OpenSEES Workshop Sept 2 and 3, 2010

9:45-11:00 Cloud Computing, NEEShub & OpenSees
11:00-12:00 NEEShub Hands-On

Gregory P. Rodgers Ph.D.
NEESComm IT

9:45-11:00 Cloud Computing, NEEShub & OpenSees

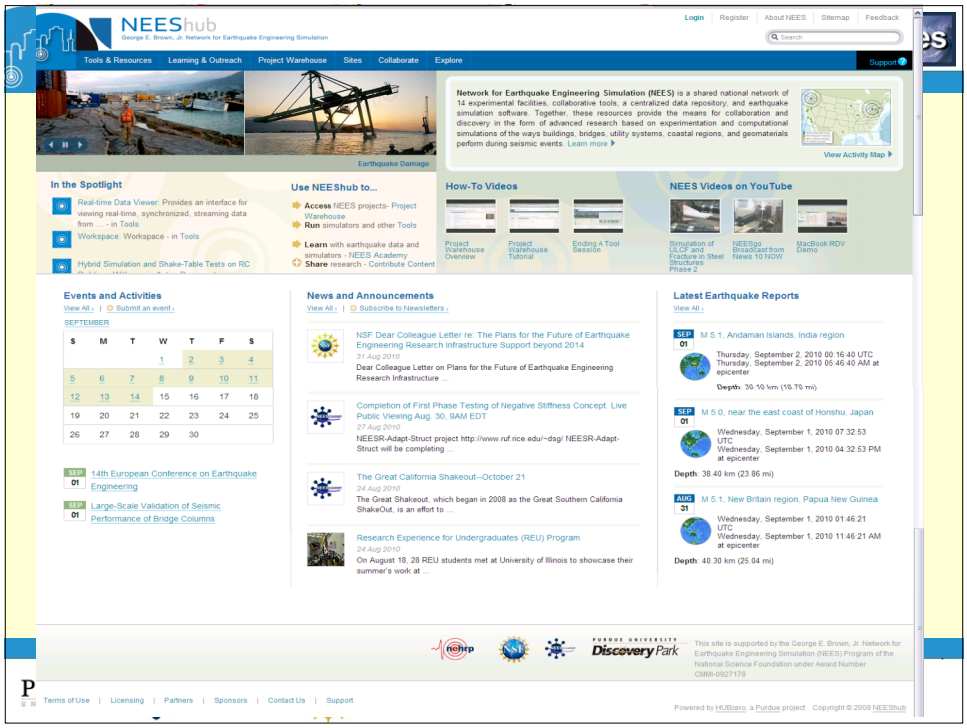
Agenda:
Introduction to HUB technology
More than a new website
NEEShub: the New nees.org
1. Website
2. Resources
3. Tools and Tool-Data Management
webdav
rappture
Synchronees
4. NEES Project Warehouse
Opensees in nees.org
opensees2
openseeslab
openseesbuild
Future
Batch Strawman for OpenSees
Integration with plotting tools

Introduction to HUBzero

- HUBzero™ is a platform used to create dynamic web sites for scientific research and educational activities. With HUBzero, you can easily publish your research software and related educational materials on the web.
- Powerful middleware serves up interactive simulation and modeling tools via your web browser. These tools connect you with rendering farms and powerful Grid computing resources.
- Proven with the nanoHUB. nanoHUB supports over 100,000 worldwide users, hundreds of nanotechnology tools, and constant worldwide collaboration. Also supported by NSF. Many smaller hubs also exist.
- NEEScomm IT has adopted HUBzero technology to transition nees.org to NEEShub. The URL is the same, the infrastructure is completely updated.

