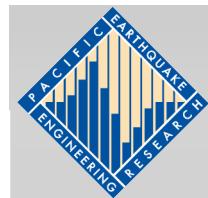
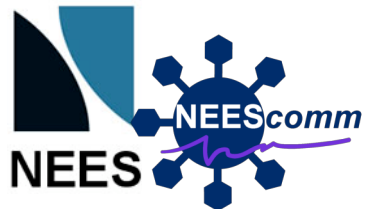


## OpenSeesLab

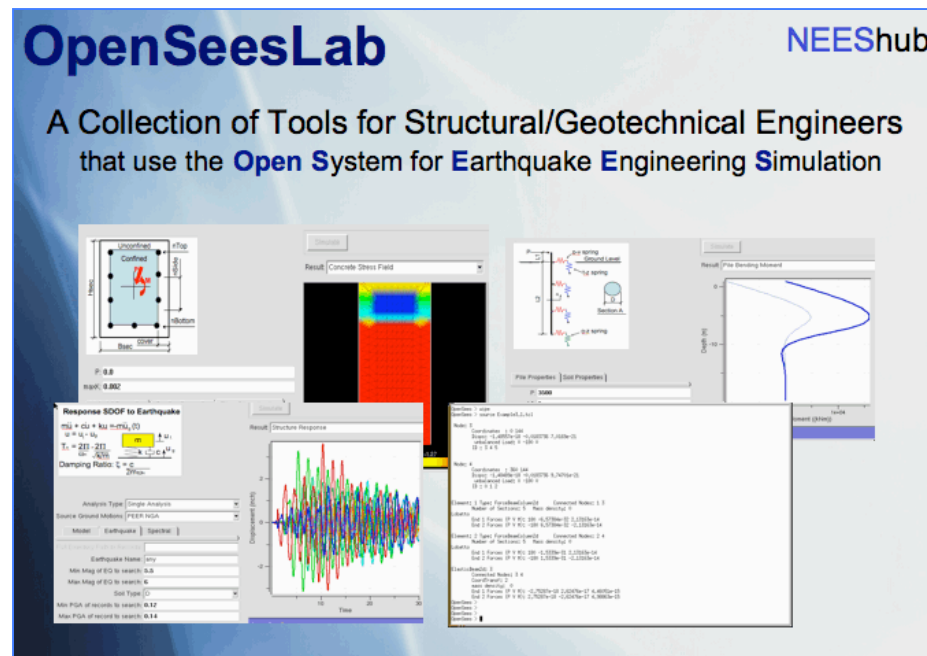
Frank McKenna  
UC Berkeley

OpenSees Days 2012



# The OpenSeesLab tool:

<http://nees.org/resources/tools/openseeslab>



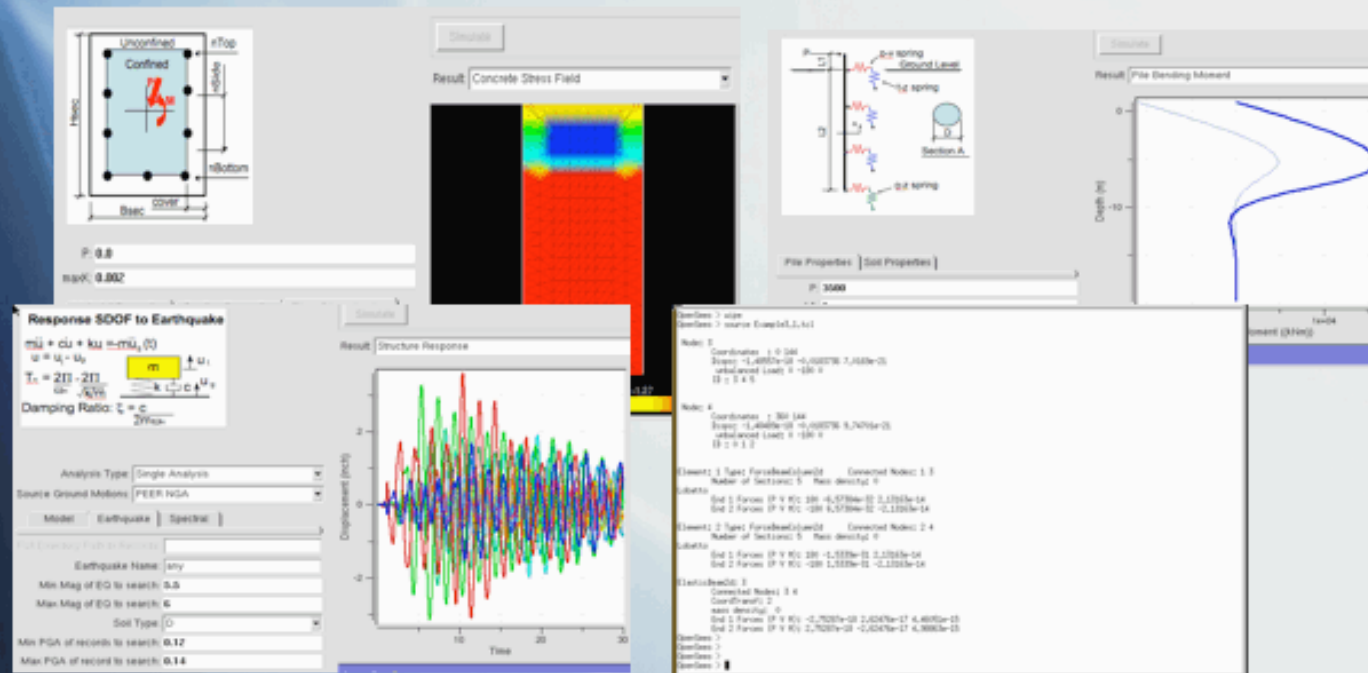
Is a suite of Simulation Tools powered by OpnSees for:

