LONG-PERIOD STRONG GROUND MOTIONS AND RESPONSE SPECTRA OF LARGE HISTORICAL EARTHQUAKES IN THE CENTRAL AND EASTERN UNITED STATES FROM KINEMATIC SOURCE MODELS

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Lacking instrumental observations of the largest earthquakes in the central and eastern United States, forward modeling is proposed as an approach to estimate time histories, strong ground motions, and response spectra at regional distances.

A kinematic source model based on recently developed source theory is proposed. First, a review of source theory is given, addressing moment tensors and finite source models. Second, seismic scaling relations are discussed. Third, a kinematic source model is developed, employing synthetic Green's functions calculated by normal mode theory as subevents on a finite fault. Finally, the technique is validated using regional Lg-wave and teleseismic body-wave magnitudes of medium size events in the central United States. Furthermore, magnitudes from random process theory and the kinematic source model show good agreement.

The kinematic source model is applied to the earthquake near Charleston, S. C., in 1886, and to the events near New Madrid, Mo., in 1811-1812. A review of contemporary observations and recent seismological research is used to define source parameters of these earthquakes. Synthetic time histories, peak ground motions, and response spectra are discussed in the distance range of 100 - 600 *km*. Peak ground motion estimates and response spectra from the kinematic modeling agree with predictions of other, completely independent techniques (e.g., random process theory) in the period range common to all methods. The numerical simulations indicate that magnitudes, peak ground motions, and response spectra greatly depend on the source model.

Results of this study have been used by the engineering community for the estimation of seismic loss at regional distances due to a large event in the central and eastern United States. Their results indicate that existing tall structures in Atlanta, Ga., and Chicago, Ill., can suffer minor structural damage during an earthquake comparable in size to those in 1811-1812.