

# *OpenSees & DesignSafe:* OpenSeesMP

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# OpenSees applications on DesignSafe



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<b>LS-Pre/Post</b> LS-DYNA	<b>OpenFOAM</b> OpenFOAM	<b>OpenSees</b> OpenSees	<b>Simcenter Dakota</b> S		

as well as data analysis and visualization tools including Jupyter, MATLAB, Paraview and VisIt.

- .pyrib\_checkpoints
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- applications
- apps
- apps\_test
- archive
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## WORKSPACE

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.ipynb\_checkpoints

The **Open System for Earthquake Engineering Simulation** (OpenSees) is a software framework for simulating the static and seismic response of structural and geotechnical systems. It has advanced capabilities for modeling and analyzing the nonlinear response of systems using a wide range of material models, elements, and solution algorithms. One sequential (**OpenSees EXPRESS**) and two parallel interpreters (**OpenSeesSP** and **OpenSeesMP**) are available on DesignSafe. Please select the desired interpreter for more details.

Select a version of **OpenSees** from the dropdown:

- ✓ -- Please Select --
- OpenSees-EXPRESS
- OpenSeesMP (V 2.5)
- OpenSeesMP (V 3.0)
- OpenSeesSP (V 2.5)
- OpenSeesSP (V 3.0)

Jobs Status

# OpenSees applications on DesignSafe

## WORKSPACE

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### DATA DEPOT BROWSER

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The **Open System for Earthquake Engineering Simulation** (OpenSees) is a software framework for simulating the static and seismic response of structural and geotechnical systems. It has advanced capabilities for modeling and analyzing the nonlinear response of systems using a wide range of material models, elements, and solution algorithms. One sequential (**OpenSees EXPRESS**) and two parallel interpreters (**OpenSeesSP** and **OpenSeesMP**) are available on DesignSafe. Please select the desired interpreter for more details.

Select a version of **OpenSees** from the dropdown:

OpenSeesMP (V 3.0)

### RUN OPENSEESMP (V 3.0) ver. 3.0.0.6709

OpenSeesMP is an OpenSees interpreter intended for high performance computers for performing finite element simulations with parametric studies and very large models on parallel machines. OpenSeesMP requires understanding of parallel processing and the capabilities to write parallel scripts. OpenSeesMP runs on up to 12 KNL Nodes on Stampede2, with 64 cores per Node.

[OpenSeesMP \(V 3.0\) Documentation](#)

### Inputs

Input Directory

Select

The directory containing your OpenSees input files as well as your OpenSees TCL script. You can drag the link for the directory from the Data Browser on the left, or click the 'Select Input' button and then select the directory. To try out sample data copy and paste 'agave://designsafe.storage.default/mock/examples/opensees/FreefieldAnalysisEffective' above.

TCL Script

The filename only of the OpenSees TCL script to execute. This file should reside in the input directory specified. To try this



# Why OpenSeesMP?

OpenSeesMP (V 2.5)



OpenSeesMP (V 3.0)



OpenSeesMP is specifically developed for HPC.

## Pros:

- Ideal for very large models and parametric studies;
- More control on the parallelization process;

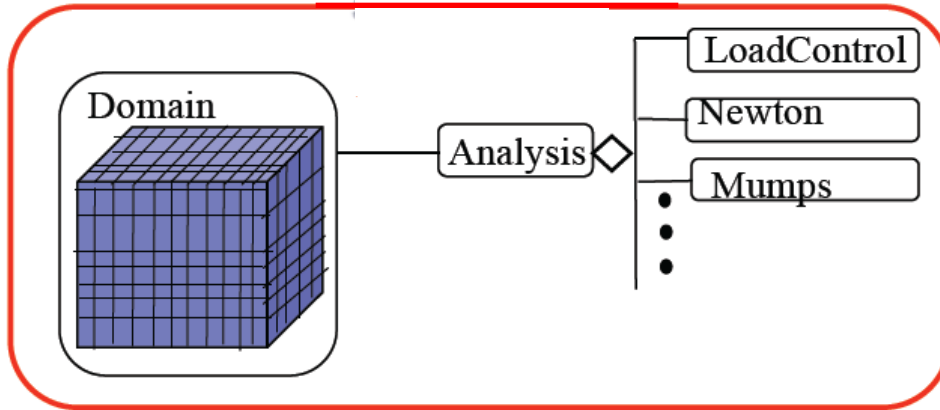
## Cons:

- Additional script needed for parametric analysis;
- It goes into the queue.

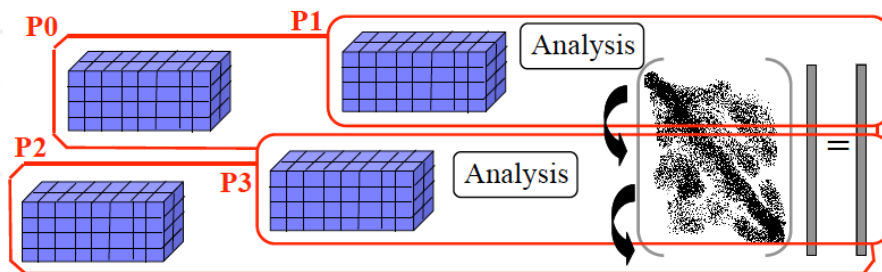
# OpenSeesMP: The **M**ultiple **P**arallel OpenSees Interpreter

In case of large models, it works like OpenSeesSP.

P0



The main Processor (P0) interprets the script to build the model and to construct the analysis.



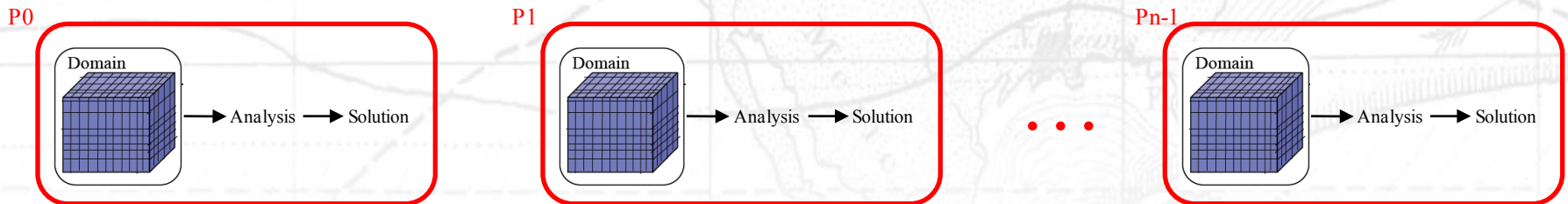
Other processors (P1, P2, P3) are running sub-domains of the model.

Graphics by McKenna

# OpenSeesMP: The **M**ultiple **P**arallel OpenSees Interpreter

In case of parametric analysis, this interpreter runs in parallel several slightly modified version of the basic OpenSees interpreter. Each of them runs an independent analysis and provides:

- the total Number of Processors available (*np*);
- Its unique Processor ID number (*pid*).



# OpenSeesMP: How to modify the script

For large model, changes to the scripts include:

- Change how degrees-of-freedom are numbered (**Numberer Command**) to one of the following:
  - numberer ParallelPlain;
  - numberer ParallelRCM.
- Change the System of Equation and the Solver (**System Command**) to one of the following:
  - system ParallelProfileSPD;
  - system Mumps;
  - system Petsc.