1. Submitting OpenSees scripts to NEEShub resources
2. Educating students and practicing engineers

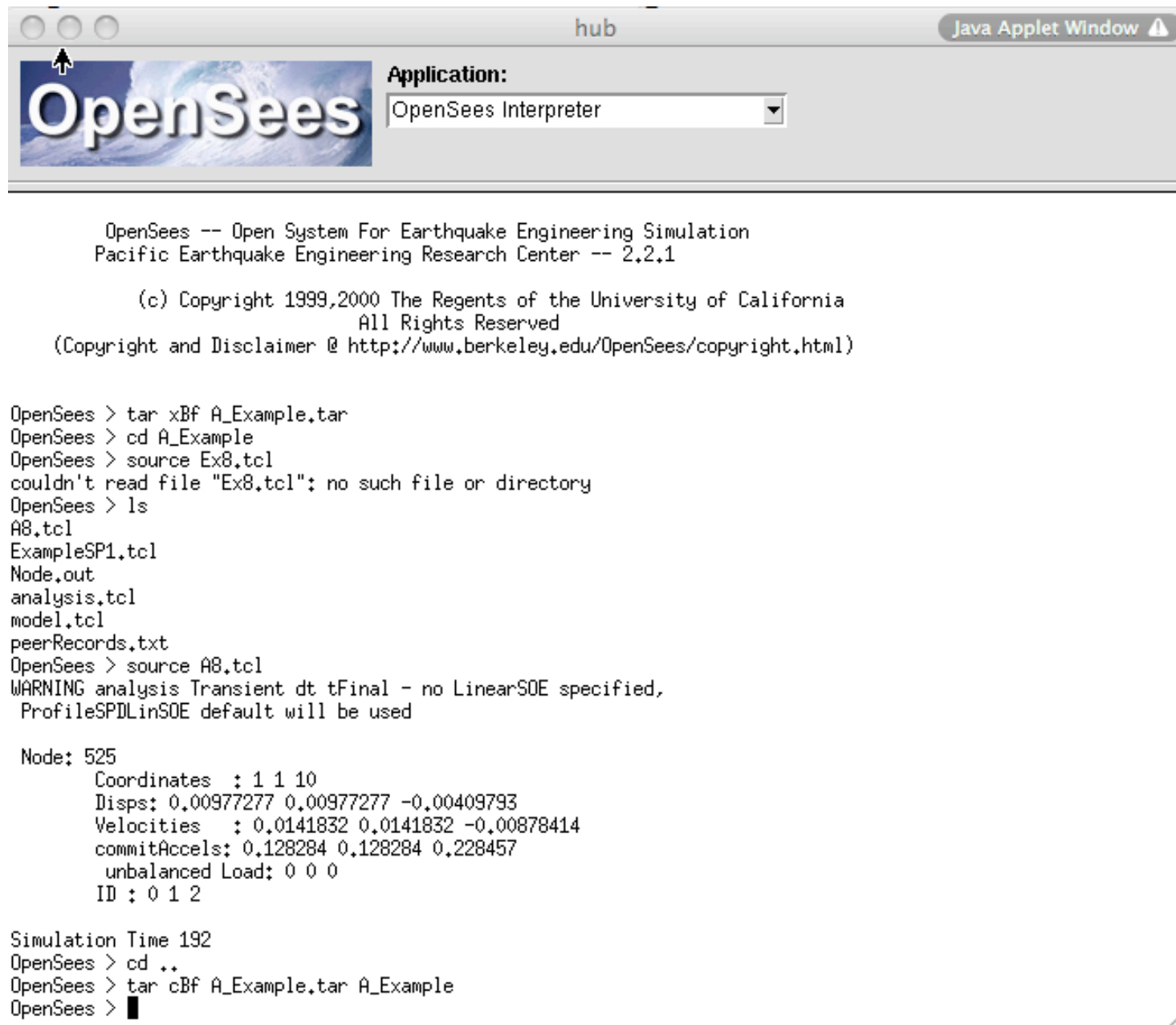
OpenSeesLaboratory



## NEEShub



# OpenSees Interpreter Tool



# Parallel Script Submission Tool

The screenshot shows the OpenSees Parallel Job Submission Tool interface. At the top left is the OpenSees logo. To its right is an 'Application:' dropdown menu currently set to 'Parallel Job Submission'. Below the logo, the 'Main Script:' field contains the path '/apps/opensseesbuild/current/NEEShubExam'. The 'Resource:' dropdown is set to 'Ranger'. A red circle highlights this dropdown, with a red arrow pointing to it from the text 'To Select Application' at the bottom left. To the right of the 'Main Script:' field is a 'Simulate' button, also circled in red, with a red arrow pointing to it from the text 'To Select Machine' at the top right. Below the 'Resource:' field is a section titled 'Ranger Options' containing an 'Application:' dropdown set to 'OpenSeesMP' (circled in red with an arrow from 'To Select Application'), a '# Processors:' field set to '512', and a 'Walltime:' field set to '04:00:00'. To the right of these fields is a yellow banner with the text 'new input parameters'. Below the 'Ranger Options' section is the 'Parallel Job Submission Tool' heading, followed by a paragraph explaining the tool's purpose and three 'NOTE' sections providing additional instructions. A mouse cursor is visible at the bottom center of the window.

**OpenSees**

Application: Parallel Job Submission

Main Script: /apps/opensseesbuild/current/NEEShubExam

Resource: Ranger

**To Select Machine**

Simulate new input parameters

**To Select Application**

Ranger Options

Application: OpenSeesMP

