Green's Functions: Inverting Geodetic Data for Fault Slip with 2-D Earth Structure

CIG — COMPUTATIONAL INFRASTRUCTURE for GEODYNAMICS

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Green's Functions Examples

- Examples are in the directory:
  - src/pylith/examples/2d/greensfns (binary)
  - src/examples/2d/greensfns (source tarball)
- There is a README file in the top-level directory.
- The examples are described in Section 7.15 of the **PyLith User Manual**.

Steps in Green's Function Examples

- Generate meshes that will be used for both forward models and GF generation.
- Create synthetic data by running a forward model and outputting the solution at a set of points.
- Generate a set of Green's functions using the same fault geometry and output points as we used for the forward problem.
- Perform a simple linear inversion.
- Visualize the results using the matplotlib Python package.

Python Packages Needed

- numpy
  - Arrays plus scientific computing tools for Python.
- h5py
  - Can read HDF5 files from Python.
- matplotlib
  - Python plotting package.

Simple Linear Inversion

- Augmented system of equations:

$$G_a m = d_a, \quad \text{where} \quad G_a = \begin{bmatrix} G \\ \lambda D \end{bmatrix} \quad \text{and} \quad d_a = \begin{bmatrix} d \\ m_{ap} \end{bmatrix}$$

- Generalized inverse:

$$G^{-g} = \left(G_a^T G_a \right)^{-1} G_a^T$$

$$m_{est} = G^{-g} d_a$$