

MAGNETIC RECORDING IN FREQUENCY ANALYSIS OF
STRONG EARTH MOTION

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This report is the explanation and evaluation of a more rapid method of frequency analysis of strong earth motion than has been usually employed.

Magnetic recordings, by means of a Sound Level Meter and a piezoelectric crystal pickup, are made of the vibrations caused by a lead weight dropped onto a concrete floor. A seismograph record and an oscillogram are made simultaneously of the weight drop.

Comparison of the oscillogram and the seismogram shows that the oscillograph is effectively filtering vibrations with frequency higher than 100 cps. The limits of the experiment are thus determined because the tape recorder is already known to be non-linear for frequencies below 20 cps.

A variable filter is placed between the tape recorder and the oscillograph. Replay of the magnetic record produces an oscillogram identical with the direct oscillogram made previously. Thus, the filter does not affect the system when the pass band is very wide.

The filter band is made very narrow by setting upper and lower cutoff dials on the same frequency, and the magnetic record replayed to produce another oscillogram. Many such oscillograms are made of the same magnetic recording with the filter band set on varied frequencies. Then the amplitudes of the oscillograms

are measured with a high precision micrometer microscope and plotted versus the filter frequency. A smooth curve is easily drawn through these values.

The direct oscillogram is analyzed using Fourier series; the values for the analysis being obtained by reading the oscillogram with the micrometer microscope. The Fourier results for the various fundamental frequencies are plotted with the graph of measured amplitudes. The results of both techniques are seen to be quite similar, provided that the fundamental used in the Fourier analysis is within the frequency limitations of the equipment.

Finally, the method is compared with a photo-mechanical method developed by Howell and associates and found to be at least as rapid and reliable, and to have some of the same limitations.

Magnetic recording, coupled with electronic filtering, is tested as a more rapid method of analysis of low frequency vibrations. The experimental setup is described, its operation tested, and recordings, magnetic tape and oscillograms, are made.

The permanent oscillograph record is analyzed using Fourier series and the results are compared with the results of the electronic filter technique. The results of both techniques are quite similar.

Finally, the entire method is compared with the

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photo-mechanical method of Howell and found to be at least as rapid and reliable.