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Frequency Processing of Blasts and Earthquakes

In this work, we exploit the difference in time-frequency signatures between blasts and earthquakes, as a possible discriminant. Time-varying instantaneous frequency signals will be computed in two ways:

1) We will use the classical method of Taner and Koehler [1]. The instantaneous frequency is obtained by differentiating the instantaneous phase of the analytic signal. If the data is very noisy, then the resulting instantaneous frequency, as a function of time, is not a useful result. When the signal envelope is very small, the instantaneous frequency is amplified incorrectly;

2) A two-dimensional frequency map is computed using a novel implementation of the Short-Time Fourier Transform, the Stockwell Transform (ST) [2], which is a form of the continuous wavelet transform [3]. The ST frequency-centroid yields the instantaneous frequency signal, without differentiation.

References

[1] Taner, M.T., Koehler, F. "Complex seismic trace analysis", Geophysics, vol. 44, Issue 6, pp.1041-1063 (1979).

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[3] Gibson, P. C., Lamoureux, M. P., Margrave G. F. "Stockwell and Wavelet Transforms", Journal of Fourier Analysis and Applications, December 2006, Volume 12, Issue 6, pp.713-721.

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