

# Software Tools

## Software Tools

by Brad Aagaard — last modified Mar 01, 2012 11:01 AM

Tools for numerical modeling of crustal dynamics and earthquake faulting.

See the [workflow diagram](#) for how combinations of these tools are usually used in the context of numerical modeling of crustal dynamics.

## Geologic Structure

### Gocad

Commercial software for constructing and interpreting models of geologic structure. Primarily used in oil, gas, mining, and environmental work. Good for constructing fault surfaces from geologic data sets. Exports surfaces in ASCII Tsurf format. Used to construct the SCEC Community Fault Model and SCEC Community Velocity Model-H (i.e., the Harvard model).

Website: [www.earthdecision.com](http://www.earthdecision.com)

Availability: commercial

### Earth Vision

Commercial software for constructing and interpreting models of geologic structure. Primarily used in oil and gas work. Can export surfaces in ASCII Tsurf format. Used to construct the USGS Northern CA 3-D geologic model.

Website: [www.dgi.com](http://www.dgi.com)

Availability: commercial

## Mesh Generation

### CUBIT

Sandia National Laboratories developed mesh generation tool for structured and unstructured 2-D and 3-D models. Support for unstructured hex meshing and its GUI and scripting interfaces make this a popular tool. Importing complex geologic models (e.g., Tsurf files) can be difficult. Export to Exodus files allows seamless integration with PyLith.

Website: [cubit.sandia.gov](http://cubit.sandia.gov) (US gov't agencies)

Tutorials: [cubit.sandia.gov/public/tutorials.html](http://cubit.sandia.gov/public/tutorials.html)

## SOFTWARE TOOLS

---

Availability: non-commercial; small, one time acquisition fee for US Gov't agencies

### **Trelis**

Commercial version of CUBIT for non-US gov't agencies. We are finding small, subtle differences with CUBIT in terms of portability of journal files.

Website: [csimsoft.com](http://csimsoft.com) (Academic and non-US gov't agencies)

Tutorials: [csimsoft.com/tutorials.jsp](http://csimsoft.com/tutorials.jsp)

Availability: commercial

### **LaGriT**

Los Alamos Grid Toolbox (LaGriT) for generation of unstructured triangular and tetrahedral meshes. User interface is the command line or an input file. Steeper learning curve than CUBIT but has rich features for manipulating the mesh and improving element quality. Seamless import of Tsurf files. Export to GMV/Pset files allows seamless integration with [PyLith](#).

Website: [lagrit.lanl.gov](http://lagrit.lanl.gov)

Availability: free; Binaries for Mac, Linux, and Sun; no longer under active development

### **Gmsh**

Open source code for generating structured and unstructured meshes. Graphical user interface for geometry construction and meshing. Similar to CUBIT but geometry tools are more limited.

Website: [geuz.org/gmsh/](http://geuz.org/gmsh/)

Availability: open source (C++)

### **TetGen**

Open source code for generating tetrahedral meshes. Volume mesh created from surface meshes.

Website: [tetgen.org](http://tetgen.org)

Availability: open source (C++)

### **Physics Code**

#### **PyLith**

## SOFTWARE TOOLS

---

CIG developed open-source code for modeling 2-D and 3-D dynamic and quasi-static crustal deformation. Elements supported include linear triangular, quadrilateral, tetrahedral, and hexahedral cells.

Website: [www.geodynamics.org/cig/software/pylith](http://www.geodynamics.org/cig/software/pylith)

Availability: Source code with binaries for several platforms.

### **Relax**

Open-source code developed by Sylvain Barbot and supported by CIG for modeling 2-D and 3-D quasi-static crustal deformation. Relax implements a semi-analytic Fourier-domain solver and equivalent body forces to compute quasi-static relaxation of a stress perturbation.

Website: [www.geodynamics.org/cig/software/relax](http://www.geodynamics.org/cig/software/relax)

Availability: Source code with binaries for several platforms.

### **GeoFEST**

NASA/JPL developed code for modeling quasi-static crustal deformation. Includes adaptive mesh refinement using Pyramid. Supports tetrahedral cells.

Website: [www.openchannelsoftware.org/projects/GeoFEST](http://www.openchannelsoftware.org/projects/GeoFEST)

Availability: source code ©; development status unknown

### **Abaqus**

Commercial finite-element code. Primarily used in mechanical engineering work.

Website: [www.simulia.com](http://www.simulia.com) Availability: commercial

## **Visualization**

### **ParaView**

Open-source, VTK-based 3-D visualization software. Easy to use GUI with Python scripting capabilities. Seamless visualization of PyLith output. Some documentation via builtin help, but detailed documentation is sold by Kitware.

Website: [www.paraview.org](http://www.paraview.org)

Tutorials: [www.paraview.org/Wiki/The\\_ParaView\\_Tutorial](http://www.paraview.org/Wiki/The_ParaView_Tutorial)

Availability: source code with binaries for several platforms.

### **Visit**

Open-source, VTK-based 3-D visualization software. Easy to use GUI with Python scripting capabilities. Seamless visualization of PyLith output. Extensive documentation.

Website: [visit.llnl.gov](http://visit.llnl.gov)

Availability: source code with binaries for several platforms.

### **Matlab**

Widely used commercial visualization and data processing software. 3-D visualization is somewhat limited compared with most 3-D visualization tools.

Website: [www.mathworks.com](http://www.mathworks.com)

Availability: commercial

### **Mayavi**

Open-source, VTK-based 3-D visualization software. Easy to use GUI with extensive Python scripting capabilities. Moderate learning curve due to limited documentation. Can be difficult to install due to many dependencies.

Website: <http://code.enthought.com/projects/mayavi/>

Availability: open source

---

## **Contributed Utilities**

### **Matlab interface to Okada 1992, Noah Fay, 2006**

Tarball with Matlab scripts and Fortran code to compute dislocations for Strike-Slip and Reverse quasi-static problems in the Crustal Deformation Modeling benchmark suite.

([https://github.com/geodynamics/pylith\\_benchmarks](https://github.com/geodynamics/pylith_benchmarks)).

- [okada1992\\_noahfay.tgz](#) (2 MB, uploaded by Lorraine Hwang 1 year 8 months ago)