



# Introduction to NEEShub

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# Outline

- ◆ Overview of NEES
- ◆ NEES Tools and Resources
- ◆ Data Management Tools
- ◆ High Performance Computing Tools
- ◆ Project Warehouse
- ◆ Project Curation





# NSF Network for Earthquake Engineering Simulation (NEES)

- ◆ Safer buildings and civil infrastructure are needed to reduce damage and loss from earthquakes and tsunamis
- ◆ To facilitate research to improve seismic design of buildings and civil infrastructure, the National Science Foundation established NEES
- ▶ NEES Objectives
  - ◆ Develop a national, multi-user, research infrastructure to support research and innovation in earthquake and tsunami loss reduction
  - ◆ Create an educated workforce in hazard mitigation
  - ◆ Conduct broader outreach and lifelong learning activities





# Vision for NEES

- ◆ Facilitate access to the world's best integrated network of state-of-the-art physical simulation facilities
- ◆ Build a cyber-enabled community that shares ideas, data, and computational tools and models.
- ◆ Promote education and training for the next generation of researchers and practitioners.
- ◆ Cultivate partnerships with other organizations to disseminate research results, leverage cyberinfrastructure, and reduce risk transferring results into practice.





# NEES Research Facilities

- ◆ NEES has a broad set of experimental facilities
  - ◆ Each type of equipment produces unique data
  - ◆ Located at 14 sites across the United States
- ◆ Shake Table, Tsunami Wave Basin
- ◆ Large-Scale Testing Facilities
- ◆ Centrifuge, Field and Mobile Facilities
- ◆ Large-Displacement Facility
- ◆ Cyberinfrastructure



**NEEScomm**

Oregon State University

University of Minnesota

University of Illinois- Urbana

University of California Berkeley

University of California Davis

<https://www.nees.org>

University of Buffalo

University of California Santa Barbara

Cornell University

University of California Los Angeles

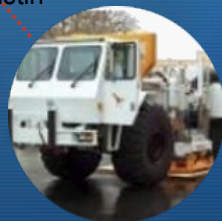
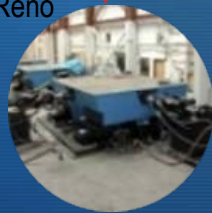
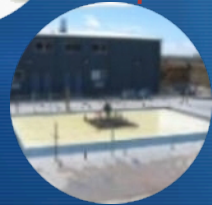
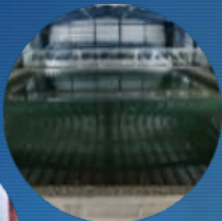
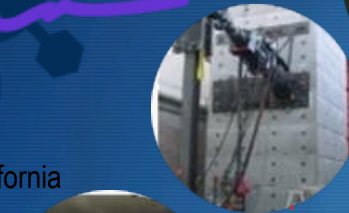
Rensselaer Polytechnic Institute

University of California San Diego

University of Nevada Reno

University of Texas Austin

Lehigh University





# NEEShub (*www.nees.org*)

- About NEES
- Tools & Resources
- Learning & Outreach
- Project Warehouse
- Simulation
- Sites
- Collaborate
- Explore NEEShub
- Support

## NEES Activities

Find out what is happening with NEEShub and around the NEES network

### TOOLS AND RESOURCES

Resources are user-submitted pieces of content that range from video presentations to publications to simulation tools.

[More...](#)

- RESEARCH**  
Resources are available to support earthquake engineering and research
- TOOLS AND RESOURCES**  
User-submitted pieces of content that range from video
- EDUCATION, OUTREACH & TRAINING**  
The primary resource for learning about earthquake engineering
- CYBERINFRA-STRUCTURE**  
Infrastructure supporting the NEES community

## New Here?

Let us show you around

**What is NEES all about?**

Click to watch a 1 minute video overview

Learn more: [Professionals](#), [Students](#), [Teachers](#), [Developers](#)

## The NEES Network

Earthquake Research Sites



Roll over the locations on the map for more details. Click a site to visit its homepage.





