POLARIZATION ANALYSIS

OF

COMPLEX SEISMIC WAVE FIELD

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Polarization analysis has been used to identify and to isolate wave types of interest. This type of analysis is more effective than conventional techniques when applied to the complex seismic wave field. This study presents a complete derivation of polarization theory and a theoretical determination of the polarization parameters. The motion product technique is the easiest way to identify wave types. It is used in this study to determine the azimuth of incoming surface waves. Eigenanalysis of the covariance matrix is used to calculate polarization parameters and is robustly tested. Each test case is discussed from a physical viewpoint to gain an insight into the eigenanalysis results. To overcome the difficulties of eigenanalysis of the covariance matrix, the modified covariance matrix and several different filter functions are introduced.

A new spectral matrix procedure based on two-component data is developed. This theory, originally developed for radar signals and optics, is modified and applied to seismic waves for the first time. A new filter function defined from the combination of the degree of polarization and the ellipticity is determined theoretically, rather than numerically. It is found to work better than any conventional method.

There is no unique polarization filter. Rather, several different algorithms are used, each of which offers desirable advantages. Four

different algorithms for polarization filtering are presented. One is rewritten from Jurkevics (1985) for comparison, the other three are new techniques based on the theory presented in this research. Polarization analysis is applied to actual teleseismic, strong motion and exploration data with succesful results.