SPECTRAL DECOMPOSITION FOR SEISMIC IMAGING

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Geophysical seismic signals are nonstationary and multiscale in character having varying frequency content in time.Non-stationary data show variations of their spectral properties.time – frequency decomposition,spectral decomposition(SD), eigen decomposition of a seismic signal aim to characterize the time dependent frequency response of subsurface rock & reservoir.spectral decomposition is the factorization of a matrix into a canonical form, whereby the matrix is represented in terms of its eigen values & eigen vectors. SD can be performed on a multitude of attributes(frequency,dip, azimuth..), though the frequency is the most common. It can be performed on either the time migrated or depth migrated seismic data. SD methods- Short Time Discrete Fourier Transform(STDFT), Stockwell Transform, wavelet transform ,CLSSA constrained least square spectral analysis, EMD Empirical Mode Decomposition, etc. For nonstationary nonlinear seismic data(vibroseis, sub bottom profiling) Hilbert Spectral Analysis,Hilbert-Huang Transform EMD is efficient. The Conventional Fourier Transform (FT) is unsuitable for providing information about the instantaneous frequency content of non-stationary signals. In fact, the Fourier Transform allows just a global representation of the frequency content of the signal as a whole. If our purpose is to extract its "instantaneous" frequency content, we need to apply other types of time-to frequency transforms. Two good candidates for that purpose are Wavelet and Stockwell transforms. Due to its ability to analyze rapidly changing transient signals, the wavelet-based approach finds cross-disciplinary utilization. In fact, every application using the Fourier transform can be formulated using wavelets, in order to provide more accurately localized temporal and frequency information. Wavelet transformation uses windowing functions that can allow only changes in time extension, but not in shape. The "scalogram" is defined as the squared magnitude of the wavelet transform. Sonification consists of a set of techniques used in several research fields to transform data into sounds and to represent, convey and interpret them. Sonification can be a complementary approach in those scientific fields where data analysis is performed mostly, or exclusively, through imaging techniques.After having obtained accurate spectrograms from time series, it is relatively simple to convert the signal information (time-frequency amplitude) into an audible perception (time-pitch-loudness). This allows sounds to be obtained from the original data.
MIDI (Musical Instrument Digital Interface) music technology is employed for seismic attributes and stratigraphic interpretation by improving thin bed ultra thin bed resolution and showing temporal bed thickness variability. Seismic data after spectral decomposition is converted in music domain with the help of MIDI . in digital music technology for geophysical data analysis, Sound intensity,pitch,harmonics, etc are used to generate MIDI attributes like seismic attributes. These attributes help in deciphering subsurface geological features.