# Data Management Tools

- ◆ Workspace
- ◆ SynchroNEES
- ◆ PEN
- ◆ inDEED (visualization)







# Workspace

Workspace ✕ Terminate ➡ Keep for later

```
Color xterm
mohan11@NEEShub:~$ which python
/usr/bin/python
mohan11@NEEShub:~$
```





# SynchroNEES

SynchroNEES

Overview groupdev x

My Files

- projects
  - 2dclick.tcl
  - cise2009
  - citations
  - colvin.tcl
  - colvin2.tcl
  - dakota

File	Size	Modifier
Desktop	4.0 kB	Mon 12 Jul 2010 10:1
Documents	4.0 kB	Tue 07 Apr 2009 08:3
Jaguar_workspace	4.0 kB	Mon 22 Feb 2010 04:
Music	4.0 kB	Mon 27 Apr 2009 11:
Pictures	4.0 kB	Mon 10 Nov 2008 12
Public	4.0 kB	Mon 27 Apr 2009 11:
Templates	4.0 kB	Mon 27 Apr 2009 11:

Group Files: Group collaboration ideas

My Files

File

- dropbox
  - classProject
  - datasets
    - trial1
      - image006.jpg
      - shaketable.csv
    - trial2
  - NOTES.txt
  - osborne.tgz

A technical drawing or schematic of a structural frame, showing a grid of nodes and connecting members, with various annotations and dimensions.

NEEScomm

# PEN

NEES-2010-0863 - PEN 1.4.9

File Tools Help

C:\Users\Ian\projects\0863 (Project 863)

- Public
- Documentation
  - GroundHotions
  - NEEScentral Tutorial
  - penTesting147.xlsx
  - penTesting149.xls
- Photos
- Project Experimental Validation Test Program
- schema
- testfile.txt
- Videos
  - Siggraph2010ovSGPATAkfinal.pdf
  - strategic\_plan\_2010-2014.pdf
  - WallDay1\_KL.txt
  - loginStart.png
  - penTesting.xlsx
- Experiment-5
- Experiment-7
- Experiment-8
- Experiment-9
- Experiment-12
- Experiment-13
- Experiment-14
- Experiment-16
- Experiment-18
- Experiment-19
- Experiment-20
- Experiment-21
- Experiment-22
- Experiment-23
- Experiment-24
- Experiment-25
- Experiment-26
- Experiment-27
- Experiment-28
- Experiment-29
  - Analysis
  - Documentation
  - Trial-1
  - Setup
  - Specimen-4995
  - R3DV
    - Trial\_1
      - Analysis
      - Documentation
      - Rep\_1
- Experiment-30
- Experiment-31
- Experiment-34

