# Rotations in a Seven Story Reinforced Concrete Hotel accompanying Nonlinear Waves During Earthquake Excitation

*V. Gicev*[a] and *M.D. Trifunac*[b]

*a) Rudarsko-geoloski fakultet, Goce Delcev 89, 2000 Stip, Republic of Macedonia*

*b) Dept. of Civil Eng., Univ. of Southern California, Los Angeles, California, 90089*

## ABSTRACT

In our recent study of a seven-story reinforced concrete hotel in Van Nuys, California, which was damaged during Northridge 1994, earthquake, we showed that the prediction of where the localized damage may occur should be carried out by non-linear wave propagation methods (Gicev and Trifunac 2006).

In this paper we describe how the rotations (local strains and drifts) in the building, depend upon the distribution of the stiffness along the building height, nonlinear properties of the reinforced concrete, and the nature of strong motion. To search for the optimum performance parameters, we vary the distribution of the velocity of propagation of SH waves from story to story. Five hypothetical buildings with: sinusoidal, linear, concave quadratic parabola, convex quadratic parabola and cubic parabola stiffness distributions, together with the actual distribution observed in the structure are considered. It is shown that the maximum rotations appear in the actual building, while the minimum rotations occur for the buildings with velocity distributions described by cubic parabola and quadratic convex parabola (maximum stiffness at the bottom) distributions.

It is concluded that the design of the seven-story reinforced concrete hotel was not optimal. For design of new structures and for retrofit of old ones near faults, the stiffness distributions should resemble the cubic parabola or quadratic convex parabola distributions.