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# Parameter Optimization of Seismic Isolator Models Using Recursive Block-By-Block Nonlinear Transient Structural Synthesis

*Kevin M. Norton*

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In order to increase building safety under earthquake motions, there has been increasing interest in base isolation with passive isolators. Computer modeling is an important aspect of the building design and evaluation process, but solving for the transient response of large structural systems with localized nonlinearities is computationally demanding. Current finite element programs can rapidly determine normalized mode shapes and natural frequencies of several thousand degree of freedom structures for use in determining the transient response. However, actual computation of the transient response can be very time-consuming and expensive for such large structures. A recently developed convolution algorithm utilizes the Volterra integral in a recursive block-by-block integral equation formulation to efficiently compute the transient response of multi-story, nonlinear, base isolated buildings. This algorithm was utilized in a versatile optimization scheme which determines parameters for both linear and nonlinear mathematical model isolators coupled to a multi-degree of freedom structure. To optimize the isolator parameters, the procedure incorporates modal properties computed from a finite element model of the structure, the earthquake accelogram of interest, and user-defined objective and constraint functions. An example is given of a 4-story, single bay structure subjected to the 1940 El Centro NS excitation.

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