# OpenSeesMP: New Commands

In order to allow each running process to determine the processor it is running on, the number of processors that the user started and to allow the inter-process communications, the following additional commands are provided:

- **getNP**: returns the total number of processors assigned to the user for the job;
- **getPID**: returns a unique processor number ranging between 0 and ( $\$getNP-1$ );
- **send -pid \$pid \$data**: to send the data from a local process to a process whose process id is given by the variable pid. Pid must be in the range 0 to  $[\text{expr}[getNP]-1]$ ;
- **rcv -pid \$pid variableName**: to receive data from a remote process and set the variable named variableName to be equal to that data. Pid must be set  $\{0,..[\text{expr} [getNP] -1, ANY\}$ . If the value of \$pid is ANY, the process can receive data from any process;
- **barrier**: causes all processes to wait until all process reach this point in the code.

Using these commands it is possible for the user to perform their own domain decomposition analysis. The getNP and getPID commands allow the user to specify which nodes and elements are created on which processor.

# OpenSeesMP: Additional tcl script for parametric studies

```
set pid [getPID]
```

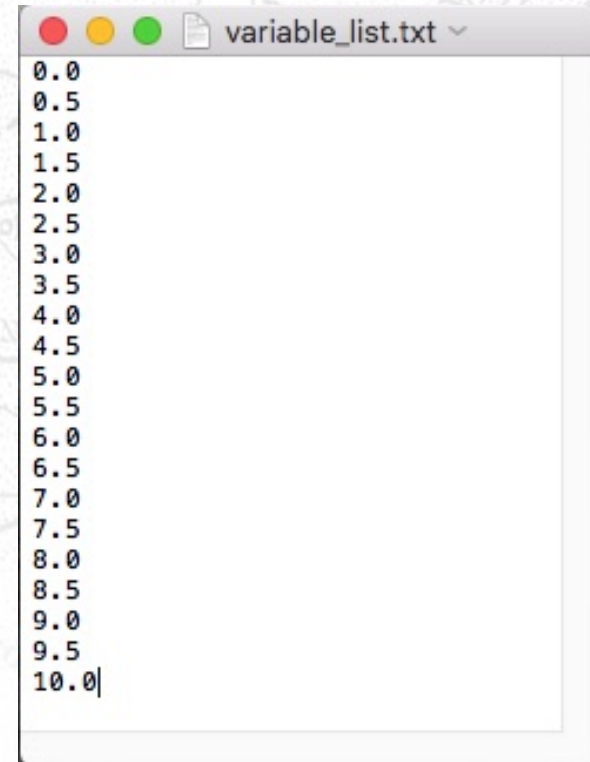
```
set np [getNP]
```

```
set par_list [open "variable_list.txt" r]
```

```
# obtains the Processor ID
```

```
# obtains the number of processors
```

```
# defines the list of variables
```



## OpenSeesMP: Additional tcl script for parametric studies

```
set pid [getPID] # obtains the Processor ID
set np [getNP] # obtains the number of processors
set par_list [open "variable_list.txt" r] # defines the list of variables
set countP 0 # initiates a count to split the analyses

foreach val [split [read $par_list] \n] { # loops through the variables

if {[expr $countP % $np] == $pid} { # assigns each analysis to one
    # processor
    set valuesList [split $val "/"] # reads one value of the variable
    set grade [index $valuesList end] # assigns the value to the variable
    source Sequential_script.tcl # calls the sequential script
    wipe # cleans the workspace
}

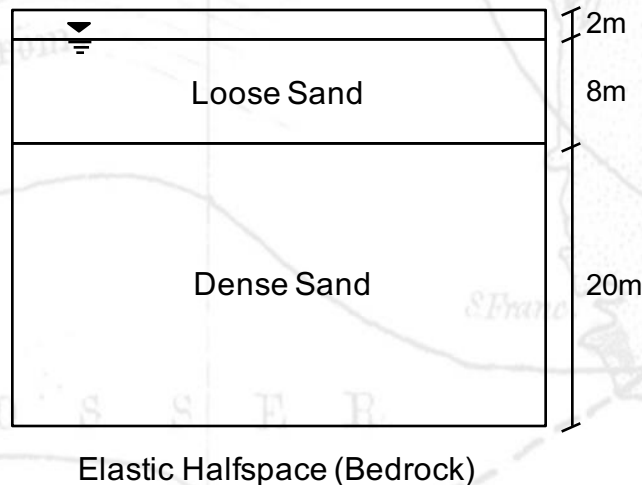
incr countP 1 # increases the count to move to the
# next analysis

}
```



# Effective Site Response Analysis

([http://opensees.berkeley.edu/wiki/index.php/Effective\\_Stress\\_Site\\_Response\\_Analysis\\_of\\_a\\_Layered\\_Soil\\_Column](http://opensees.berkeley.edu/wiki/index.php/Effective_Stress_Site_Response_Analysis_of_a_Layered_Soil_Column))



Problem: effective stress site response analysis of a layered deposit of cohesionless soil underlain by an elastic half-space.

Model: A single column of soil is modeled in 2D (with periodic boundary conditions to emulate a 1D analysis) and is subject to an earthquake excitation. Nine node quadrilateral elements with both displacement and pore pressure degrees of freedom enable the model to track changes in pore pressure and effective stress during the earthquake excitation. A Lysmer-Kuhlemeyer (1969) dashpot is utilized to account for the finite rigidity of the underlying elastic medium.

Parametric analysis with OpenSeesMP using three different input motions



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NHERI Five-Year Science Plan



This NOAA/AMMB satellite image taken on October 8, 2018 shows Hurricane Michael off the U.S. Gulf Coast. (HO / AFP/Getty Images)

## Hurricane Michael Barreling Toward Florida Gulf Coast

Hurricane Michael will make landfall mid-day Wednesday, Oct 10 with life threatening storm surge forecasted up to 12 feet, heavy rainfall up to 12 inches and damaging winds. Researchers from the Florida Coastal Monitoring Program are heading into the field ahead of the storm to set up two 15 meter weather stations.

[READ MORE IN THE NEWSROOM](#)

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archive	--	4/5/17 11:21 AM
beachball.png	9.3 kB	9/21/18 6:12 PM
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# OpenSeesMP analysis: *additional files needed*

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Additional files for the parallel analysis!!!

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GM	--	10/24/18 7:04 PM
parallel_motion.tcl	783.0 bytes	10/24/18 7:04 PM
plotAcc.py	1.4 kB	10/24/18 7:04 PM
plotAcc_multiple.py	3.6 kB	10/24/18 7:04 PM
plotPorepressure.py	573.0 bytes	10/24/18 7:04 PM
plotPorepressure_multiple.py	1010.0 bytes	10/24/18 7:05 PM
plotProfile.py	2.4 kB	10/24/18 7:03 PM
plotProfile_multiple.py	4.3 kB	10/24/18 7:04 PM
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# OpenSeesMP analysis: *additional files needed*

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the parallel  
analysis!!!

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<b>GM</b>	--	10/24/18 7:04 PM	
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plotAcc.py	1.4 kB	10/24/18 7:04 PM	
	3.6 kB	10/24/18 7:04 PM	
	573.0 bytes	10/24/18 7:04 PM	
	1010.0 bytes	10/24/18 7:05 PM	
Kobe1985_KobeUniversity.VT2	49 KB	Document	10/24/18 7:03 PM
LomaPrieta198...ilroyArray1.VT2	123 KB	Document	10/24/18 7:03 PM
Northridge1994_UCLA.VT2	46 KB	Document	10/24/18 7:04 PM
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	322.0 bytes		10/24/18 7:05 PM
	322.0 bytes		10/24/18 7:04 PM

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Additional files for  
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analysis!!!

