allows to effectively reproducing the nonlinear, irreversible and hysteretic response of shallow foundations subject to cyclic/dynamic loading conditions.

Recent formulations, developed in the framework of elastoplasticity and hypoplasticity, include the possibility for the macroelement of: *i*) reproducing the full–scale behavior of the soil-foundation system starting from small–scale tests, *ii*) simulating the foundation response under six-dimensional loading paths; *iii*) modeling the shake-down effects that occur when a structure is subject to a large number of cyclic loads. Applications to real case studies will be presented to show the capability of the approach.