WAVE THEORY FOR SEISMOGRAM SYNTHESIS

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A complete system of wave integral theory is established for purpose of synthesizing high quality and high frequency seismograms in plane layered media. The system consolidates the foundations of wave theory, and greatly facilitates its numerical application.

A classical contour integration method is extensively studied. Without introducing any sort of attenuation, the integration is taken directly along branch cuts and poles. An attempt to classify the constituents of seismograms from different integration contributions is discussed. Such a discussion proposes a new viewpoint for understanding wave fields.

The eigenfunctions of surface waves are found to have concise analytic solutions. These analytic forms not only provide a firm basis for theoretical development, but also provide a way to study high frequency signals and complicated structures.

The reflection and transmission properties of layer interfaces are reconsidered using a new approach. A simple method is proposed to decompose the wave fields, which can easily be incorporated into our system. Using this method, body as well as surface waves from a particular portion of structure are generated.

A new method for expressing seismic sources is explored, which enables us to isolate the fault orientation and receiver azimuthal dependences, thus faciliating the study of source mechanism. An inversion technique is developed to extract the instrument response coefficients. These coefficients were included in designing a recursive filter to describe the instrument effect.

Comparisons with other methods confirm that the new theory is both flexibile and reliable. The present study clarifies several ambiguities in the theory of the wave integral method and provides several new techniques for simulating wave propagation in the earth.