COMPARISON OF ARTIFICIAL AND NATURAL EARTHQUAKE TIME HISTORY FUNCTIONS WITH REGARD TO THEIR FLOOR RESPONSE SPECTRA

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SUMMARY

Artificial time histories are used either for generating floor response spectra or for direct evaluation of structural response. Several methods are described for evaluation of these time histories whereby the generating condition is to match a given target response spectrum.

In each method monotony for the structural response is assumed but not proved. In this context monotony means that time histories with larger response spectrum will produce larger structural response. If time histories are used for generating floor response spectra the monotony hypothesis would require that the floor response spectrum generated with the larger ground response spectrum must envelope the floor response spectrum generated with the time history with the smaller ground response spectrum.

It can be shown by simple examples that monotony is not granted in general. To use the time history method to predict structural response it is of vital importance that monotony is fullfilled for time histories similar to earthquakes.

Some processes have been developed which propose to generate such time histories. In these procedures a number of parameters can be changed where consequences cannot be generally predicted.

In this paper the parameters:
(1) damping of targer spectrum,
(2) duration,
(3) number and distribution of frequencies,
(4) phase relationships,
are studied by using the two degree of freedom resonance system as a sensitive tool for testing the monotony hypothesis and the ability of the developed time history to generate conservative floor response spectra.

Our results show, roughly spoken, that the normalizing process, i.e. matching the given response spectrum, has not as much influence on the response of the equipment as the choice of the special parameters.