NEEShub: The new nees.org

	NEES Communications & Support	NEES Engineering, Research, & Development
Dynamic / Transient	**1. Joomla Website**	**3. HUB tools with personal and group data**
Static / Permanent	**2. HUB Resources**	**4. NEES Project Warehouse**



Main Menu Organization

- Tools & Resources – User and NEES contributed content (e.g. videos, publications, simulation tools)
- Education & Training – NEES Academy
- Project Warehouse - Perpetual database of research projects
- Sites- NEES Sites and related information
- Collaborate – User oriented collaboration options
- Explore – Information managed by NEESComm

1. The nees.org website

- NEES Communication Portal
  - Activities
  - Calendar
  - News and Reports
  - Videos
  - nees.org general content Contact: Allegra East
- NEES Education Outreach and Training
  - Education organized for Teachers, Students, Professionals, and the Public
  - Initial Source of many HUB Resources
  - Contact: Sean Brophy

2. Resources

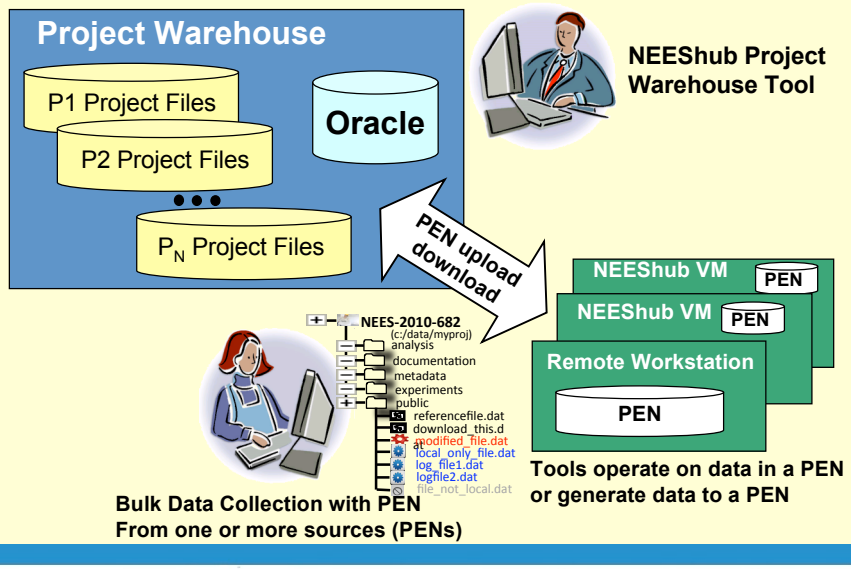
- Resource Types
  - Documents Library
  - Learning Objects
  - Series
  - Citations
  - Tools
- Organization by Resource Types and tags.
  - Parent tags coming soon.
- Searchable
- Each resource has a permanent URL.
- Anyone can contribute but publication is monitored.

3. NEES Tools and Workspace Data Management

- HUB tools run in a virtual machine with access to a persistent file system. No installation required.
- Anyone can contribute a tool.
- Organization of NEES tools is a work-in-progress.
  - Hundreds of Tools in NanoHub
  - Tags defined by tool owner help to organize tools
- One very important tool: Workspace
  - A Linux desktop with access to personal HOME and shared group data.
  - This is where tool developers build and test tools .
- Please consider contributing tool with graphical interface to your Opensees simulation model.
  - TCL extension available to OpenSees TCL for building GUI. This is called Rappture.
- Two types of data
  - HOME directory, Quota is 1GB but extendable with a ticket
  - Group space

4. NEES Project Warehouse

- Perpetual Database for NEES Research Projects
  - Required for NEES funded projects
  - Migrated from old NEES Central
  - A combination of Oracle database and filesystem
  - Access managed by PIs who create projects.
- Three access methods to Warehouse
  - Nees.org project warehouse http://nees.org/warehouse
  - PEN , a Java tool for moving data in and out of the warehouse from HUB or local workstation.
  - Web services (API).
- New for NEEShub.
  - HUB Tools have read-access to data stored in Warehouse file system. /nees/home/<PROJECT NAME.groups/
  - Read-only ftp server authenticated with your nees.org userid and password ftp neesws.neeshub.org



