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Identification of short period transients in microtremors using wavelet transform

F.Vallianatos (1), G. Hloupis (1,2), J.Makris (1), J.Stonham (2), D.Triantis (3)

(1) Technological Educational Institute of Crete,Chania, Greece (2) Department of Electronic and Computer Engineering, Brunel University of London, United Kingdom (3) Department of Electronics, Technological Educational Institute of Athens, Athens, Greece (fvallian@chania.teicrete.gr / Fax:+302821023003)

The spectral ratio between horizontal and vertical components (H/V ratio) of microtremors has been widely used to estimate fundamental periods and amplification factors of a site in order to identify the site's response during earthquake. The accuracy of this method depends on the stationarity of the recorded microtremors signals. Transients and other non-stationary components contaminate the signal and reveal frequencies that are not related with site's characteristics. This problem arises from the fact that H/V ratio is estimated using the Fourier transform where the transformation assumes stationarity which is not always true. In practice, to avoid this contamination, amplitude threshold techniques are used in order to reject from H/V estimation these portions of microtremors signals that assumed to be non stationary. This approach is not the best solution since there may be non-stationary components in the signal with amplitude comparable to microtremors, therefore unidentified by an amplitude threshold technique.

In this study we propose an unsupervised identification scheme based on wavelet tresholding. The microtremors signal is first decomposed into a set of wavelet coefficients. Then we separate these coefficients by estimating the effective signal level in each coefficient using conventional wavelet tresholding techniques. Then the short-period detection problem could be seen as a binary hypothesis testing problem where under the null hypothesis the transient is not present. The critical point for hypothesis test is the estimation of acceptance threshold which largely depends from the ratio between acceptable costs of false alarms and omissions. We investigate also how this ratio could be optimized for microtremors signals.