A NEW TECHNIQUE FOR GENERATING SYNTHETIC ACCELEROGRAM CORRESPONDING TO SMOOTH DESIGN RESPONSE SPECTRA

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Characteristics of a strong ground motion can best be represented by a response spectrum. For design purposes response spectra are generally smoothened. A need exists to reconstruct the ground motion corresponding to the smoothen response spectrum. Some efforts have been made in this direction.

The frequency content as well as the relative strength of Fourier components vary as a function of time in an accelerogram. The response spectrum gives the peak value for each Fourier component and is the result of a 'time varying' frequency analysis akin to speech analysis by 'speech spectrum analyzer'. The ordinary amplitude spectrum obtained by Fourier transform of a time function (accelerogram) represents a constant amplitude value of the Fourier component which is independent of time and therefore differs from that obtained by response spectrum analysis.

In the present analysis response spectrum amplitudes have been used as the Fourier amplitudes in order to reconstruct the time history.

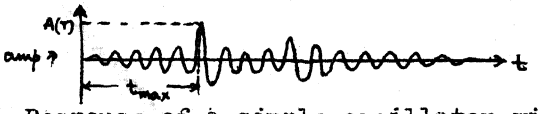

Fig.1 Response of a simple oscillator with natural period T

$\phi(T)$ = [Fraction of $\{t_{max}/T\}$] x 2π

$A(T)$ = Maximum response at period T

$$a(t) = \frac{1}{2\pi}\int_{-\omega_N}^{\omega_N} A(\omega)\, e^{i\phi(\omega)}\, e^{i\omega t}\, d\omega$$

where $\omega = 2\pi/T$; ω_N = Nyquist Frequency

The time to the peak responses in the response of simple harmonic oscillator has been used to calculate the phases of the various Fourier components (Fig.1). The fast Fourier transform algorithm of Cooly and Tukey has been used to synthesise the time history of the ground motion. The response spectrum of the synthetic time history displays a fair agreement with the response spectrum of the original accelerogram. The results are found to be satisfactory in so far as the shape of the response spectrum is concerned. There is however some discrepency in amplitude values of response towards higher frequencies. The matching is comparatively better at longer periods ($T > 1s$) both in shape as well as magnitude.

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