PyLith Modeling Tutorial

Troubleshooting PyLith Simulations

Brad Aagaard

June 10, 2019

What parameters are available?

Parameters are specified as a hierarchy of components and properties

- Components (Facilities) are the object building blocks
  Appendix B of the PyLith manual lists all of the components
  - Problem **TimeDependent**
  - Boundary conditions **DirichletTimeDependent**
  - Faults **FaultCohesiveKin**
  - Materials **Elasticity**
  - Solution observers **OutputSolnBoundary**
  - Readers **MeshIOCubit**
- Properties are the basic types
  - String **mat_viscoelastic.spatialdb**
  - Integer **4**
  - Float **2.3**
  - Dimensioned quantity **2.5*year**
  - Array of Strings, Integers, or Floats **[0, 0, 1]**

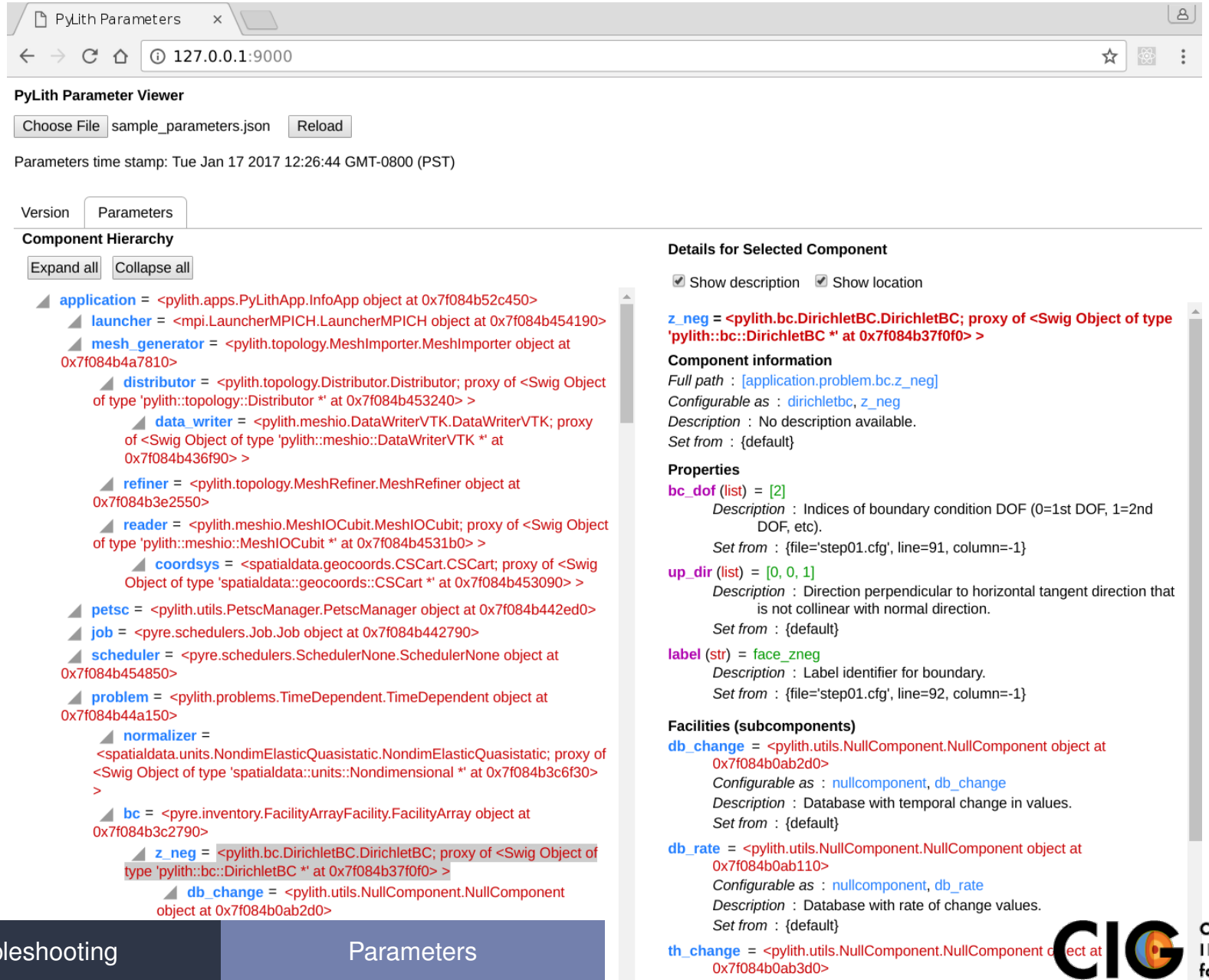
Parameter Files

Simple syntax for specifying parameters for properties and components

```
# Syntax
[pylithapp.COMPONENT.SUBCOMPONENT] ; Inline comment
COMPONENT = OBJECT
PARAMETER = VALUE

# Example
[pylithapp.mesh_generator] ; Header indicates path of mesh_generator in hierarchy
reader = pylith.meshio.MeshIOCubit ; Use mesh from CUBIT/Trelis
reader.filename = mesh_quad4.exo ; Set filename of mesh.
reader.coordsys.space_dim = 2 ; Set coordinate system of mesh.

[pylithapp.problem.solution_outputs.output] ; Set output format
writer = pylith.meshio.DataWriterHDF5
writer.filename = axialdisp.h5

[pylithapp.problem]
bc = [x_neg, x_pos, y_neg] ; Create array of boundary conditions
bc.x_neg = pylith.bc.DirichletTimeDependent ; Set type of boundary condition
bc.x_pos = pylith.bc.DirichletTimeDependent
bc.y_neg = pylith.bc.DirichletTimeDependent

[pylithapp.problem.bc.x_pos] ; Boundary condition for +x
constrained_dof = [0] ; Constrain x DOF
label = edge_xpos ; Name of nodeset from CUBIT/Trelis
db_auxiliary_field = spatialdata.spatialdb.SimpleDB ; Set type of spatial database