OpenSees in nees.org

- The OpenSees binary was built for Debian Linux
  - Not directly executable (except through workspace.
  - User interface tools use this binary to run OpenSees
- A Rappture-based *developer* interface was created to manage a set of simulation models stored in a user's home directory. (Called opensees2)
  http://nees.org/resources/opensees2.
  - One model per directory in $HOME/opensees2/<name>/<name>.tcl
  - 5 examples copied to $HOME/opensees2 that show GUI and non-GUI models
- Frank built a more elaborate GUI framework for specific models. No need to understand TCL to operate. (Called OpenSees Lab)
  http://nees.org/resources/openseeslab
- We expect TCL model developers to contribute reusable models with GUIs as new HUB tools for easier execution by users who are not TCL developers.
  http://nees.org/resources/???
  Or Frank could include GUIs and models in OpenSees Lab.

Batch Strawman for OpenSees in NEEShub.

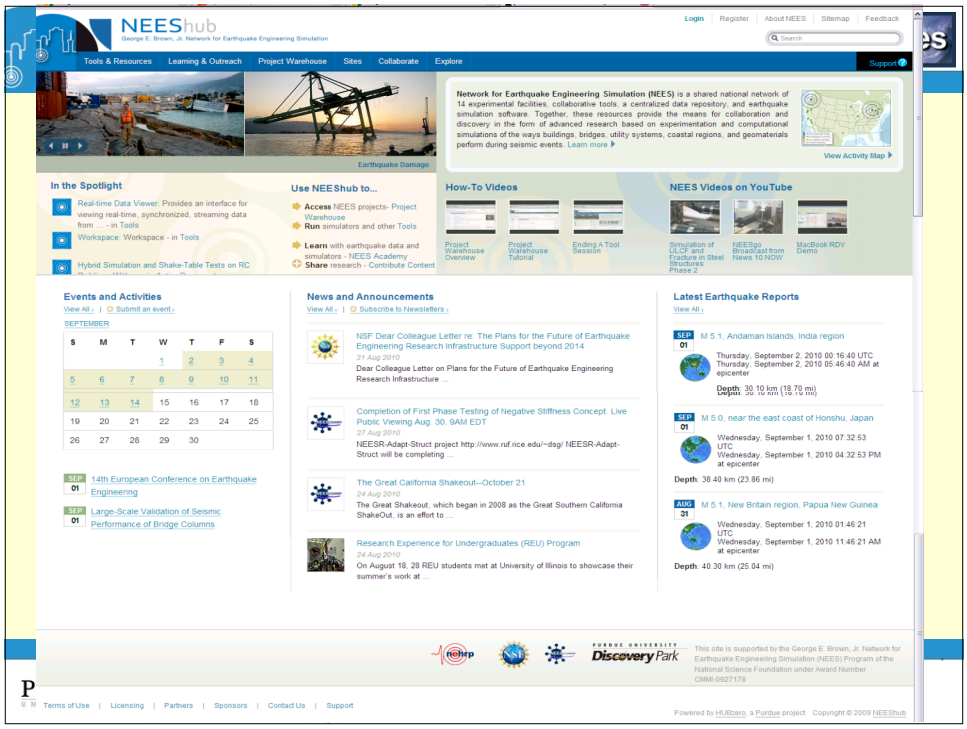
- Three Options
  - Default : Run OpenSees in the HUB interactively
  - Medium: Submit 4-processor job to Purdue Condor pool.
  - Large: Submit 16-processor job to Terragrid
- Medium and Large options would not be generally available.

