Seam Wave Characteristics in an Eastern U.S. Coal

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Some New Aspects of In-Seam Seismics C1.6
Especially by Improved Determination of Dispersion
M. Knecht, Th. Krey, R. Marschall, Frakla-Seismos, West Germany

Parallel to the steadily growing interest in in-seam seismic surveys for coal prospecting, it is necessary to extend and improve existing processing steps continuously. Up to now, transmission surveys only the observation of the Airy phase as an indication of unfaulted seams was considered. However, attempts are being made to use the whole dispersion curve, i.e., also the low frequency part, for interpretation purposes. From observed seismic wave data, an improved dispersion curve can be obtained by stacking the curves of several single traces.

Exact knowledge of the dispersion curve is also an important prerequisite for successful recompression of dispersive seam waves. In the case of reflection surveys, the aim of recompression is to replace the dispersive wave train with a simple and uniform wavelet which enables the subsequent stacking of single traces without having to form envelopes, or which at least improves the envelope method if still necessary. This is also the aim of another method based on correlation of traces with a signal similar to the Airy phase. In both cases higher resolution and an improved signal-to-noise ratio are achieved. The methods mentioned are discussed on the basis of several data examples.

High-Resolution Seismic: A Practical Approach C1.7
to Coal Exploration
R. C. Fry, Utah Power & Light Co.; E. Berkman and A. Orange, Emerald Exploration Consultants

The use of high-resolution seismic surveys has been extremely effective in defining the geologic structure and stratigraphy of a developed coal property located within the Wasatch Plateau coal field, Emery County, Utah. The coal property, which is the East Mountain property owned by Utah Power & Light Co., contains 5 underground coal mines that collectively produce about 4 million tons of coal annually.

High-resolution seismic surveys were conducted in 1980 and 1981 to define the geologic structure in areas where data collected by geologic mapping and drilling resulted in questionable interpretations regarding the geologic structure. These surveys produced data which allowed detailed identification of the geologic structure, continuity and thickness trends of the coal seams present, and location of fluvial channel sandstones superimposed on these coal seams.

Coal Seismology

S. S. Lee, J. Ragueiro, and J. Reeves, Colorado School of Mines

Synthetic seismograms have been computed, using selected subspecies of a generalized ray classification, to simulate two instances for which there is field data available: (1) hole-to-hole seam wave survey, and (2) underground seam wave survey. The kinematic discontinuity method is used to calculate amplitudes and arrival times for far-field, high-frequency components with long supercritical offset. The asymptotic ray method is applied to the critical region. Azimuthally symmetric P and SH point sources are employed. Automatic ray generation is applied to generate a set of multiple-reflected rays. The deep coal model consists of a sequence of horizontal, isotropic, homogeneous, elastic layers overlaying a half-space.

The Love and pseudo-Rayleigh waves, as well as leaky modes, compare favorably to the seismogram obtained from the field experiments. For the Love wave, the \((S_2)^2\), \((S_2)^4\), \((S_3)^4\), \((S_4)^4\), and \((S_5)^4\) species were the greatest contributors to the synthetic record. Pseudo-Rayleigh waves are the result of superposition of reflected \(P\) and \(SV\) waves, primarily by the species \((P_2)^2\), \((P_4)^2\), \(P_2H\), \(P_2H(P_2)^2\), etc. The \(PL\) phases result from superposition of many head subspecies: \(P_2H\), \(P_2H(P_2)^2\), etc. These results show that generalized ray analysis can be used as an aid in the interpretation of seam waves.