be developed. Work in this area is only just barely beginning. Further, elastic properties at tidal and Chandler periods differ from those at seismic periods and this also restricts the application of a Standard Earth Model.

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A First-Motion Alternative to Geometrical Ray Theory

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In recent years, the direct measurements of the seismic ray parameter and comparisons with synthetic seismograms have improved the interpretations of seismic data. This is particularly true of structure near interfaces in both the crust and deep interior of the earth. Until very recently, however, the computation of synthetic seismograms was too expensive and complicated for routine use. In addition several approximations were necessary in the theory. In this paper the approximations used in generalized ray theory are investigated in more detail and a new approximation is derived.

The generalized ray method is extended to vertically inhomogeneous media without approximation by homogeneous layers (Chapman, 1976a). The response is obtained as an infinite series of depth integrals rather than a summation of many rays. It is shown that this series converges rapidly to geometrical ray theory when the latter is valid. However, it is still expensive to compute the multiple integrals and a simple approximation exists for the infinite series. This we call the *first-motion approximation.*

The first-motion approximation is equivalent to geometrical ray theory but remains valid at caustics and shadows. The same approximation can be derived from generalized ray theory, the WKBJ approximation (Chapman, 1976b) or an intuitive physical argument (disk ray theory). The approximation is sufficiently simple that computations can be performed on a routine basis from the travel-time curve. Comparisons of synthetic seismograms using the first-motion approximation and other methods have been made. The method is sufficiently simple that it can be extended to cases where the WKBJ approximation is invalid, to laterally inhomogeneous and attenuating models and to the inverse problem.

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