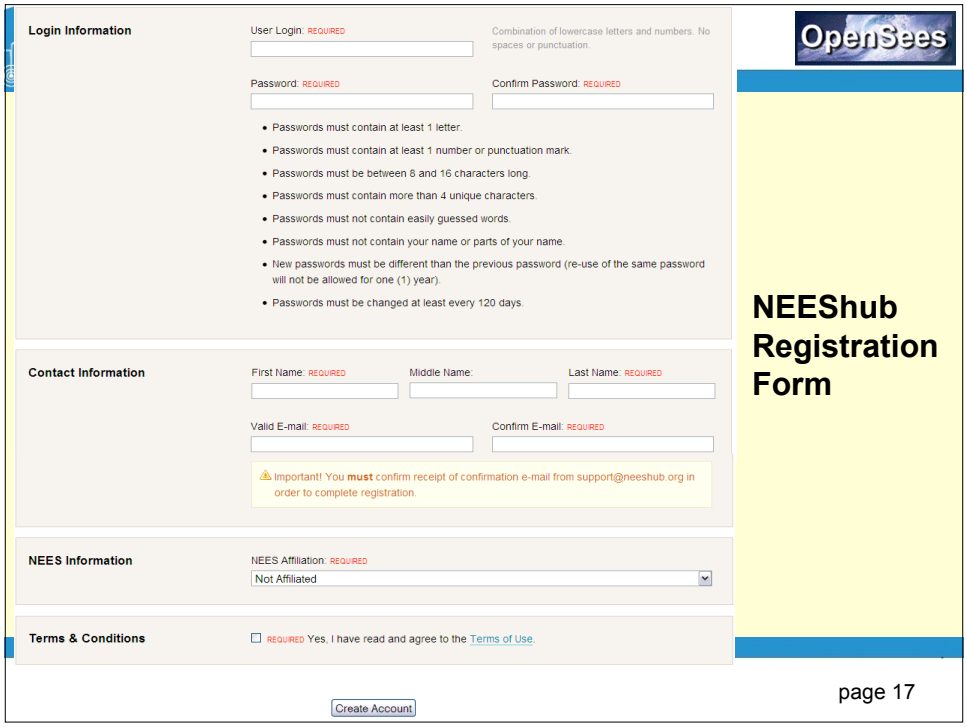
NEESHub
George E. Brown, Jr. Network for Earthquake Engineering Simulation
OpenSees

11:00-12:00 NEESHub Hands-On

Agenda:

- Account Registration
- Quick tour of 4 segments described earlier
- myneeshub
- Tool execution
  - opensees2 – Run the examples and create a new TCL simulation directory
  - openseeslab – Frank to demo
  - workspace – How to run the OpenSees binary.
- Data Transfer
  - Webdav
  - File import/export.
- Communication
  - Tickets
  - Questions and Answers
  - Wishlist
  - Sharing sessions
- Tool Contribution and Development