db_auxiliary_field.label = Dirichlet BC +x edge
db_auxiliary_field.iohandler.filename = axial_disp.spatialdb ; Filename for database
```

Parameters Graphical User-Interface

```
cd parametersgui; ./pylith_paramviewer
```



COMPUTATIONAL INFRASTRUCTURE for GEODYNAMICS

Parameters Graphical User-Interface

Case study: `examples/2d/box/step02_sheardisp`

1. Generate the JSON file with the parameters

```
cd examples/2d/box
pylithinfo step02_sheardisp.cfg
```

2. Start the web-server (start at your top-level PyLith directory)

```
cd parametersgui
./pylith_paramviewer
```

3. Point your web browser to `http://127.0.0.1:9000`
4. Load the parameter file

Show values of parameters using the command line

Case study: `examples/2d/box/step02_sheardisp`

- Components and properties for given component `--help`

  step02_sheardisp.cfg `[pylithapp.problem.bc.y_neg]`

  shell `pylith step02.cfg --problem.bc.y_neg.help`

- Current components of a given component `--help-components`

  step02_sheardisp.cfg `[pylithapp.problem.bc.y_neg]`

  shell `pylith step02_sheardisp.cfg --problem.bc.y_neg.help-components`

- Current properties of a given component `--help-properties`

  step02_sheardisp.cfg `[pylithapp.problem.bc.y_neg]`

  shell `pylith step02_sheardisp.cfg --problem.bc.y_neg.help-properties`

What about a GUI for editing parameters?

On the wish list but will require time or a developer

- Parameter viewer $\rightarrow$ editor
  - See possible choices for components and properties
  - Basic validation of parameters
  - $\Rightarrow$ Generate JSON schema from component specifications
  - $\Rightarrow$ Translate JSON schema into GUI
- Export parameters to single file
  Facilitates archiving parameters used in given simulation

Troubleshooting Examples

See `examples/troubleshooting/nofaults-2d`

Introduce common (and a few uncommon) errors into 2d/box input files