# Processors: 512

Walltime: 04:00:00

**Parallel Job Submission Tool**

This tool can be used to submit parallel openssees jobs. The user is asked which parallel OpenSees application to use, which parallel machine to run on, how many processes to run and which parallel machine to run these on. The results from the analysis when completed will be placed in the users /scratch directory. The actual directory location will be shown in the result screen.

NOTE: the main script CANNOT be located in your home directory. It and the files it requires must be in a subdirectory.


NOTE: control will return after the job has been submitted, AND NOT after the job has completed. This means you may have to wait awhile before the actual results are located in your output directory.

NOTE: as an example set the main script as:  
/apps/opensseesbuild/current/NEEShubExamples/SmallIMP/Example.tcl

DO NOT SELECT OpenSeesSP for this example.

# Parallel OpenSees Interpreters

- OpenSeesSP: An application for large models which will parse and execute the exact same script as the sequential application. The difference being the element state determination and equation solving are done in parallel.
- OpenSeesMP: An application for **BOTH** large models and parameter studies.



Application:  
Parallel Job Submission

Main Script: /apps/openseesbuild/current/NEEShubExam  
Resource: Ranger

Ranger Options

Application: OpenSeesMP  
# Processors: 512  
Walltime: 04:00:00

Simulate

Result: Output

Rounding NCPUS to nearest multiple of 16 (For Ranger NCPUS m  
Number of nodes:32 Processor Per Node:16 Total number of CPU:  
/home/neeshub/fmk/scratch/openseesmp/job00131/SmallMP

**Results Found HERE**

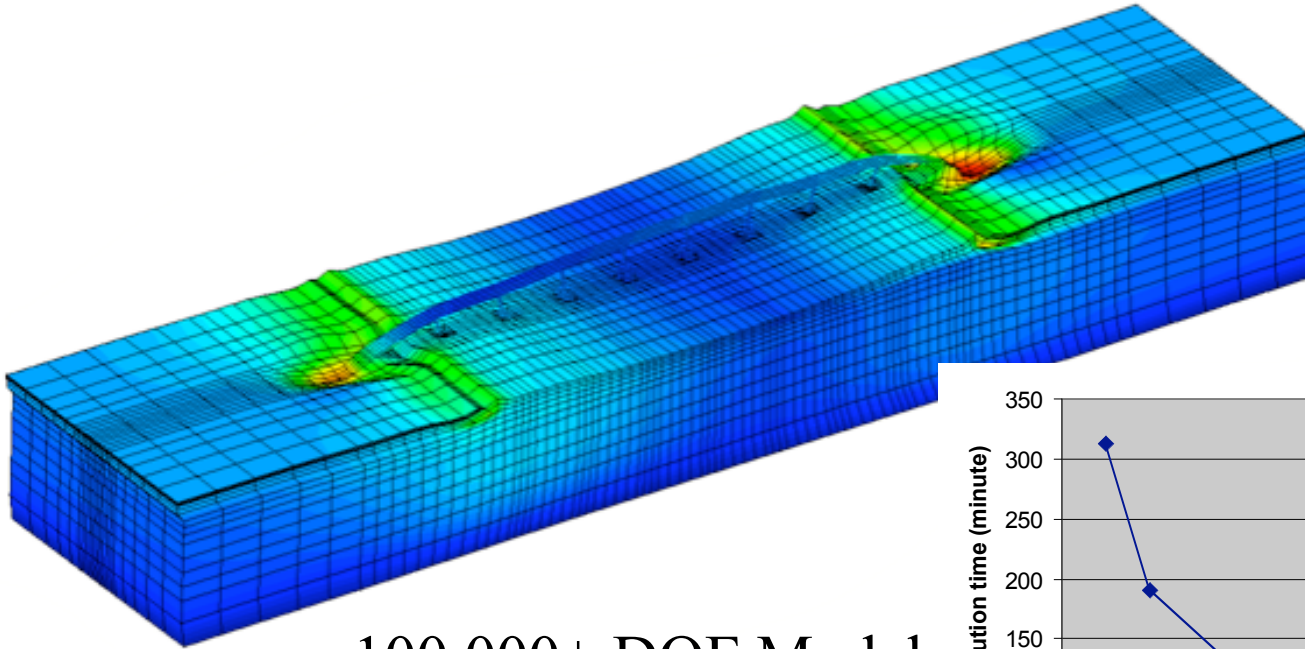
Email sent when job starts and job finishes