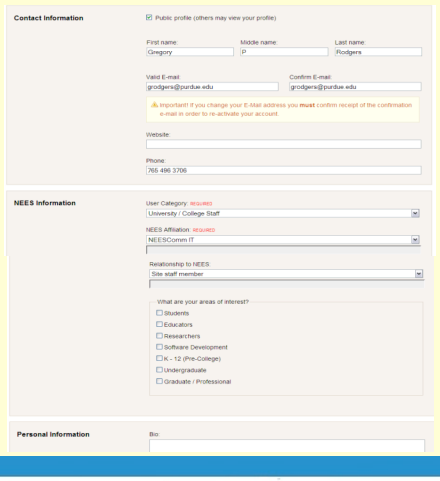
OpenSees

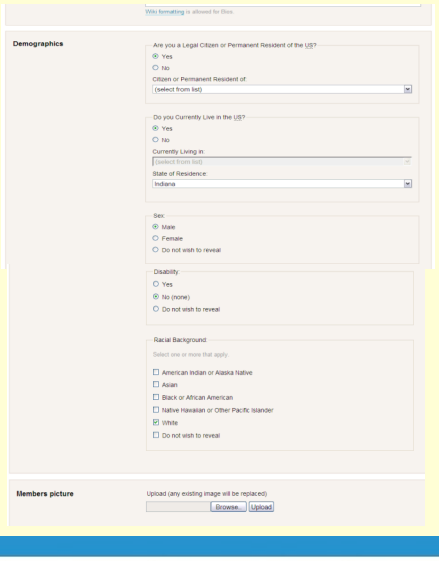
NEEShub Registration Form

NEEShub
George E. Brown, Jr. Network for Earthquake Engineering Simulation

OpenSees

Optional Information after you have account



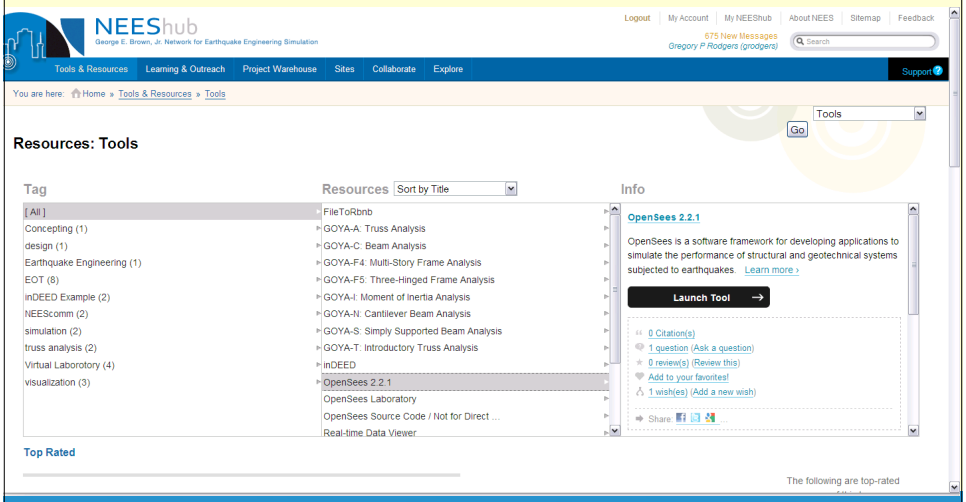


PURDUE UNIVERSITY

NEEShub
George E. Brown, Jr. Network for Earthquake Engineering Simulation

OpenSees

The Tools (and Resources) Trifold



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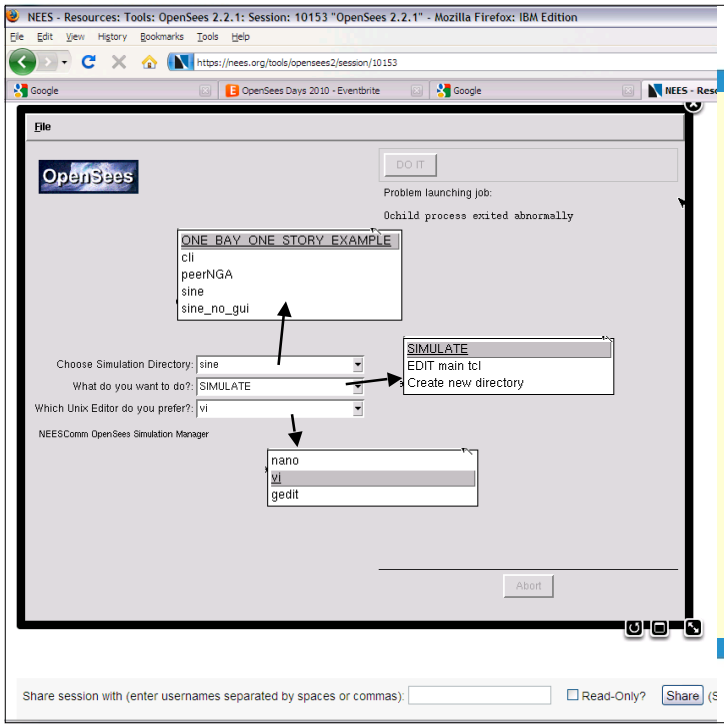


