CG-FDM
Curved-grid finite-different method for modeling dynamic rupture on non-planar fault

1. Overview of CG-FDM

- Code name: CG-FDM
- Current version: 2.1
- Type of code: Finite-difference method
- Name of developer: Zhenguo Zhang, Wei Zhang, and Xiaofei Chen
- Special features: Using curvilinear collocated grid and split nodes to represent fault plane.
- Code availability: In personal communication.
- Funding source: National Science Foundation of China.

2. Technical description.

- The code solves first order stress-velocity formulation of the elastodynamic equations in curvilinear coordinates. The theory and example simulations about this method for wave propagation simulations can refer to Zhang and Chen (2006) and Zhang et al. (2012) in 2D and 3D, respectively.
- The code uses perfectly matched layer (PML) to absorb outgoing wave at the truncated boundaries except at the free surface. When the calculation volume is normal, the complex frequency-shifted PML with auxiliary differential equations (ADE CFS-PML) (Zhang and Shen, 2010) is used. In the case of large grid deformation, a generalized scheme (Zhang et al., 2014a) is implemented.
- The method use collocated grid for FDM, that all the parameters are located in the same grid point. Split nodes are used to represent the fault. The slip-weakening law is used. No inelastic attenuation is considered in our method.
- Please see the paper introducing this method, which just has been submitted for GJI, for technical details (Zhang et al., 2014b).

Reference

Zhang, W., and X. Chen (2006), Traction image method for irregular free surface boundaries in finite difference seismic wave simulation, *Geophys. J. Int*, *167*(1), 337–353, doi:10.1111/j.1365-246X.2006.03113.x.

Zhang, W., and Y. Shen (2010), Unsplit complex frequency-shifted PML implementation using auxiliary differential equations for seismic wave modeling, GEOPHYSICS, 75(4), T141–T154, doi:10.1190/1.3463431.

Zhang, W., Z. Zhang, and X. Chen (2012), Three-dimensional elastic wave numerical modelling in the presence of surface topography by a collocated-grid finite-difference method on curvilinear grids, *Geophys. J. Int.*, *190*(1), 358–378, doi:10.1111/j.1365-246X.2012.05472.x.

Zhang, Z., W. Zhang, and X. Chen (2014a), Complex frequency-shifted multi-axial perfectly matched layer for elastic modelling on curvilinear grids, *Geophys. J. Int.*, doi: 10.1093/gji/ggu124.

Zhang, Z., W. Zhang, and X. Chen (2014b), Three dimensional curved grid finite-difference modeling for non-planar rupture dynamics, *Geophys. J. Int.*, submitted.