Select All

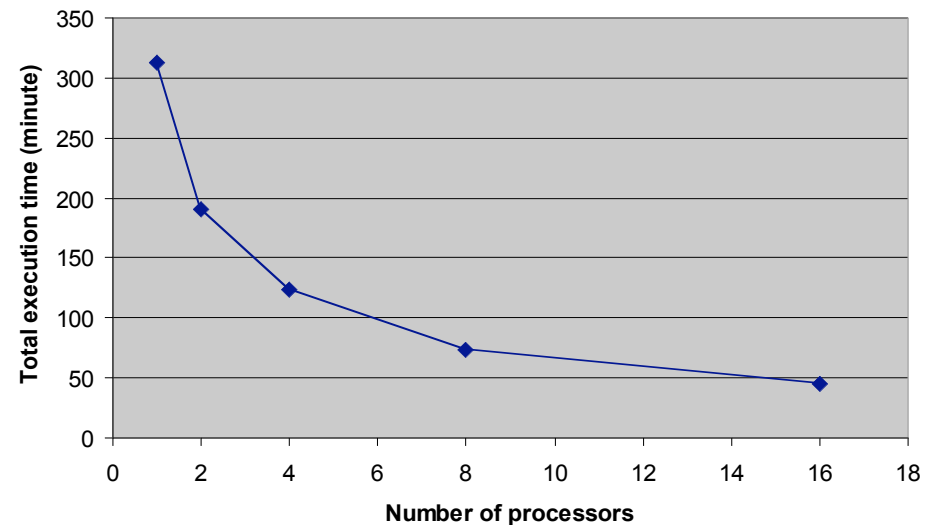
<input type="checkbox"/> ☆ root	"JOB openseesmp job00130 COMPLETED at 2012/07/10 17:52:44" - DO NOT REPLY TO THIS EMAIL/n/n	Jul 10
<input type="checkbox"/> ☆ root	"JOB openseesmp job00130 STARTED at 2012/07/10 17:48:26" - DO NOT REPLY TO THIS EMAIL/n/n/app	Jul 10

# OpenSeesSP:

## An application for Large Models



100,000+ DOF Model  
Implicit Integration  
Mumps Direct Solver



Only change to existing script requires changing solver type  
**system Mumps**



# OpenSees MP

## An Application for large models and parameter studies

```
set pid [getPID]
set np [getNP]
set count 0;
source parameters.tcl
source ReadSMDFileNewFormat.tcl;
foreach GMfile $iGMFile {
  foreach Factor1248 $iFactor1248 {

    if {[expr $count % $np] == $pid} {

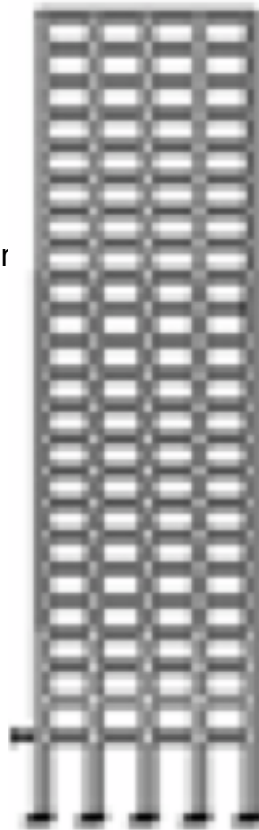
      set inFile $GMDir/$GMfile.AT2
      set outFile $GMDir/$GMfile.g3;
      ReadSMDFileNewFormat $inFile $outFile dt r

      wipe
      source GravityAnalysisScript.tcl

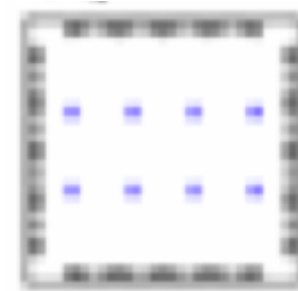
      loadConst -time 0.0;
      wipeAnalysis

      source EQ_Recorder.tcl
      source EQAnalysisScript.tcl

      if {$ok == 0} {
        puts "Process $pid $GMfile x $Factor1248
      } else {
        puts "Process $pid $GMfile x $Factor1248
      }
      incr count 1
    }
  }
}
```



***113 records, 4 intensities  
3 hour a record, would have  
taken 1356 hours or 56.5 days  
Ran on 452 processors of a  
Teragrid in less than 5 hours.***

