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A THEORETICAL INVESTIGATION OF THE PROPAGATION OF SURFACE WAVES PARALLEL TO LATERAL VARIATIONS IN STRUCTURE

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Simple models of acoustic diffraction suggest that the amplitude of a Rayleigh wave, propagating parallel to a sharp horizontal change of material properties, decays as $(\text{distance})^{-\frac{1}{2}}$ in the far-field near to the interface. Matching the far-field amplitudes, derived by Green's function methods, in the two separate materials gives an opportunity to evaluate these amplitudes on the interface exactly. These in turn provide constraints on approximate solutions for the far-field in more extended regions.

A possible method of evaluation of the near-field, when the lateral variations are smooth, is provided by the parabolic approximation. This method has two major advantages for time-harmonic problems: the parabolic equation does not require a radiation condition (only forward propagation is allowed) and so integration may proceed step by step from an initial plane, and the step-size for numerical integration may be larger than a wavelength.

This paper is a progress report on these methods of investigating different aspects of the solution to the problem.

SCATTERING OF SH WAVES BY OBSTACLES EMBEDDED IN A HALF-SPACE USING BOUNDARY METHODS

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This paper is part of a program of research in which a unified approach to boundary methods is being developed. In some previous papers (1,2) the theoretical foundations have been discussed and the method applied to scattering of SH waves by topography changes. Consideration is given here to the problem of scattering and diffraction of plane harmonic SH waves incident upon an obstacle. The method reduces the dimension of the problem by one, avoids the introduction of singular integral equations, and is applicable to obstacles whose dimensions are comparable with the length of the incident waves. The scattered displacement is represented in terms of Hankel functions; and the transmitted displacement by means of Bessel functions. The coefficients in both representations are derived by a least-squares error criterion in the interface conditions which also provides a useful error measure. Comparison with known solutions yields very good agreement.

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COMPUTATION OF SYNTHETIC SEISMOGRAMS BY THE METHOD OF CHARACTERISTICS

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The synthetic seismogram has been extensively used for several years in geophysical prospecting. Its recent exploitation has placed emphasis on obtaining the responses of complex structural and stratigraphic geologic models with deep objective horizons. The responses of near surface earth models are equally important to the exploration industry. In this paper, a numerical technique, the method of characteristics, is introduced as an exploration tool. The characteristics method is used to compute one-dimensional synthetic seismograms from dry, elastic and viscoelastic near surface earth models. The synthetic data are compared to data recorded by various types of receivers located at shallow depth and on the surface.

RESPONSE OF LIFELINE SYSTEMS TO NONSTATIONARY TRAVELING SEISMIC WAVES

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A mathematical model has been developed to study the dynamic behavior of above-the-ground lifeline structures. The total lifeline system has been considered as a single linear time invariant multi-input, multi-output filter with nonstationary input and output processes. The seismic loading is assumed as a far-field motion of a nonstationary Gaussian plane S-wave. The nonstationarity of the processes has been taken into account both in the time and the frequency domain. With the utilization of consistent power spectra, someone can incorporate the risk analysis into the model developed. The model in particular, has been used to study the affects of traveling characteristics of the seismic wave and out-of-phase support motions on the lifeline responses, and in general, can be applied to the lifeline systems, long structures with many supports (bridges) and secondary systems, etc.