

EXSIM12: A stochastic finite-fault computer program in FORTRAN

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Modified from the EXSIM code of Motazedian and Atkinson (2005), incorporating the improvements suggested by Boore (2009). Original FINSIM code by Beresnev and Atkinson (1998). The program is run from a DOS window (within the directory containing the program and its input files) by typing EXSIM12

The files in this directory include the FORTRAN source (EXSIM12.for) and executable (EXSIM12.exe) codes for EXSIM12. All needed subroutines are directly embedded in the source code. EXSIM12 is a stochastic finite-fault algorithm to generate acceleration time series for specified earthquake fault rupture scenarios, where the ruptures are specified by a few simple metrics such as earthquake magnitude and distance, with options to include more detailed information on fault geometry and slip, or net propagation effects, as available. See the references for the methodology. Comments on program operations are contained within the source code. The main loops for the program operations are shown below.

Required input files:

Input parameter file (main input file): see the example file **Example_EXSIM12.par**

Site amplification file (specifies site amplifications to be applied): see the example file **site_amps.txt**

Crustal amplification file (specifies crustal amplification to the base of the site soil profile): see the example file **crustal_amps.txt**

Empirical amplification file (allows multiplication by an empirical filter to fine-tune the specified spectrum as per Atkinson et al., 2011): see the example file **empirical_amps.txt**

Note that the Fourier spectrum that generates the time series includes the product of the site, crustal and empirical amplifications.

Generated output files:

Acceleration time series: **ACC.out** gives the 1st simulated trial for each case in a single output file in the root directory. The subdirectory **ACC** contains all of the generated trials.

Response and Fourier Spectra: the subdirectory **PSA** contains average output spectra (over all trials for a given scenario) in the *.out files. Values for individual trials are given in the *.tmp files

Other: The subdirectory **other** provides other information including modeling parameters, Husid parameters, Arias intensity and duration parameters.

References

- Atkinson, G., K. Goda and K. Assatourians (2011). Comparison of nonlinear structural responses for accelerograms simulated from the stochastic finite-fault approach versus the hybrid broadband approach. *Bull. Seism. Soc. Am.*, **101**, 2967-2980
- Beresnev, I. and G. Atkinson (1998). FINSIM - a FORTRAN program for simulating stochastic acceleration time histories from finite faults. *Seism. Res. L.*, **69**, 27-32.
- Boore, D. (2009). Comparing stochastic point-source and finite-source ground-motion simulations: SMSIM and EXSIM. *Bull. Seism. Soc. Am.*, **99**, 3202-3216.
- Motazedian, D. and G. Atkinson (2005). Stochastic finite fault modeling based on a dynamic corner frequency, *Bull. Seism. Soc. Am.*, **95**, 995-1010

Main EXSIM12 Program Loops