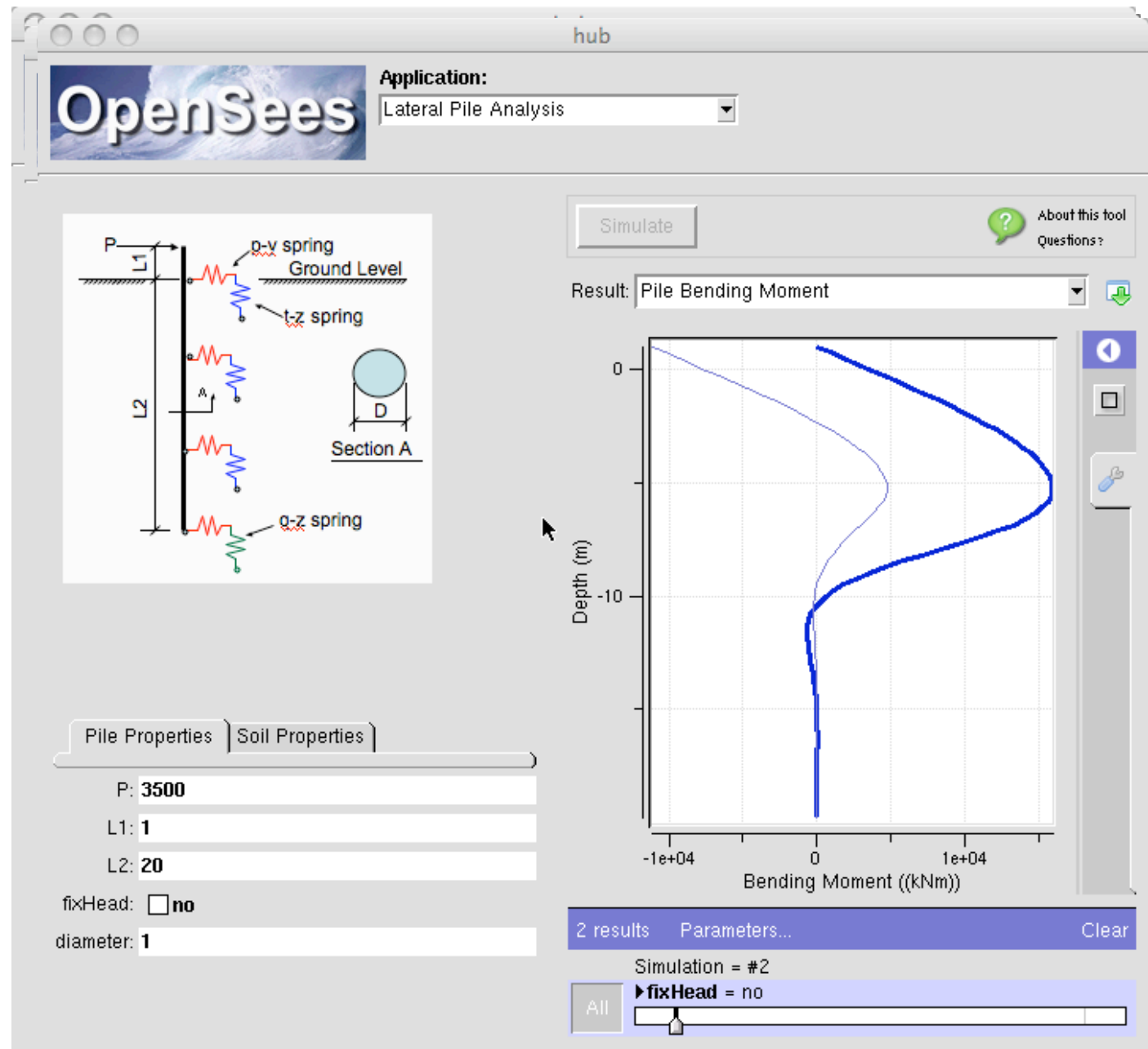


lTime [getTime]"

eTime [getTime] desiredTime \$TmaxAnalysis]"

# Lateral Pile Analysis

[http://opensees.berkeley.edu/wiki/index.php/Laterally-Loaded\\_Pile\\_Foundation](http://opensees.berkeley.edu/wiki/index.php/Laterally-Loaded_Pile_Foundation)  
Chris McGann U. Washington