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				322.0 bytes	10/24/18 7:05 PM
				322.0 bytes	10/24/18 7:04 PM

```
parallel_motion.tcl
~/Desktop/Research/UserGuide/Webinar/OpenSeesMP/parallel_motion.tcl
1 set pid [getPID]
2 set np [getNP]
3 #set par_list [open "slope_values.txt" r]
4 set countP 0;
5
6 source ReadRecord.tcl
7
8 set startT [clock seconds]
9
10 foreach gMotion [glob -nocomplain -directory GM *.VT2] {
11 if {[expr $countP % $np] == $pid} {
12
13 set gMotionName [string range $gMotion 0 end-4]
14
15 set MotionID [string range $gMotion 3 end-4]
16
17 set name1 Motion$MotionID
18
19 ReadRecord ./$gMotionName.VT2 ./$gMotionName.dat dT nPts
20
21 set velocityFile ./$gMotionName.dat
22
23 puts "set velocityFile ./$gMotionName.dat"
24
25 # time step in ground motion record
26 set motionDT $dT
27 # number of steps in ground motion record
28 set motionSteps $nPts
29
30 source freeFieldEffective.tcl
31 wipe
32 }
33 incr countP 1;
34 }
35 set endT [clock seconds]
36
37 puts "Total duration for processor $pid [expr $endT-$startT] seconds!"
```

# OpenSeesMP analysis: *Run the analysis*

## WORKSPACE

Learn About the Workspace.

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Parallel SWAN+ADCIRC 160 cores <b>ADCIRC</b>	Parallel ADCIRC <b>ADCIRC</b>	ADCIRC <b>ADCIRC</b>	ADCIRC (NetCDF) <b>ADCIRC</b>	clawpack <b>C</b>	CWE Parallel <b>C</b>
CWE Serial <b>C</b>	Dakota <b>D</b>	LS-DYNA <b>LSI</b>	LS-Pre/Post <b>LSI</b>	OpenFOAM <b>▽</b>	OpenSees-EXPRESS 
OpenSeesMP (V 2.4) 	<b>OpenSeesMP (V 3.0)</b> 	OpenSeesSP (V 2.5) 	OpenSeesSP (V 3.0) 	Simcenter Dakota <b>S</b>	

- Comparison\_stampede2 4 kB
- Examples 4 kB
- Fixed\_base 4 kB
- flexi\_base\_Uwall\_param 4 kB
- FreefieldAnalysisEffective 4 kB
- Freq\_dep 4 kB



# OpenSeesMP analysis: *Run the analysis*

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File name

- .ipynb\_checkpoints
- .Trash
- .Trash-458981
- archive
- Comparison\_stampede2
- Examples

**RUN OPENSEESMP (V 3.0)** ver. 3.0.0.6709

OpenSeesMP is an OpenSees interpreter intended for high performance computers for performing finite element simulations with parameteric studies and very large models on parallel machines. OpenSeesMP requires understanding of parallel processing and the capabilities to write parallel scripts. OpenSeesMP runs on up to 12 KNL Nodes on Stampede2, with 64 cores per Node.

[OpenSeesMP \(V 3.0\) Documentation](#)

**Inputs**

**Input Directory**

Select Click to select input data

The directory containing your OpenSees input files as well as your OpenSees TCL script. You can drag the link for the directory from the Data Browser on the left, or click the 'Select Input' button and then select the directory. To try out sample data copy and paste 'agave://designsafe.storage.default/mock/examples/opensees/FreefieldAnalysisEffective' above.

**TCL Script**

The filename only of the OpenSees TCL script to execute. This file should reside in the Input Directory specified. To try this out copy and paste in 'freeFieldEffective.tcl'.

**Job details**

**Maximum job runtime**

01:00:00

In HH:MM:SS format. The maximum time you expect this job to run for. After this amount of time your job will be killed by the job scheduler. Shorter run times result in shorter queue wait times. Maximum possible time is 48:00:00 (48 hours).

**Job name**

A recognizable name for this job.

**Job output archive location (optional)**

Select <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB\_NAME}-\${JOB\_ID}

Specify a location where the job output should be archived. By default, job output will be archived at: <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB\_NAME}-\${JOB\_ID}.

**Node Count**

1

Number of requested process nodes for the job. Default number of nodes is 1.

Run Close

Each Node assigns  
to the job 64 cores!

# OpenSeesMP analysis: *Run the analysis*

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File name	Size
GM	4 kB
accel_disp_Plot_parallel.m	4 kB
freeFieldEffective.tcl	17 kB
parallel_motion.tcl	783 bytes
plotAcc.py	1 kB
plotAcc_multiple.py	4 kB
plotPorepressure.py	573 bytes
plotPorepressure_multiple.py	1010 bytes

### RUN OPENSEESMP (V 3.0) ver. 3.0.0.6709

OpenSeesMP is an OpenSees interpreter intended for high performance computers for performing finite element simulations with parametric studies and very large models on parallel machines. OpenSeesMP requires understanding of parallel processing and the capabilities to write parallel scripts. OpenSeesMP runs on up to 12 KNL Nodes on Stampede2, with 64 cores per Node.

[OpenSeesMP \(V 3.0\) Documentation](#)

### Inputs

#### Input Directory

Select agave://designsafe.storage.default/margod/Examples/OpenSeesMP ✓

The directory containing your OpenSees input files as well as your OpenSees TCL script. You can drag the link for the directory from the Data Browser on the left, or click the 'Select Input' button and then select the directory. To try out sample data copy and paste 'agave://designsafe.storage.default/mock/examples/opensees/FreefieldAnalysisEffective' above.

#### TCL Script

parallel\_motion.tcl ✓

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01:00:00 ✓

In HH:MM:SS format. The maximum time you expect this job to run for. After this amount of time your job will be killed by the job scheduler. Shorter run times result in shorter queue wait times. Maximum possible time is 48:00:00 (48 hours).

##### Job name

OpenSeesMP ✓

A recognizable name for this job.

##### Job output archive location (optional)

Select <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB\_NAME}-\${JOB\_ID}

Specify a location where the job output should be archived. By default, job output will be archived at: <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB\_NAME}-\${JOB\_ID}.

##### Node Count

1

Number of requested process nodes for the job. Default number of nodes is 1.

Run Close

Each Node assigns to the job 64 cores!



# OpenSeesMP analysis: *Check job status*

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### DATA DEPOT BROWSER

Select data source

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Browsing:

### Job Submitted Successfully

Your job *OpenSeesMP* has been submitted. Monitor its status on the right.

### RUN OPENSEESMP (V 3.0)

ver. 3.0.0.6709

OpenSeesMP is an OpenSees interpreter intended for high performance computers for

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OpenSeesMP

PENDING

More info

### JOBS STATUS

OpenSeesMP

RUNNING

More info

### JOBS STATUS

OpenSeesMP

FINISHED

More info

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Application  
OpenseesMp-3.0.0.6709u5

Status  
FINISHED

Submitted  
Oct 24, 2018 7:51:00 PM

Finished  
Oct 24, 2018 7:53:45 PM

Output

View

Actions

Delete

Close

OpenSeesMP is an OpenSees interpreter intended for high performance computers for

# OpenSeesMP analysis: *Check job result*

**File Preview: openseesmp-3802335650284311016-242ac11b-0001-007.err**

<b>File name</b>	openseesmp-3802335650284311016-242ac11b-0001-007.err
<b>File path</b>	/margod/archive/jobs/2018-10-25/openseesmp-3802335650284311016-242ac11b-0001-007/openseesmp-3802335650284311016-242ac11b-0001-007.err
<b>File size</b>	11.6 kB
<b>Last modified</b>	10/24/18 7:53 PM

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```
Modules based on Lua: Version 7.8.3 2018-09-11 13:20 -05:00
  by Robert McLay mclay@tacc.utexas.edu

module [options] sub-command [args ...]