imathew

NEES-2010-0863

penTesting149.xls

View in Warehouse

Info File Metadata File Import

Title: penTesting149.xls

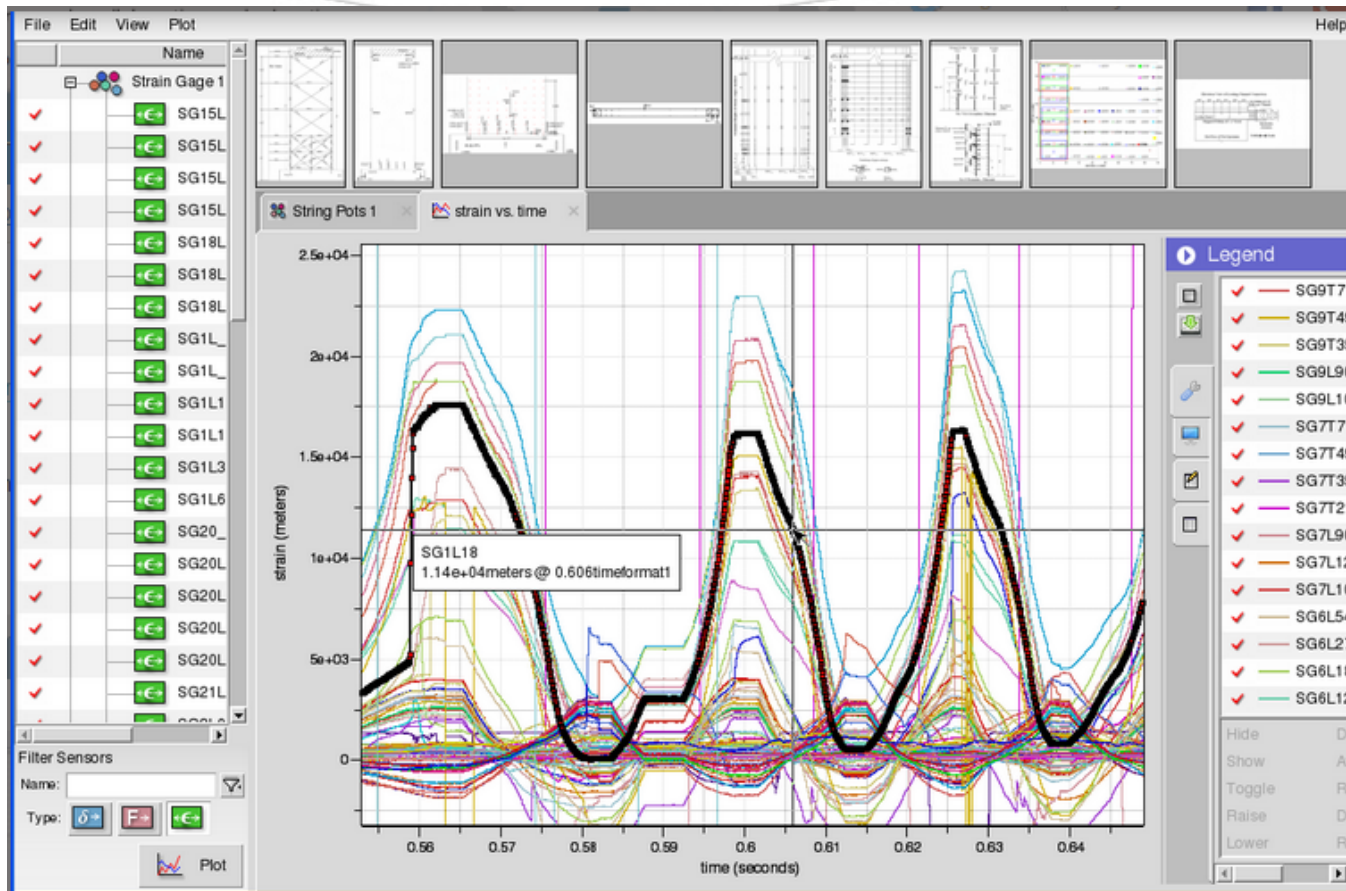
Description: Internal testing document for PEN 1.4.9.

Save Reset





# inDEED





# Data is the 4<sup>th</sup> Paradigm

- ◆ Producing an avalanche of high resolution digital data
- ◆ All (or most) of the data needs to be accessible over a long period of time
  - ◆ Much of the data is not reproducible
- ◆ Example – NEES project
  - ◆ Structure or sample destroyed through testing
  - ◆ Very expensive to rebuild for more tests





# Need for High Performance Computing(HPC) Simulation

- ◆ Earthquake engineering problems:
  - ◆ Involves intense computation on large volumes of data
  - ◆ Will take days to complete simulation on normal computers
- ◆ Earthquake engineering problems on an HPC resource takes hours to complete
- ◆ Using HPC resources for solving computationally intensive problems results in huge time savings
- ◆ Different HPC resources include:
  - ◆ XSEDE: Kraken, Stampede
  - ◆ Purdue: Hansen, Carter
  - ◆ Open Science Grid (OSG)





# Why Batchsubmit?

Different steps of job submission on an HPC resource includes:

- Login to the remote venue and copy all input files
- Ensure that the simulation program is available on the remote venue and copy program to the venue if necessary
- Prepare venue specific script file specifying parameters for job submission
- Submit the job to the correct job class and wait for the result
- Copy the results to a local system for analysis and visualization





# Why Batchsubmit?

- ◆ Repeating this process for multiple simulations is tedious and time consuming
- ◆ Batchsubmit automatically performs all the steps for submitting a job in an HPC resource
- ◆ User can submit jobs using batchsubmit to multiple venues
- ◆ Batchsubmit will intimate the user when job finishes execution and all results will be available in user job directory
- ◆ Batchsubmit makes job submission easier and results in huge time savings







# Batchsubmit Features

- ◆ Simple command line interface and GUI interface
- ◆ Easy to do parallel processing
- ◆ Asynchronous job submission
- ◆ Select HPC resource(venue) to run the job
- ◆ Send executables to the venue, if required





# Batchsubmit Features

- ◆ Automatic retrieval of results
- ◆ Email notification once results are available
- ◆ Monitor job status
- ◆ Monitor queue traffic at different venues
- ◆ Cancel a job