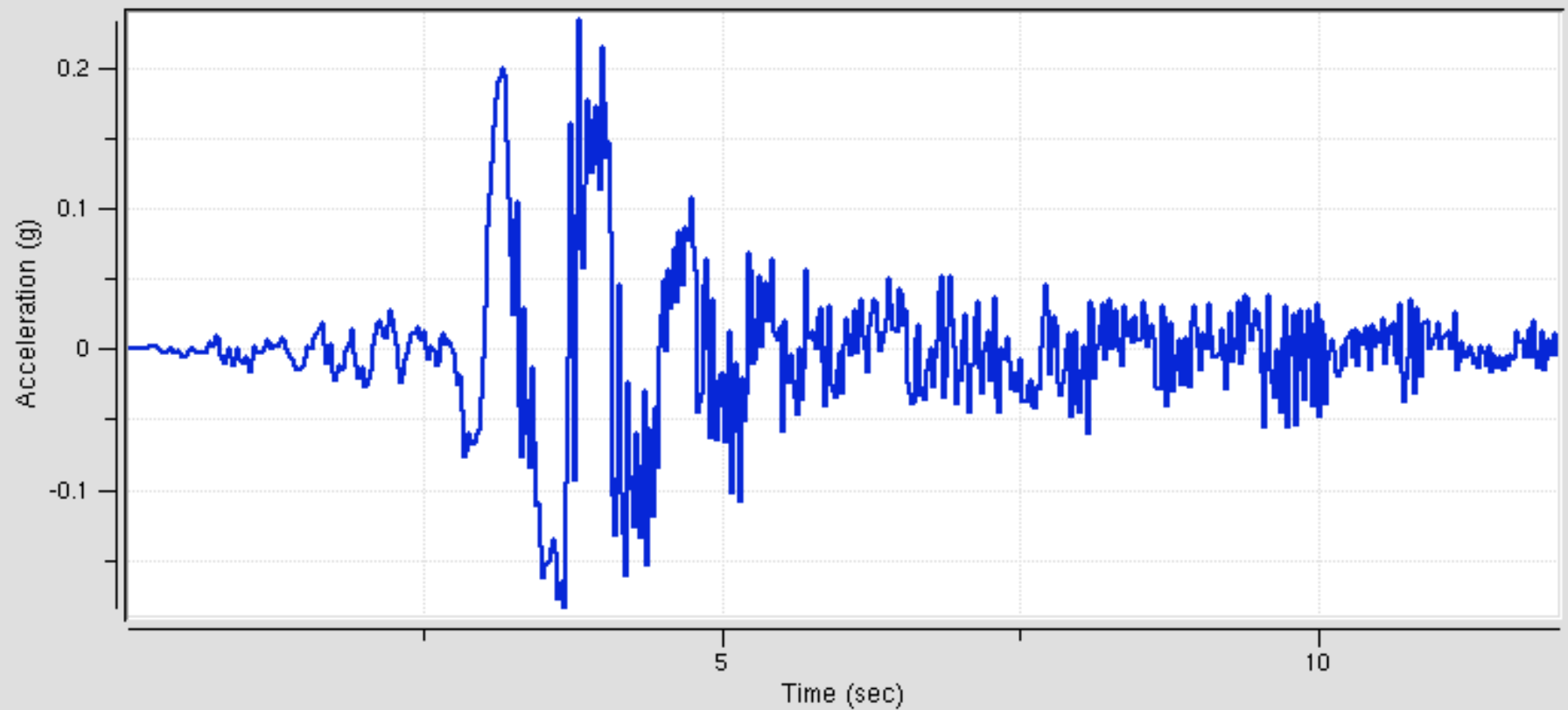


Application:

Site Response Analysis

1 Introduction → 2 Geometry → 3 Materials → 4 Motion → 5 Output → 6 **Simulate**

Result: Surface Acceleration



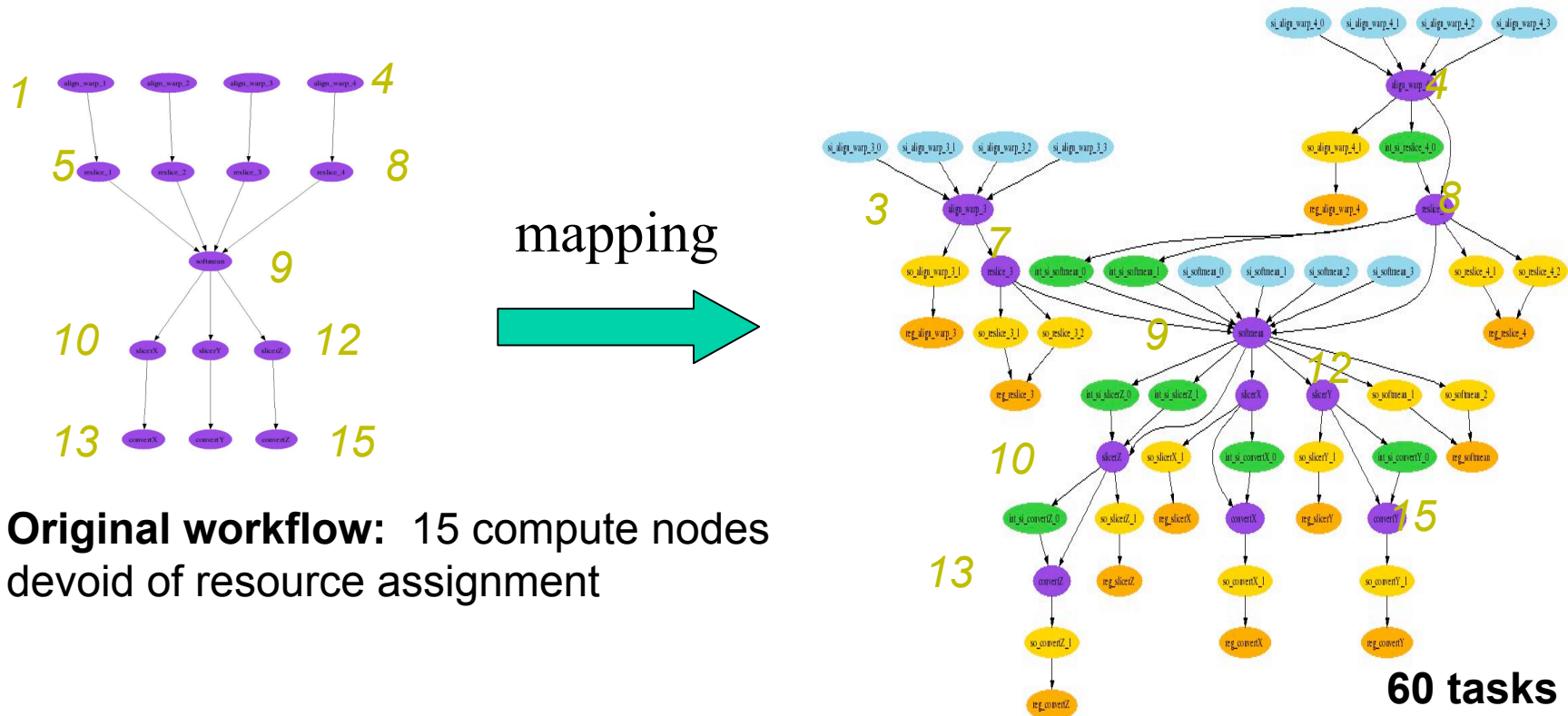
1 result Parameters...