Help sub-commands:
-----
help                prints this message
help module [...]  print help message from module(s)

Loading/Unloading sub-commands:
-----
load | add          module [...] load module(s)
try-load | try-add  module [...] Add module(s), do not complain if not
                        found
del | unload        module [...] Remove module(s), do not complain if not
                        found
swap | sw | switch  m1 m2       unload m1 and load m2
purge               unload all modules
refresh            reload aliases from current list of
                        modules.
update             reload all currently loaded modules.

Listing / Searching sub-commands:
-----
list               List loaded modules
list s1 s2 ...    List loaded modules that match the
                        pattern
avail | av         List available modules
avail | av string List available modules that contain
                        "string".
spider            List all possible modules
spider            List all possible version of that module
spider            file
spider string     List all module that contain the
                        "string".
```

[Close](#)

# OpenSeesMP analysis: *Check job result*

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[Community Data](#)

[margod](#) / [archive](#) / [jobs](#) / [2018-10-25](#) / [openseesmp-3802335650284311016-242ac11b-0001-007](#) / [OpenSeesMP](#)

Name	Size	Last modified
<a href="#">accel_disp_Plot_parallel.m</a>	3.6 kB	10/24/18 7:53 PM
<a href="#">accelerationMotionKobe1985_KobeUniversity.out</a>	796.3 kB	10/24/18 7:53 PM
<a href="#">accelerationMotionLomaPrieta1989_GilroyArray1.out</a>	1.9 MB	10/24/18 7:53 PM
<a href="#">accelerationMotionNorthridge1994_UCLA.out</a>	762.0 kB	10/24/18 7:53 PM
<a href="#">displacementMotionKobe1985_KobeUniversity.out</a>	817.7 kB	10/24/18 7:53 PM
<a href="#">displacementMotionLomaPrieta1989_GilroyArray1.out</a>	2.0 MB	10/24/18 7:53 PM
<a href="#">displacementMotionNorthridge1994_UCLA.out</a>	763.9 kB	10/24/18 7:53 PM
<a href="#">elementInfo.dat</a>	1.0 kB	10/24/18 7:53 PM
<a href="#">freeFieldEffective.flavia.msh</a>	3.3 kB	10/24/18 7:53 PM
<a href="#">freeFieldEffective.tcl</a>	17.5 kB	10/24/18 7:53 PM
<a href="#">GaccelerationMotionKobe1985_KobeUniversity.out</a>	592.1 kB	10/24/18 7:53 PM
<a href="#">GaccelerationMotionLomaPrieta1989_GilroyArray1.out</a>	592.1 kB	10/24/18 7:53 PM

# Post-processing alternatives

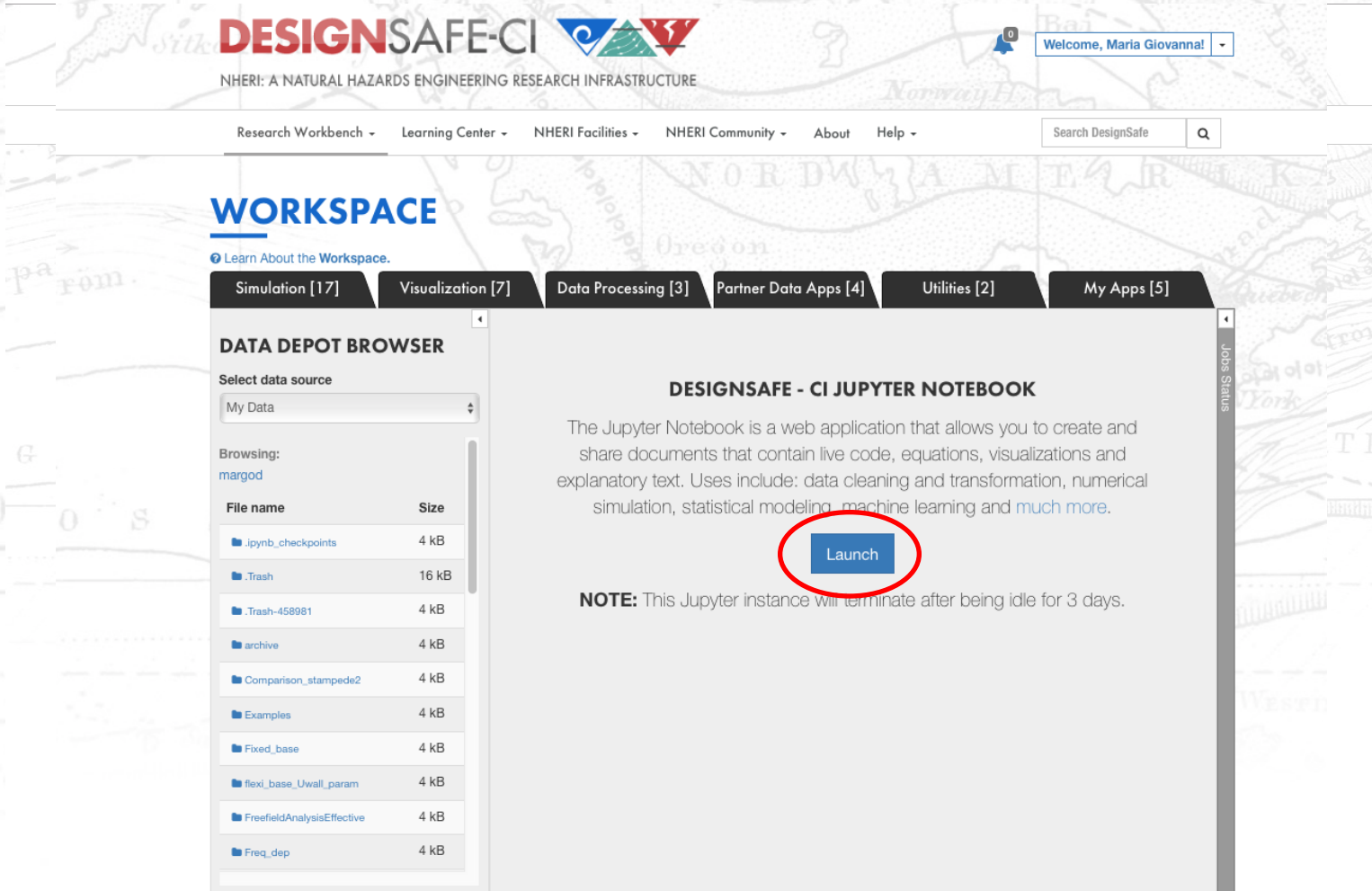
- Work on the Cloud using the tools available on DesignSafe (Data Processing Tab):
  - Jupyter Notebook;
  - Matlab.
- Download all the output and post-process data locally.




# Post-processing alternatives

- Work on the Cloud using the tools available on DesignSafe (Data Processing Tab):
  - Jupyter Notebook;
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- Download all the output and post-process data locally.

# Post-processing alternatives: *Jupyter Notebook*



**DESIGNSAFE-CI** 

NHERI: A NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE

Welcome, Maria Giovanna!

Research Workbench - Learning Center - NHERI Facilities - NHERI Community - About - Help -

Search DesignSafe

## WORKSPACE

Learn About the Workspace.

Simulation [17] Visualization [7] Data Processing [3] Partner Data Apps [4] Utilities [2] My Apps [5]

### DATA DEPOT BROWSER

Select data source

My Data

Browsing: margod

File name	Size
.ipynb_checkpoints	4 kB
.Trash	16 kB
.Trash-458981	4 kB
archive	4 kB
Comparison_stampede2	4 kB
Examples	4 kB
Fixed_base	4 kB
flexi_base_Uwall_param	4 kB
FreefieldAnalysisEffective	4 kB
Freq_dep	4 kB

### DESIGNSAFE - CI JUPYTER NOTEBOOK

The Jupyter Notebook is a web application that allows you to create and share documents that contain live code, equations, visualizations and explanatory text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, machine learning and [much more](#).

**Launch**

**NOTE:** This Jupyter instance will terminate after being idle for 3 days.

# Post-processing alternatives: *Jupyter Notebook* – *OpenSeesMP* (*Community Data/Workspace Applications Examples/ OpenSees/ freeFieldEffectiveJupyter\_postprocessing\_parallel.ipynb*)

The screenshot shows the JupyterLab interface. At the top left is the 'jupyter' logo. On the top right are 'Logout' and 'Control Panel' buttons. Below the logo are tabs for 'Files', 'Running', and 'Clusters'. A message says 'Select items to perform actions on them.' with 'Upload', 'New', and a refresh icon on the right. The main area shows a file browser for the path '/ CommunityData / Workspace Applications Examples / OpenSees'. It lists several items:

	Name	Last Modified
<input type="checkbox"/>	..	seconds ago
<input type="checkbox"/>	OpenSeesEXPRESS	an hour ago
<input type="checkbox"/>	OpenSeesMP	an hour ago
<input type="checkbox"/>	freeFieldEffectiveJupyter_postprocessing.ipynb	40 minutes ago
<input checked="" type="checkbox"/>	freeFieldEffectiveJupyter_postprocessing_parallel.ipynb	39 minutes ago
<input type="checkbox"/>	model.png	2 hours ago

# Post-processing alternatives: Jupyter Notebook – OpenSeesMP *(Community Data/Workspace Applications Examples / OpenSees/freeFieldEffectiveJupyter\_postprocessing\_parallel.ipynb)*

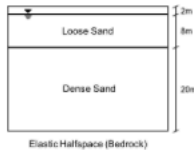
## Free Field Analysis Example

This example shows how to postprocess the output results of OpenSeesMP analysis using python scripts.

The site response analysis discussed in this article is for a soil profile consisting of a 10 m thick layer of loose sand ( $D_r = 40\%$ ) above a 20 m thick layer of more dense sand ( $D_r = 75\%$ ). A schematic representation of the analyzed soil profile is shown in Fig. 1. The entire soil profile is underlain by an elastic half-space which represents the finite rigidity of an underlying medium such as bedrock. The groundwater table is located at a depth of 2 m, therefore, saturated unit weights are used for the soil below this point and effective stress analysis is considered through the use of nine-node quadrilateral elements which are able to simulate fluid-solid coupling.

The results are presented for each ground motion in terms of:

- Time history of acceleration at the surface and corresponding response spectra;
- Profiles of maximum displacement, PGA, maximum shear strain, stress ratio, and stress strain plots for a point near the center of the liquefiable zone;
- Evolution of pore water pressure for a point near the center of the liquefiable zone.



## Postprocess Results

**Out [1]:** The raw code for this IPython notebook is by default hidden for easier reading. To toggle on/off the raw code, click [here](#).

### Import python libraries