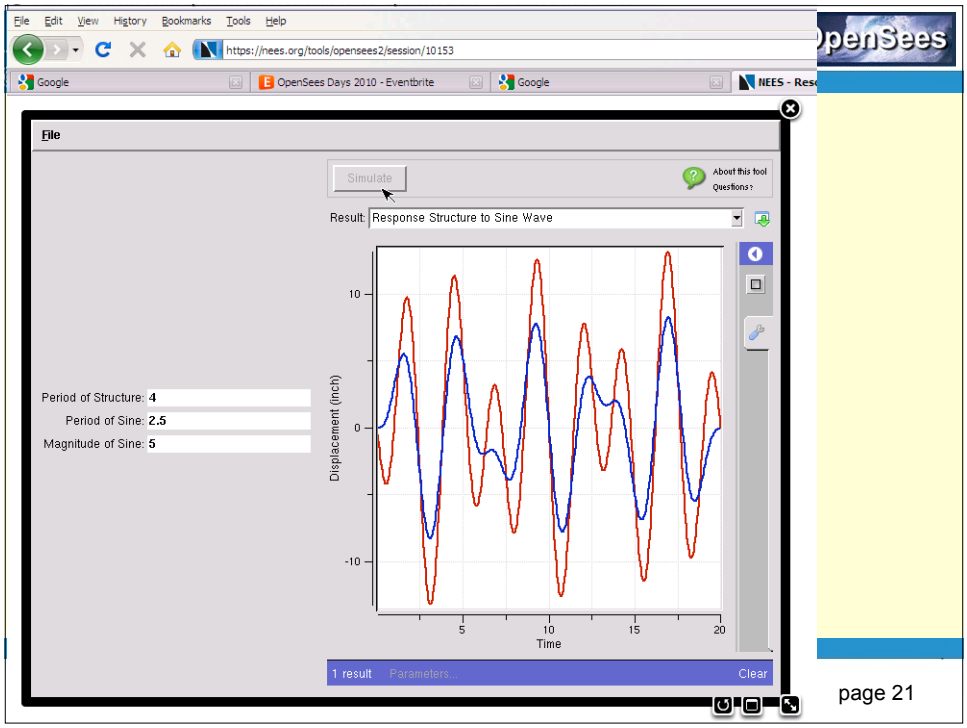
OpenSees

Opensees developer interface

Used to develop models and GUIs.

Five examples will be placed in your HOME directory the first time you start tool

This interface will be extended for batch submission.