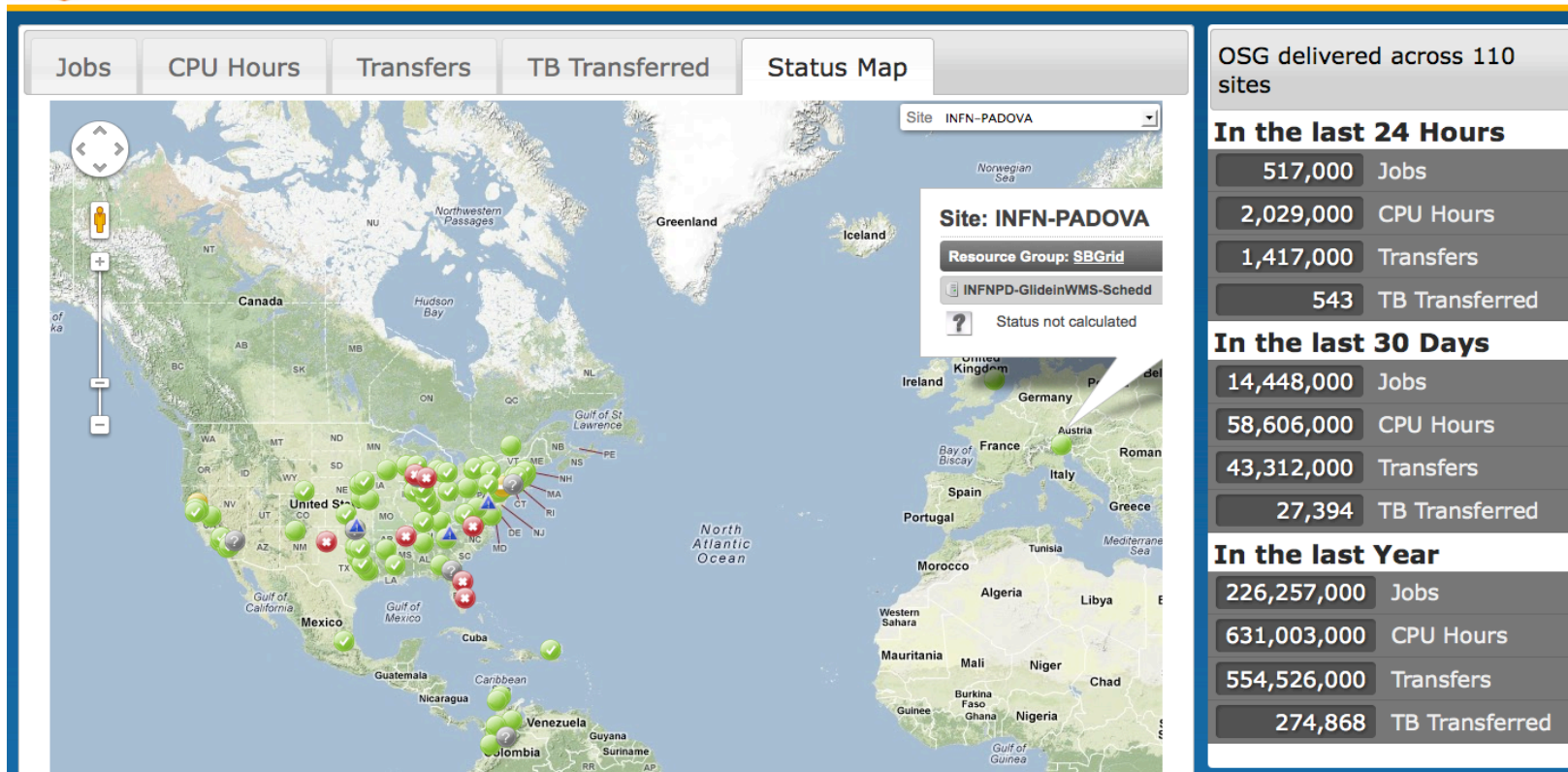
# Workflows in the Cloud



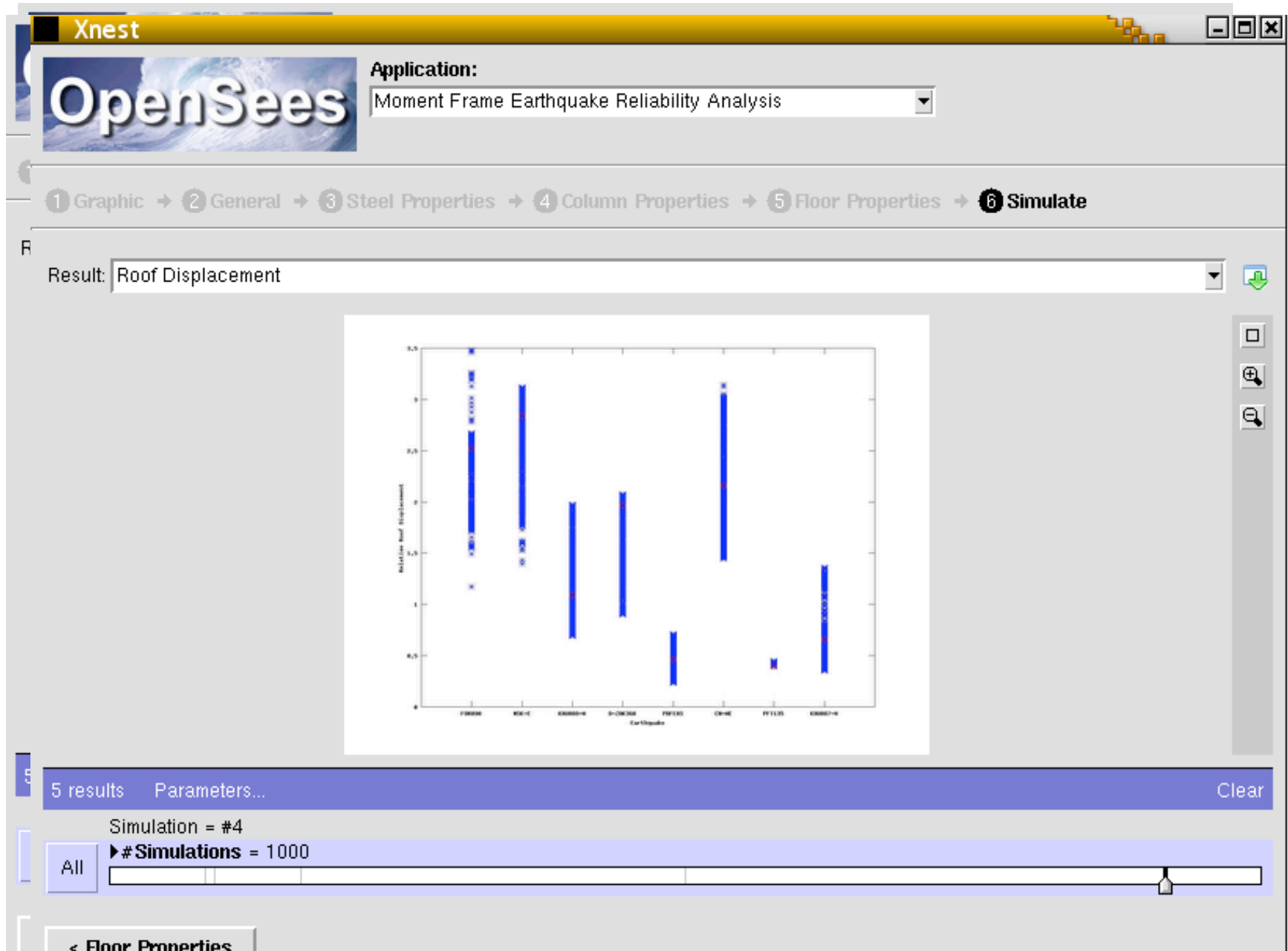
## OpenSees cannot do it all!

Software exists (pegasus, ...) for creating scientific workflows that can take advantage of computational resources in the cloud! A scientific workflow allows engineers to compose and execute a series of computational or data manipulation steps in a scientific application.





# Moment Frame Reliability Analysis



Thank You

**Your Turn!**