```
/Users/Margo/Desktop/Research/UserGuide/Webinar
```

### Change directory

```
/Users/Margo/Desktop/Research/UserGuide/Webinar/OpenSeesMP_motion
```

Logout Control Panel

Upload New ↕ ↻

amples / OpenSees

Name ↓ Last Modified

	seconds ago
	an hour ago
	an hour ago
	40 minutes ago
	39 minutes ago
	2 hours ago



# Post-processing alternatives: Jupyter Notebook – OpenSeesMP *(Community Data/Workspace Applications Examples / OpenSees / freeFieldEffectiveJupyter\_postprocessing\_parallel.ipynb)*

## Free Field Analysis Example

This example shows

The site response at 40% above a 20 m shown in Fig. 1. The underlying medium : weights are used for quadrilateral elemen

The results are pres

- a) Time history of ac
- b) Profiles of maxim
- c) Evolution of pore

## Postprocess

Out [1]: The raw code for this here.

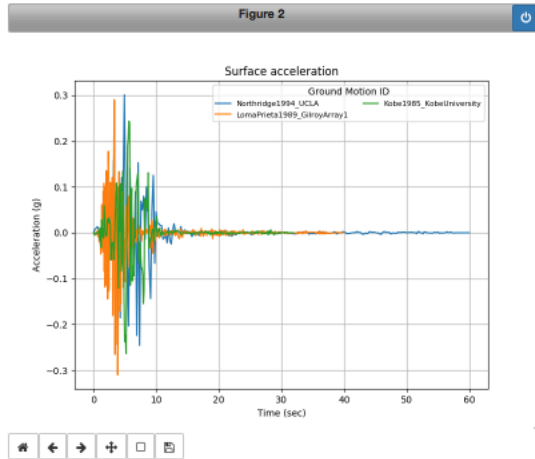
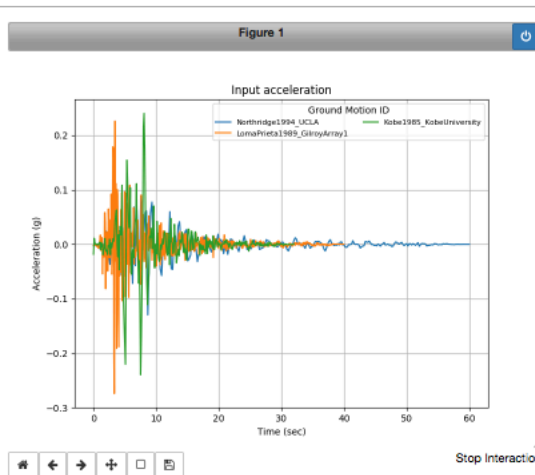
Import python libra

