J. J. Cabrera and S. Levy. *Stable plane-wave decomposition and spherical-wave reconstruction: applications to converted S-mode separation and trace interpolation*

Plane-wave decomposition of the vertical displacement component of a spherical-wave field corresponding to a compressional point source is solved as a set of inverse problems. The solution method utilizes the power and stability of Backus and Gilbert (smallest and flattest) model-construction techniques, and achieves computational efficiency through the use of analytical solutions to the involved integrals. The theory and algorithms developed in this work allow stable and efficient reconstruction of spherical-wave fields from a relatively sparse set of their plane-wave components. Comparison of the algorithms with discrete integration of the Hankel transform shows very little or no advantage for the transformation from the time-distance (t-x) domain to the intercept time angle of emergence (τ-y) domain if the seismograms are equisampled spatially. However, when the observed seismograms are not equally spaced or the transformation τ-y to t-x is performed, the proposed schemes are superior to the discrete integration of the Hankel transform. Applicability of the algorithms to reflection seismology is demonstrated by means of the solution of the problem of trace interpolation, and also that of the separation of converted S modes from other modes presented in common-source gathers. In both cases the application of the algorithms to a set of synthetic reflection seismograms yields satisfactory results.

J. Virieux. SH-*wave propagation in heterogeneous media: velocity-stress finite-difference method*

A new finite-difference (FD) method is presented for modeling SH-wave propagation in a generally heterogeneous medium. This method uses both velocity and stress in a discrete grid. Density and shear modulus are similarly discretized, avoiding any spatial smoothing. Therefore, boundaries will be correctly modeled under an implicit formulation. Standard problems (quarter-plane propagation, sedimentary basin propagation) are studied to compare this method with other methods. Finally a more complex example (a salt dome inside a two-layered medium) shows the effect of lateral propagation on seismograms recorded at the surface. A corner wave, always in-phase with the incident wave, and a head wave will appear, which will pose severe problems of interpretation with the usual vertical migration methods.

S.-K. Chang and B. Anderson. *Simulation of induction logging by the finite-element method*

The response of an electromagnetic induction logging tool passing through many invaded thin beds is simulated by the finite-element method. This simulation has achieved high accuracy by using a difference potential which enables the transmitter-receiver mutual coupling to be treated analytically. Consequently the removal of the mutual coupling from the induction tool response has no numerical ill effects. The finite-element model is truncated at a very large distance with a zero field outside the model. In order to achieve both accuracy and computational efficiency, the grid is projected to the truncation surface by gradually increasing its size according to an estimated error analysis of the finite-element method. The numerical results were verified against analytical solutions for limiting cases and excellent agreement was obtained. In the presence of skin effect, which is beyond Doll's analysis by geometrical factor theory, the finite-element solution conveniently provides a way to check and improve the interpretation of induction logs. It also lends itself to future applications in tool design, signal processing, and resistivity inversion schemes.

N. R. Garg and G. V. Keller. *Synthetic electric sounding surveys over known oil fields*

The possibility of using various types of electrical methods to locate oil or gas fields has been proposed in recent years. In an effort to quantify the anomaly to be expected with electrical sounding methods, average geoelectrical parameters have been determined by studying electrical well logs from several oil fields characterized by different geoelectrical sections. The dc resistivity anomaly due to the presence of an oil-bearing layer at depth depends upon the sequence of resistivities above and below and the electrode array employed. The radial dipole array gives the largest anomaly values, and is followed by other arrays such as the Schlumberger and Wenner arrays. The maximum anomaly in apparent resistivity is observed when the resistivity beneath the target zone is lower than that above; the relative anomaly in apparent resistivity is almost the same as the contrast ratio of the transverse resistance of the oil-bearing layer to the overlying beds. When the radial dipole array is used, a limited areal extent of the oil-bearing layer does not cause a significant change from the anomaly value due to a layer of infinite lateral extent. In that case the least dimension is about four times the depth. Use of one buried current electrode in the vicinity of the oil-bearing layer increases the amplitude of the anomaly; the maximum anomaly appears at a separation comparable to the depth. Typical anomalies in apparent resistivity caused by these oil fields range from less than 0.1 per cent to more than 10 per cent. Such anomalies would be detectable only with an order of magnitude improvement in the capabilities of electrical sounding methods, or with considerably larger oil field targets.

L. B. Pedersen and M. Svennekjaer. *Extremal bias coupling in magnetotellurics*

Bias effects due to uncorrelated noise on electrical and magnetic channels are cast into a quantitative framework which allows for an immediate conservative judgment of impedance tensor quality from a single station set up. The horizontal magnetic field is regarded as input to a linear system with the horizontal electrical field and the vertical magnetic field as outputs. The coherence between inputs, the predicted coherence between outputs and inputs, and the polarization characteristics of the inputs determine the extremal bias effects. Exact expressions for impedance tensor elements and tipper elements are given. Moreover, rotation angles of principal impedance direction, skew, and ellipticity are calculated. Finally, we study some practical examples that show some of the characteristics predicted by our model.