nonlinear elastic geo-medium and multiple structures due to shock waves. From asymptotic equations of each order the complete function series which approach the solution of that problem are obtained by complex function. The problem is reduced to the solution of linear algebraic equations. As an example, the displacement and stress results of the response of two-cylindrical structures to shock waves are given. -from English summary

943350 **Robust active optimal control scheme including soil-structure interaction**
S. M. S. Alam & S. Baba, *Journal of Structural Engineering - ASCE*, 119(9), 1993, pp 2533-2551.

A robust active optimal-control scheme is presented for the vibration control of a seismically excited structure. The conventional optimal-regulator-control scheme for civil engineering structures with fixed-base assumption and without an observer is found to be quite ineffective for soft soils, where the effect of soil-structure interaction is prominent. A new algorithm is developed including the effect of soil-structure interaction in which soil is represented by the frequency-independent springs and dampers. An acceleration-type observer is used, which minimizes the difference of accelerations between the real structure and the mathematical model. The scheme is found to be robust for a considerable range of variation in the soil stiffness. -from Authors

943351 **Torsion in base-isolated structures with elastomeric isolation systems**
S. Nagarajaiah, A. M. Reinhorn & M. C. Constantinou, *Journal of Structural Engineering - ASCE*, 119(10), 1993, pp 2932-2951.

Torsion in base-isolated structures with inelastic elastomeric isolation systems due to bidirectional lateral ground motion is studied. Various multistoried structural systems with elastomeric isolation systems are investigated, with the objective of studying the influence of: 1) the flexibility of the superstructure; 2) the ratio of uncoupled torsional to lateral frequencies; 3) stiffness eccentricity in the superstructure; 4) eccentricity in the isolation system; 5) higher mode effects; and 6) number of bearings in the isolation system. Response to different ground motions is also studied. It is shown that although the total superstructure response is reduced significantly due to the effects of elastomeric base isolation, torsional amplification can be significant depending on the isolation and superstructure eccentricity and the lateral and torsional flexibility. -from Authors

943352 **Theoretical and experimental studies on rectangular liquid dampers under arbitrary excitations**
C. G. Koh, S. Mahatma & C. M. Wang, *Earthquake Engineering & Structural Dynamics*, 23(1), 1994, pp 17-31.

This paper presents a study on the behaviour of rectangular liquid dampers under a horizontal excitation of arbitrary time history. The theoretical model to predict motion of a shallow liquid in a rectangular tank is adapted from a previous researchers' model which was developed for sinusoidal excitations. The model includes an energy dissipation term arising from liquid viscosity. The results illustrate the strong dependency of liquid motion upon the natural frequency of the damper, amplitude and frequency content of the excitation spectrum. The model is applied to study the effectiveness of tuned liquid dampers in vibration control of a single-degree-of-freedom structure subjected to earthquake excitations. Significant suppression of structural vibration can be achieved using tuned liquid dampers. -from Authors

943353 **Seismic response of and design aids for arch bridges**
R. K. Wen, *Journal of Structural Engineering - ASCE*, 119(10), 1993, pp 2969-2985.

Design aids for estimating the seismic effects on deck type of arch bridges are presented. They are based on the in-plane response of a linearized model. For the model, the structural tangent stiffness at the end of a nonlinear analysis for the dead-load response is used as the linear stiffness in the subsequent linear seismic response calculations. Comparisons with results produced by using a nonlinear analysis throughout the ground motion indicated very close agreement. The design aids are based on the American Association of State Highway Transportation Officials response spectrum. Time-history solutions were also obtained for parabolic ribs using three earthquakes. -from Author

943354 **Effective stiffness and equivalent damping of base-isolated bridges**
J. S. Hwang & L. H. Sheng, *Journal of Structural Engineering - ASCE*, 119(10), 1993, pp 3094-3101.

In this paper, the guide specifications for bridge base isolation published in 1991 by the American Association of State Highway Transportation Officials (AASHTO) are briefly summarized and discussed. The effective stiffness and equivalent damping ratio given in the AASHTO isolation specifications are evaluated. Based on this study, it is concluded that the equivalent damping ratio determined using the AASHTO procedure may decrease with respect to the increase of the inelastic deformation of lead-rubber bearings. -from Authors

943355 **Relative performance of fixed-base and base-isolated concrete frames**
H. W. Shenton III & A. N. Lin, *Journal of Structural Engineering - ASCE*, 119(10), 1993, pp 2952-2968.

Results of a study are presented in which the performance of code-designed fixed-base and base-isolated concrete frames are compared. The purpose of the investigation is to compare in a quantitative manner the relative performance of code-designed frames, and to determine approximately the design force level for an isolated frame that will result in performance comparable to that of the fixed-base frame. Time-history analyses were conducted for three ensembles of recorded earthquakes. Analysis considered the nonlinear behavior of the isolation system and superstructure. Statistical analysis of peak response quantities demonstrates the superior performance of the code-designed isolated structures. Results illustrate that comparable performance is generally achieved when the isolated frames are designed to between 25% and 50% of the recommended lateral force. -from Authors

943356 **Response analysis of reinforced concrete structures under seismic excitation**
K. J. Mork, *Earthquake Engineering & Structural Dynamics*, 23(1), 1994, pp 33-48.

The theoretical background and capabilities of a program for response analysis of reinforced concrete structures under seismic excitation are presented. The emphasis is on the analysis of stiffness and strength degradation due to severe plastic deformations. An extended version of the model of Roufaiel-Meyer is utilized as the constitutive moment-curvature relation. The stochastic earthquake excitation may be specified either as a standardized acceleration time-series applied at the earth surface and scaled with stochastically varying maximum acceleration and duration, or as an intensity modulated Gaussian white noise process filtered through a Kanai-Tajimi filter. Based on Monte-Carlo simulation, the program calculates the mean values and standard deviations of storey displacements, bending moments in critical sections and maximum softening damage indicators, defined from the lower time-averaged eigenperiods. -from Author

943357 **Seismic performance of joist-pocket connections. I: modeling**
W. B. Cross & N. P. Jones, *Journal of Structural Engineering - ASCE*, 119(10), 1993, pp 2986-3007.

This paper outlines the development of a technique for the examination of the seismic performance of joist and beam bearing connections in unreinforced masonry structures. An understanding of these 'pocket' connections will allow for better estimates of the behavior of brick buildings, and provide a useful tool for the design of seismic retrofit details, particularly in cases when it is imperative to minimize the interventions. A finite-element model that accounts for the friction and impact behavior at the diaphragm-to-wall interface is developed. An equivalent coefficient-of-restitution procedure is described to account