```
/Users/Margo/
```

Change directory

```
/Users/Margo/
```

a) Time history of acceleration at the surface and corresponding response spectra:



Logout

Control Panel

Upload

New



Name

Last Modified

seconds ago

an hour ago

an hour ago

40 minutes ago

39 minutes ago

2 hours ago



RICE

Florida Tech

# Post-processing alternatives: Jupyter Notebook – OpenSeesMP

(Community Data/Workspace Applications Examples / OpenSees / freeFieldEffectiveJupyter\_postprocessing\_parallel.ipynb)

## Free Field Analysis Example

This example shows

The site response at 40% above a 20 m shown in Fig. 1. The underlying medium weights are used for quadrilateral elements

The results are presented as:

- a) Time history of acceleration at the surface and corresponding
- b) Profiles of maximum displacement, PGA, maximum shear strain, stress ratio, and stress strain plots for a point near the center of the liquefiable zone
- c) Evolution of pore

a) Time history of acceleration at the surface and corresponding

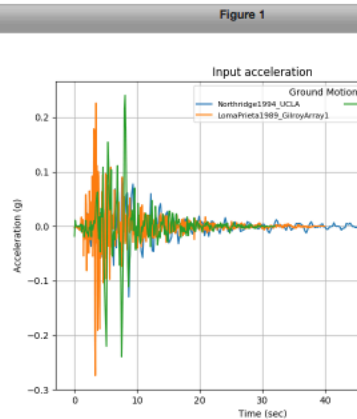
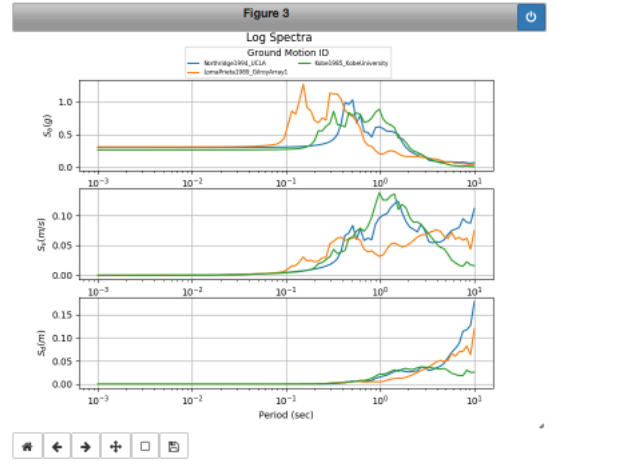
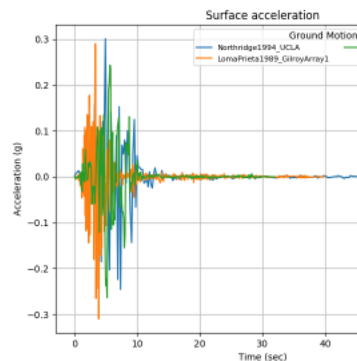
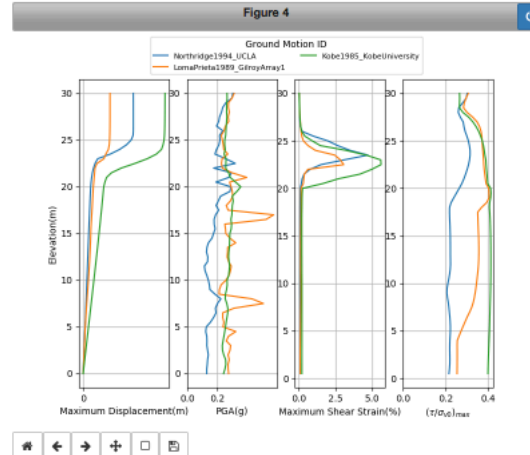


Figure 2



b) Profiles of maximum displacement, PGA, maximum shear strain, stress ratio, and stress strain plots for a point near the center of the liquefiable zone



Logout Control Panel

Upload New ↕ ↻

Name ↓ Last Modified

seconds ago

an hour ago

an hour ago

40 minutes ago

39 minutes ago

2 hours ago



# Post-processing alternatives: *Jupyter Notebook* – *OpenSeesMP* (Community Data/Workspace Applications Examples / OpenSees / freeFieldEffectiveJupyter\_postprocessing\_parallel.ipynb)

## Free Field Analysis Example

This example shows the site response at 40% above a 20 m shown in Fig. 1. The underlying medium weights are used for quadrilateral element

- The results are presented as:
  - Time history of acceleration
  - Profiles of maximum displacement, PGA, maximum point near the center of the liquefiable zone
  - Evolution of pore water pressure

## Postprocess

Out[1]: The raw code for this here.

## Import python libra

/Users/Margo/

## Change directory

/Users/Margo/

a) Time history of acceleration at the surface and corresponding

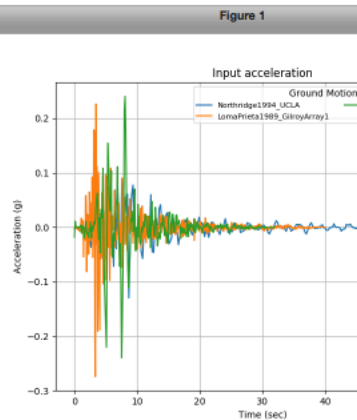
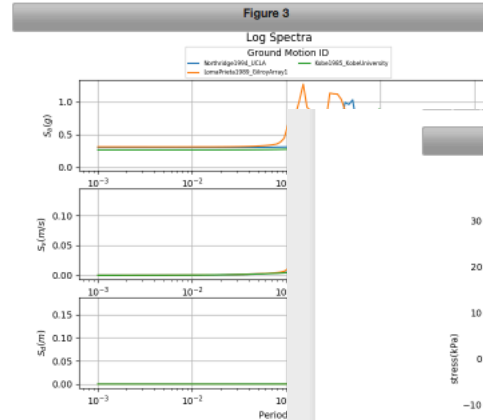
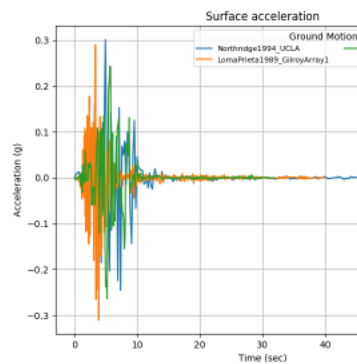
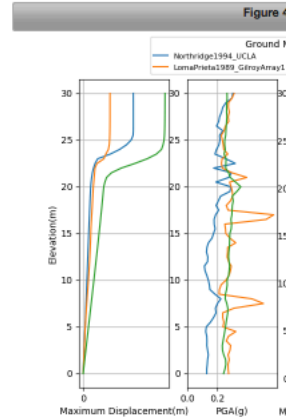


