Finite-fault modeling, interpolation of Green's functions over the fault.

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Abstract

We model high-frequency radiation of finite fault by combining the composite and kinematic models. The composite model makes up time histories of mainshock from time histories of subevents. The subevent size distribution is fractal. The time histories of subevents are computed either using point-source approximations or considering subevent as a finite-source. We introduce a technique of Green's function interpolation over fault, which enhances efficiency of calculations. Calculation is also performed for the 1999 Athens earthquake, for which we make comparisons with other data.

Synthetic tests

- Test the interpolation method to get correct Green's functions
- Include nonlinearity in the composite model of subevents

Synthetic model

Figure 1: Synthetic model for finite fault, showing mainshock and its branches of subevents.

Interpolation of Green's functions

- To reduce response of computation, we introduce interpolation of regular response (IR). The interpolation is carried out in frequency domain. Real and imaginary parts of regular response are approximated using B-splines within fast method for local resonance. In 2D, IR approximation is obtained by using fast method for local resonance. In 3D, IR approximation is computed using 3D wave equation solver.

Composite modeling

The composite model is performed according to the scheme of Burjánek (2002) with following parameters:
- Number of subevents
- Number of branches
- Number of elementary sources per subevent
- Location of elementary sources

The location of elementary sources is determined on the basis of time history of mainshock and its branches. The number of elementary sources is determined by the number of subevents. The branches of subevents are obtained by dividing each subevent into branches. The location of elementary sources for each branch is determined by the location of mainshock and its branches for that branch.

At each subevent:
- Compute time history of mainshock and its branches.
- Compute time history of subevent.
- Compute time history of subevent branch.

At each elementary source:
- Compute time history of mainshock and its branches.
- Compute time history of elementary source.
- Compute time history of elementary source branch.

Modeling of Athens 1999 earthquake

10 layered model was taken from Youroukos (2001).
- Fault parameters were taken from Youroukos (2001).
- Receiver functions were used as an input for the composite model.
- Parameters of subevents were taken from Fichtner & Zilch (2000). Calculations were made on the basis of the composite model.
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Conclusions

- Energy calculations are enabled by efficient Green's function interpolation
- Composite model is superior to kinematic model
- Modeling of strong ground motion in Athens has been confirmed

References