TWO-DIMENSIONAL SEISMIC MODEL STUDIES OF DISPERSION IN LAYERED MEDIA

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Introduction

The solutions to many problems in seismology may be obtained by means of ultrasonic pulses propagating through small scale-models. To establish a facility for this type of work, a system of seismic model equipment was assembled. The equipment was evaluated by application to the problem of Rayleigh wave dispersion in layered media. Thin sheets, serving as two-dimensional models, were employed, and specifically, three basic configurations were considered: (1) simple half-space; (2) half-space with single layer, low rigidity contrast; and (3) half-space with single layer, high rigidity contrast.

Method

To study the dispersion of the fundamental Rayleigh mode in layered media, the group velocity-period relationship of the Rayleigh wave was observed for each of the configurations employed. This permitted the seismogram obtained for a single source-detector separation to be analyzed for a given model. In each case, the experimental results were compared to theoretical group velocity - period curves obtained by computation from previously derived theoretical expressions.

Results

In the case of the simple half-space, the empirical results are in general agreement with the predictions of classical theory.

The Rayleigh pulse is non-dispersed, and the valid replacement of the ideal half-space by a practical model construction is well illustrated. Results for initial layered models are in general disagreement with theory. After consideration of the possible sources of error, the discrepancies between theory and experiment were attributed to the departure of the actual models from two-dimensional thin plates. A "thin" model was then constructed in an attempt to approach the zero thickness requirement for a two-dimensional plate. The results obtained with this model are in excellent agreement with the theoretical predictions supporting the view that boundary condition requirements play the essential role in seismic model fabrication.