Figure 2



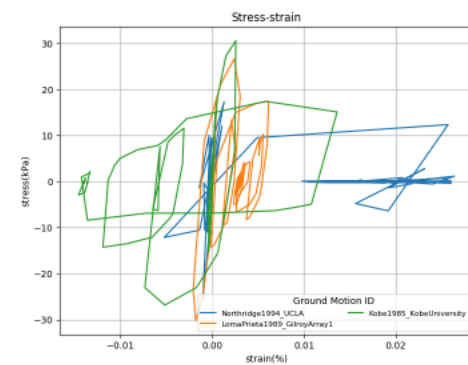
b) Profiles of maximum displacement, PGA, maximum point near the center of the liquefiable zone



Logout

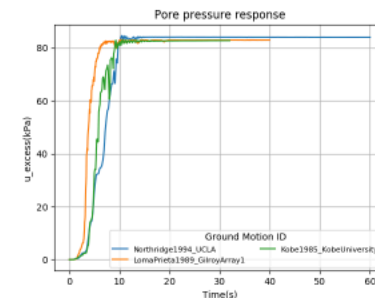
Control Panel

Figure 5



c) Evolution of pore water pressure for a point near the center of the liquefiable zone:

Figure 6



# Post-processing alternatives

- Work on the Cloud using the tools available on DesignSafe (Data Processing Tab):
  - Jupyter Notebook;
  - Matlab.
- Download all the output and post-process data locally.



# Post-processing alternatives: *Matlab*

You have to submit a ticket to activate your license on DesignSafe

The screenshot shows the DesignSafe-CI workspace interface. At the top, the logo for DESIGNSAFE-CI is displayed, along with the text "NHRI: A NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE". A navigation bar includes links for "Research Workbench", "Learning Center", "NHRI Facilities", "NHRI Community", "About", and "Help". A search bar is located on the right. The main content area is titled "WORKSPACE" and features a "Learn About the Workspace" link. Below this, there are tabs for "Simulation [17]", "Visualization [7]", "Data Processing [3]", "Partner Data Apps [4]", "Utilities [2]", and "My Apps [5]". Under the "Data Processing" tab, three application icons are visible: "Jupyter", "MATLAB R2017b", and "MATLAB". The "MATLAB R2017b" and "MATLAB" icons are circled in red. Below the application tray, a file browser shows a list of files and folders with their names and sizes. The main workspace area contains instructions to "Select an application from the tray above" and a description of the workspace's capabilities.

**DESIGNSAFE-CI**  
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## WORKSPACE

Learn About the Workspace.

Simulation [17] Visualization [7] Data Processing [3] Partner Data Apps [4] Utilities [2] My Apps [5]

Jupyter MATLAB R2017b MATLAB

Browsing: margod

File name	Size
.ipy_nb_checkpoints	4 kB
.Trash	16 kB
.Trash-458981	4 kB
archive	4 kB
Comparison_stampede2	4 kB
Examples	4 kB
Fixed_base	4 kB
flexi_base_Uwall_param	4 kB
FreefieldAnalysisEffective	4 kB
Freq_dep	4 kB

Select an application from the tray above.

The *Workspace* allows users to perform simulations and analyze data using popular simulation codes including OpenSees, ADCIRC, and OpenFOAM, as well as data analysis and visualization tools including Jupyter, MATLAB, Paraview and Vist.