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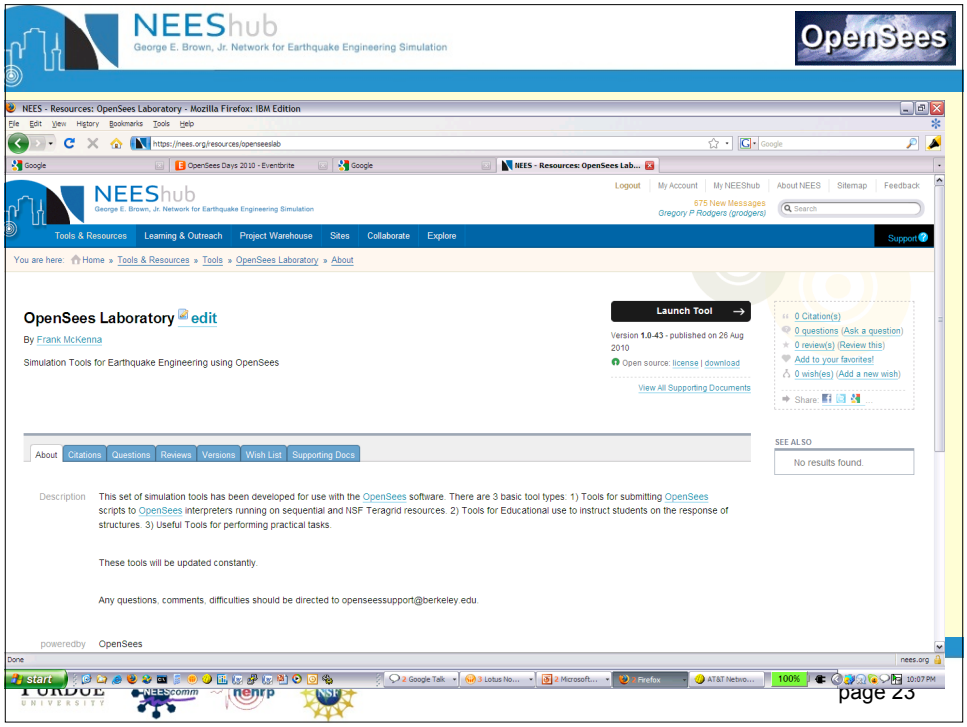
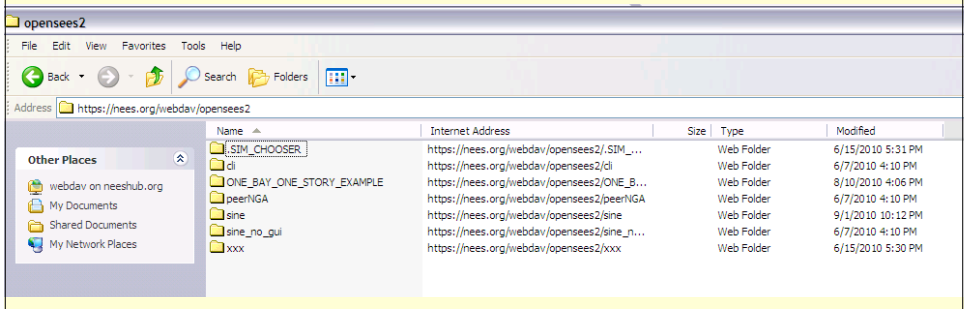


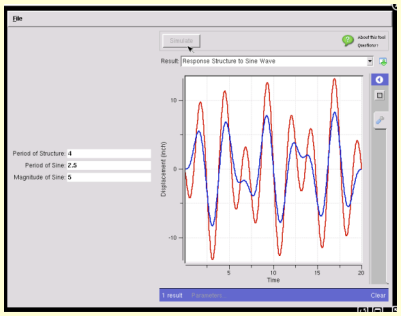
Using Windows Webdav to access your HOME directory on the NEEShub



How to Build A GUI with OpenSees, Rappture, and TCL

- Build an xml file (tool.xml) that defines the driver for your simulation model.
- Modify tcl script to read and write values from a "driver".

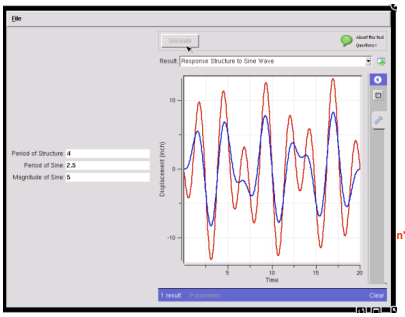
tool.xml
+
sine.tcl
➔




```
lappend auto_path /apps/rappture/current/lib
pa
# c
<?xml version="1.0"?>
<run>
  <tool>
    <id>opensees2</id>
    <name>OpenSees 2.2.1</name>
    <about>Press Simulate to view results.</about>
    <command>
      /apps/opensees2/current/bin/OpenSees @tool/sine.tcl @driver 2>stderr.out
    </command>
  </tool>
  <input>
    <number id="periodStruct">
      <about>
        <label>Period of Structure</label>
        <description>Period of Structure</description>
      </about>
      <units></units>
      <min>0.001</min>
      <max>5.0</max>
      <default>4.0</default>
      <current>4.0</current>
    </number>
    <number id="periodSine">
      <about>
        <label>Period of Sine</label>
        <description>Period of Input Sine Motion</description>
      </about>
      <units></units>
      <min>0.001</min>
      <max>10</max>
      <default>2.5</default>
      <current>2.5</current>
    </number>
    <number id="magnitude">
      <about>
        <label>Magnitude of Sine</label>
        <description>Magnitude of Input Sine Motion</description>
      </about>
      <min>0.0</min>
      <max>10</max>
      <default>5.0</default>
      <current>5.0</current>
    </number>
  </input>
</run>
```

```
if {$patternType == "UniformExcitation"} {
output.curve(multi$patternType).about.group "Response Structure to Sine Wave"
output.curve(multi$patternType).about.label "Steady State Response"
output.curve(multi$patternType).about.description \
n example of a multiple curves on the same plot."

ormExcitation  1 1 -accel $accelSeries -vel0 $vel0
```



