ANALYSIS ON DYNAMIC BEHAVIOURS OF SEMI- INFINITE GROUND AND STRUCTURE SYSTEMS

by

Kazufumi Hanada[I], Toyonori Kudoh[II]

In the use of finite elements analyses for problems of ground structure interaction, the semi-infinite foundation medium must be represented by a finite size model. This model, unlike the semi-infinite continuum it represents, will have the effect of trapping energy of the system in a finite region. The effect may be overcome by the use of extremely large model or by the use of special boundary condition. In this paper, a numerical model of semi-infinite ground and structure system is idealized, in which the dampers being independent of frequency are introduced at the boundary of the model to absorb the radiation energy. The steady state harmonic responses of a semi-infinite elastic body with plane strain by horizontal and vertical excitations on its surface are introduced. Then, the power transmitted by body and surface waves, and evaluated by integrated the time avarage of the intencity over the corresponding wave surface at infinity are decided.

Numerical model with surface wave absorbing dampers set on the side face of the model, cannot be used for the transient problems, because it depends on frequency. Therefore, the damper coefficients of the model are decided so as to minimize the ratio of the total reflection energy to the incident energy to the boundary of the model from a line excitation source, taking account of energy partition and distribution. As the result of error examination, a maximum mesh size should be smaller than (1/4-1/8)x shortest wave length and the horizontal model size should be more wide than a half of the maximum wave length. Horizontal and vertical dynamic complex reactions of rigid base on semi-infinite ground, calculted by this model agree closely with those obtained by the half plane theory, for the wide dynamic range. A representative case is shown in Fig. As for the response of the earthquake input motion, a similar model equipped with energy absorbing dampers is proposed, which is slightly arranged by using the wave propagation theory.

In order to examine this procedure, a concrete mat on mud stone has been excited by a harmonic force. The mat has 68m x 68m area and has 5m thickness. Secondary wave velocity of the mud stone is about 550~700m/sec. The response curves of the concrete mat are similar to the caluculated curves obtained by this model.

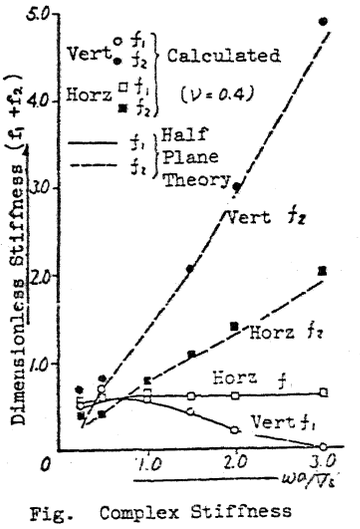

Fig. Complex Stiffness

I Junior Research Engineer, CRIEPI, Abiko, Abiko City, Chiba, Japan
II Senior Research Engineer, Tokyo Electric Power Co., Inc. Tokyo, Japan