# Post-processing alternatives: *Matlab*

MATLAB



Run an interactive Matlab 2016a session on a virtual machine. Work directly on your files rather than needing to copy them to and from Stampede.

Recommended for standard post-processing analyses.

MATLAB R2017b



Run an interactive MATLAB 2017b session on Stampede2.

# Post-processing alternatives: *Matlab*

## WORKSPACE

[Learn About the Workspace.](#)

Simulation [17]

Visualization [7]

Data Processing [3]

Partner Data Apps [4]

Utilities [2]

My Apps [5]

### DATA DEPOT BROWSER

Select data source

My Data

Select file for Working Directory.

[More info](#)

Browsing:

margod / Examples

File name

Size

Select  OpenSeesEXPRESS 4 kB

Select  OpenSeesMP 4 kB

### RUN MATLAB ver. 0.1

Run an interactive Matlab 2016a session on a virtual machine. Work directly on your files rather than needing to copy them to and from Stampede.

[MATLAB Documentation](#)

#### Inputs

##### Desktop Resolution

1280x800

Set the desktop screen size for your visualization session.

#### Job details

##### Maximum job runtime

01:00:00 ✓

In HH:MM:SS format. The maximum time you expect this job to run for. After this amount of time your job will be killed by the job scheduler. Shorter run times result in shorter queue wait times. Maximum possible time is 48:00:00 (48 hours).

##### Job name

Matlab ✓

A recognizable name for this job.

##### Job output archive location (optional)

Select <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB\_NAME}-\${JOB\_ID}

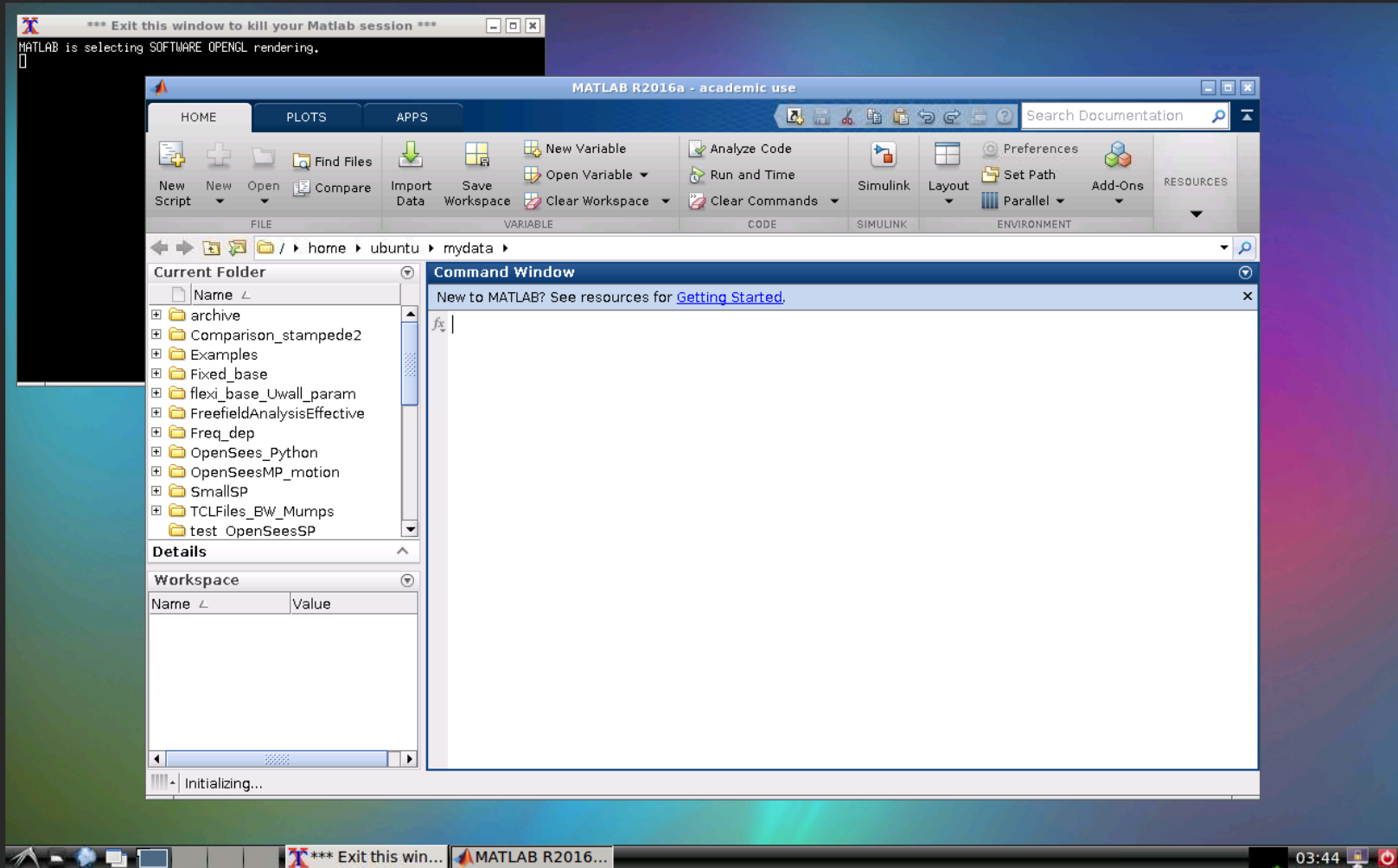
Specify a location where the job output should be archived. By default, job output will be archived at:

<username>/archive/jobs/\${YYYY-MM-DD}/\${JOB\_NAME}-\${JOB\_ID}.

Run Close

d for  
analyses.

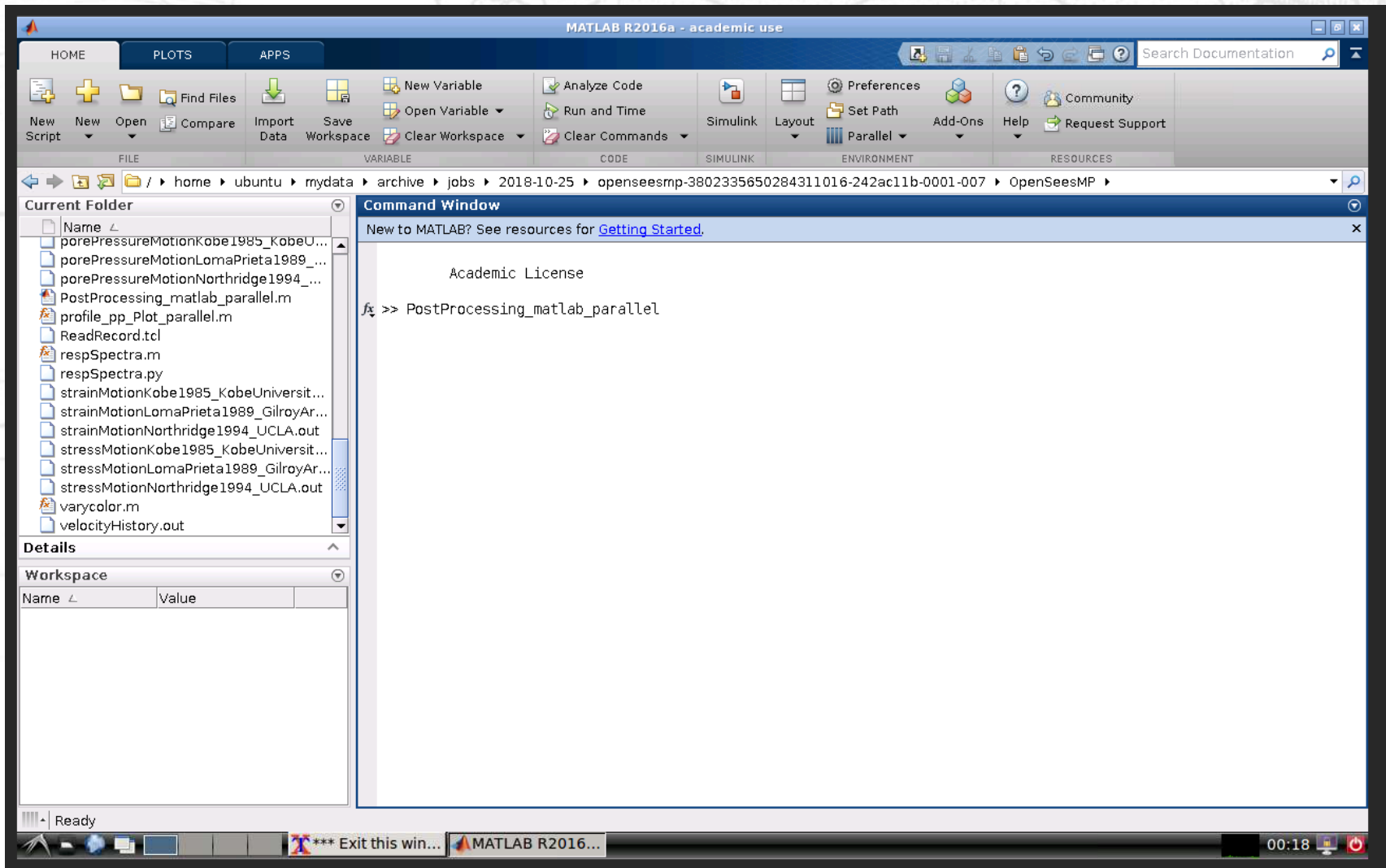
# Post-processing alternatives: *Matlab*





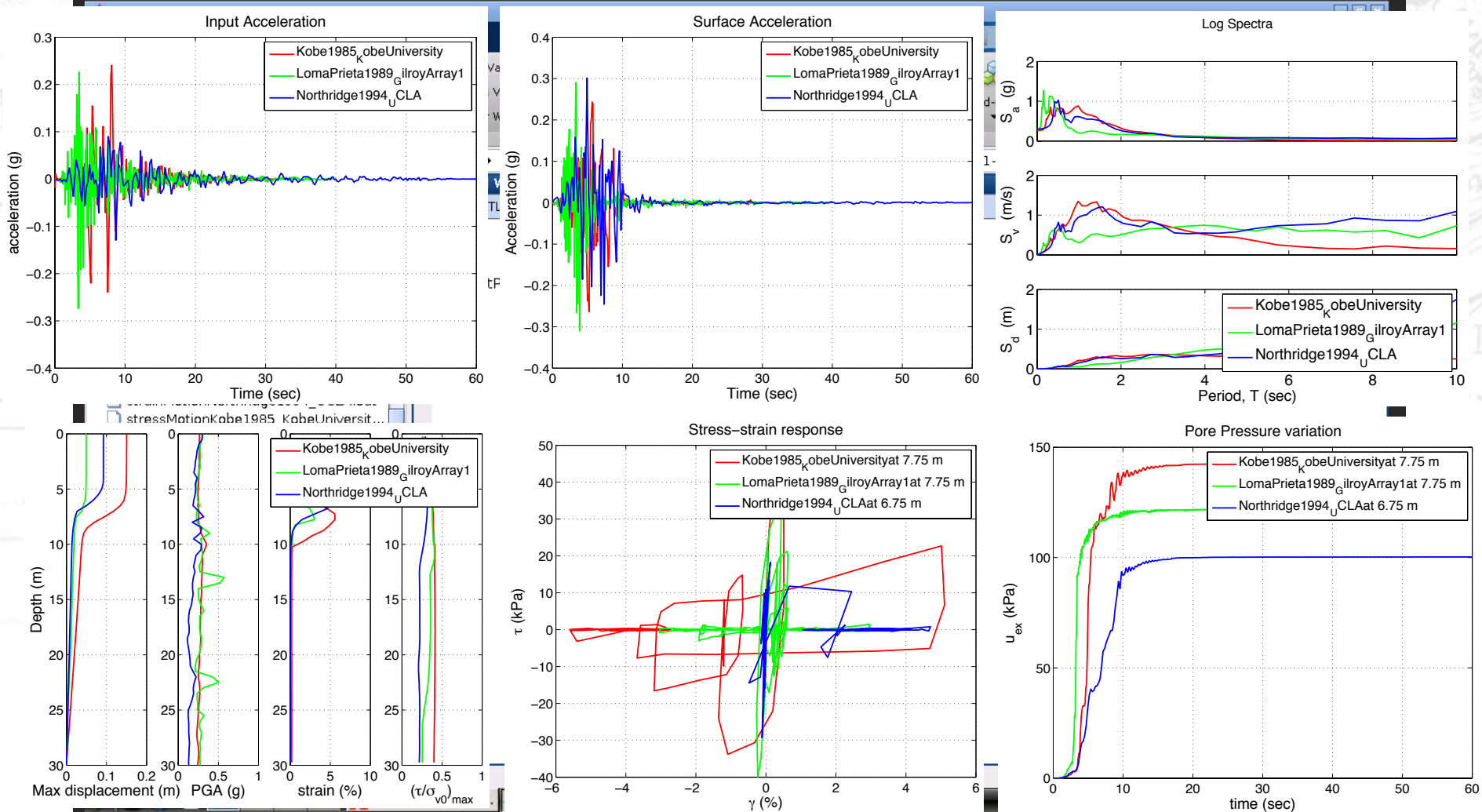
# Post-processing alternatives: *Matlab* –

*OpenSeesMP* (Community Data/Workspace Applications Examples/ OpenSees/ OpenSeesMP /PostProcessing\_matlab\_parallel.m)



# Post-processing alternatives: Matlab –

**OpenSeesMP** (Community Data/Workspace Applications Examples/ OpenSees/ OpenSeesMP/PostProcessing\_matlab\_parallel.m)



# *OpenSees & DesignSafe:* OpenSeesMP

## **...Questions?**

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[mgdurante@utexas.edu](mailto:mgdurante@utexas.edu)