Example: $HOME/opensees2/sine

```
lappend auto_path /apps/rappture/current/lib
package require Rappture
# open the XML file containing the run parameters
set driver [Rappture::library [lindex $argv 0 ]]
if {[Rappture::library isvalid $driver] != 1} {
   error "$driver is not a valid Rappture Library \n"
}
set periodStruct [$driver get input.(periodStruct).current]
set periodSine [$driver get input.(periodSine).current]
set mag [$driver get input.(magnitude).current]
set maxT 20.0
if {$periodSine > $periodStruct} {
   set dT [expr $periodSine/100.0]
} else {
   set dT [expr $periodStruct/100.0]
}
set g 386.4
set PI [expr 2.0 * asin(1.0)]
set L 10.0
set A 1.0;
set m 1.0;
set wSine [expr 2.0 * $PI / $periodSine]
set wStruct [expr 2.0 * $PI / $periodStruct]
set K [expr $wStruct * $wStruct * $m]
set E [expr $L * $K / $A]
set vel0 [expr -1.0*$wSine*$mag]

foreach patternType {MultipleSupport UniformExcitation} {
   wipe
   model basic -ndm 1 -ndf 1
   node  1       0.0
   node  2       $L -mass $m
   uniaxialMaterial Elastic 1 $E
   element truss 1 1 2 $A 1
   set dispSeries "Sine 0 $maxT $periodSine -factor $mag"
   set accelSeries "Sine 0 $maxT $periodSine -factor [expr -1.0 * $wSine * $wSine * $mag]"
   if {$patternType == "MultipleSupport"} {
      set type 1
      $driver put output.curve(multi$patternType).about.group "Response Structure to Sine Wave"
      $driver put output.curve(multi$patternType).about.label "Total Response"
      $driver put output.curve(multi$patternType).about.description \
         "This is an example of a multiple curves on the same plot."
      pattern MultipleSupport  1   {
          groundMotion 1  Series -disp $dispSeries
          imposedSupportMotion 1 1 1
      }
   }
   if {$patternType == "UniformExcitation"} {
      $driver put output.curve(multi$patternType).about.group "Response Structure to Sine Wave"
      $driver put output.curve(multi$patternType).about.label "Steady State Response"
      $driver put output.curve(multi$patternType).about.description \
         "This is an example of a multiple curves on the same plot."
      set type 2
      pattern UniformExcitation  1 1 -accel $accelSeries -vel0 $vel0
      fix 1 1
   }
   constraints Transformation
   integrator Newmark 0.5 0.25
   system ProfileSPD
   algorithm Linear
   numberer RCM
   constraints Transformation
   analysis Transient
   $driver put  output.curve(multi$patternType).xaxis.label "Time"
   $driver put  output.curve(multi$patternType).yaxis.label "Displacement"
   $driver put  output.curve(multi$patternType).yaxis.units "inch"
   set t 0.0
   while {$t < $maxT} {
      analyze 1 $dT
      set time [getTime]
      set d [nodeDisp 2 1]
      set progress [expr ($t/$maxT)*100]
      Rappture::Utils::progress $progress -mesg "Iterating"
      $driver put -append yes output.curve(multi$patternType).component.xy "$time $d\n"
      set t [expr $t + $dT]
   }
}
# save the updated XML describing the run...
Rappture::result $driver 0
exit 0
```

sine.tcl

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