EARTHQUAKE RESPONSE OF STRUCTURES CONSIDERING THE EFFECT OF GROUND COMPLIANCE (4 TH REPORT)

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Synopsis

To estimate reasonably the safety of a building structure subjected to earthquakes, it is important to analyze earthquake response of the structure coupled with sub-soil ground and to make clear the effect of ground-structure interaction on the earthquake response.

In this study, the dynamical characteristics of the ground is simulated mathematically to a transfer function, expressed by a rational function, which approximates the dynamical ground compliance of a rectangular foundation on an elastic half-space. An above-ground structure is idealyzed, for the simplicity, as a one-degree-of-freedom system, the restoring characteristics of which are supposed to be a bilinear hysteretic type. As the adjacent soil-ground to the foundation may behave inelastically during strong earthquakes, the elasto-plastic boundary layer is placed between the above-ground structure and the elastic ground.

A set of band-limited white noise which has a finite duration-time is used as the earthquake acceleration excitation, and making use of an analog computer the non-stationary response analysis is carried out for various sets of parameter of the ground characteristics and earthquake excitation. An effect of ground-structure interaction on the average of the maximum relative displacement responses for the excitation ensemble is discussed.

As a result, the following remark can be mainly pointed out. The ground-structure interaction has a significant influence on the transmission of excitation energy to the above-ground structure. The response of the above-ground structure is suppressed by the hysteretic energy dissipation of the boundary layer as well as the energy radiation into the ground. This advantageous coupling effect of the ground may be much more anticipated for the relatively rigid structure on a soft ground.