SEISMIC RESPONSE ANALYSIS OF FRAMED STRUCTURES (3-127)

by

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A computer analysis has been made of the seismic response of 5- to 20-storey framed structures, with using El-Centro 1940, Hollister 1949, Taft 1952, Santa-Barbara 1952, Taft 1954, and San-Fernando 1971 accelerograms. The design scheme has been considered as a cantilever with discrete masses at the level of each floor. Variants have been considered of softened interaction between underground and overground structures owing to first storey rigidity reduction by 80% and owing to the use of foundations as roller semi-spherical bearings on a curved spherical surface. For the framed system an analog technique analysis has been made of the failure mechanism, with the determination of a succession of plastic hinge formation in the frame bars.

The analysis has shown that the real-accelerograms of the actual earthquake resistance of multistorey structures must be evaluated from the sum of seismic response parameters distributed over the height: seismic accelerations, seismic storey inertial forces, total shears at the each storey level, each storey drift, absolute displacement of the system (lateral deflection), and base overturning moment. The analysis has shown that the maximum values of these seismic response parameters are not synchronous, and each of them may turn out to limit the actual seismoresistance of the structure, with practically occasional combination of factors. The seismic analysis should include the structure calculation for the maximum display of each of the listed above factors.

The obtained relationship between accelerations at the top and bottom levels of the building poorly depends upon the height of building and equals about two, which agrees with the observed data from Los-Angeles (San-Fernando earthquake, 1971).

Taking account of cubic-parabola non-linearity leads to the 10-20% change in different response parameters. The yield ratio for the frame failure stage is 15-17.

Softening the interaction between underground and overground structures results in twofold reduction of the seismic response.

Damping of 5% of the critical value reduces the seismic response 2.6 times, as compared to the calculation without damping.

General statistical values of seismic ground motion damping have been obtained for the six accelerograms used. For three of them, variations in the damping coefficient are constant in time and are in the range of 0.25-0.29. For the other three accelerograms, the damping coefficient law approximates the hyperbolic one with the value of 0.30-0.60 at the beginning and to 0.05-0.10 at the end of the record.

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