THE ENERGY CONTAINED IN A RECORD OF GROUND DISPLACEMENT AS DETERMINED BY THE AUTOCORRELATION FUNCTION

Digest

by

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The Fourier transforms of these autocorrelation estimates were then determined by a numerical integration of the appropriate function. These transforms were shown, theoretically and experimentally, to be the same as an amplitude spectrum of the Fourier series representing the phase from which the autocorrelation estimates were obtained.

From this fact and the differentiability of the Fourier series an energy spectrum naturally resulted from this transform. The area under this energy spectrum, giving the energy in the phase, was also shown to be proportional to the autocorrelation function of the time derivative of the displacement seismogram at zero lag.

This resulted in a very easy method for determining the energy in a complex wave form on a displacement seismogram if the constants of the Fourier series analysis of the phase are known.

In addition to the above the following conclusions were drawn:

1) The autocorrelation function showed the similar nature of the T #1 phase for the two longest delays indicating that delay blasting had little effect on the vertical component of this phase after a certain delay had been exceeded.

2) The energy content of the phases was determined, with the 20 millisecond delay record having the least amount of energy in the T #1 phase and the greatest amount of energy in the T #2 phase as compared with the other two seismograms.

3) Since a very simple method was employed to obtain the energy in a phase from a Fourier series analysis of the phase, and since this energy determination agreed very well with an analysis of the actual energy spectrum (involving an estimate of a Fourier transform), then a Fourier series analysis is much more practical than a direct autocorrelation function estimate when energy is desired.

4) The main object of this work was to obtain a method for estimating the energy in a complex wave form in the minimum amount of time. This writer thinks that the problem has been solved, the time factor depending on the tools that the researcher has at hand.