# Batchsubmit Examples

◆ batchsubmit date

◆ batchsubmit --venue carter --ncpus 16 OpenSeesMP /apps/  
opensees/NEEShubExamples/SmallMP/Example.tcl

◆ batchsubmit --venue stampede --ncpus 64  
--appdir /apps/share64/opensees/stampede  
--rcopyindir OpenSeesMP /LargeMP/Example.tcl





# OpenSees Laboratory

hub

**OpenSees** Application: Parallel Job Submission

Main Script: /apps/openseesbuild/current/NEEShubExa  
Resource: Carter

**Simulate** new input parameters [About this tool Questions?](#)

**Carter Options**

Application: OpenSeesMP  
# Processors: 16  
Walltime: 00:30:00

**Parallel Job Submission Tool**

This tool can be used to submit parallel opensees 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.

**IMPORTANT NOTES:**

- 1) the main script CANNOT be located in your home directory. It and all the files it requires must be in a subdirectory.
- 2) 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.
- 3) NEES is a local machine limited to around 16 processors BUT the jobs will start right away. Hansen is an intermediate machines with 96 processors. The others are larger machines. All jobs sent to machines other than the local machine can take awhile to start!
- 4) as an example set the main script as:  
/apps/openseesbuild/current/NEEShubExamples/SmallIMP/Example.tcl

DO NOT SELECT OpenSeesSP for this example.





# Batchsubmit GUI

The screenshot shows the BatchSubmit GUI window. The title bar reads "BatchSubmit". Below the title bar is a tab labeled "Overview". The main area contains a table with the following data:

Job Name	State	Running Time	Venue
testjob01	Submitted		carter

To the right of the table is a "Venue Status" panel. It lists three venues: "carter", "hansen", and "local". Each venue has a status message, a queue name, and resource limits:

- carter**: "This venue is currently available." Queue: standby. Procs Per Node: 16. Max Procs: 64. Walltime: 72:00:00. Max Walltime: 72:00:00.
- hansen**: "This venue is currently available." Queue: nees. Procs Per Node: 4. Max Procs: 412. Walltime: 24:00:00. Max Walltime: 720:00:00.
- local**: "This venue is currently available." Queue: standby. Procs Per Node: 16. Max Procs: 16. Walltime: 24:00:00. Max Walltime: 25:00:00.

At the bottom of the window are four buttons: "New Job", "Cancel Job", "View Job", and "Download".





# Batchsubmit GUI

hub

### BatchSubmit

Overview | New Job x

**Submission Command Preview**

```
00:00 --ncpus 16 --nn 1 --ppn 16 OpenSeesMP /home/neeshub/mohan11/examples/SmallIMP/Example.tcl
```

**Command Options**

Job Name:  Job Prefix:

Executable:

Arguments:

**Input File Options**

Infile:

Input file is first argument

Infilearg:

Input file directory  
 Input dir + subdirectories  
 Input file only

**Venue Options**

Venue:

Queue:

Walltime:

NCPUs:  NN:

MPICH:  PPN:

MPIargs:

Notify upon completion





# Project Warehouse

- ◆ NEES online data repository
- ◆ Allows researchers to upload, archive, and disseminate data from their physical, cyber, and hybrid experiments and simulations.
- ◆ Provides user with tools to organize data into projects, experiments, trials, and results.
- ◆ The data in the Project Warehouse can be cited and shared with researchers across the world, or only within a research group.
- ◆ Facility to curate the data in the repository to ensure the long-term preservation of valuable NEES data.





# Project Warehouse

## NEES Project Warehouse

### Seismic Response of Structural Walls with Geometric and Reinforcement Discontinuities

OPEN DATA

No reviews have been created for this project. [Review This Project](#)

Project

Experiments

Team Members

File Browser

Reviews

warehouse search

GO

To access data, please select an experiment on the [Experiments](#) tab.

**Executive Summary:** [Download Document](#)

**PI(s):** [Santiago Pujol](#)

**Dates:** July 20, 2011 - August 09, 2014

**Facility:** Purdue University at West Lafayette, IN, United States

**Organization(s):** Purdue University at West Lafayette, IN, United States

**Description:** Discontinuities in the geometry and the reinforcement of structural walls create stress concentrations that have detrimental effects on wall seismic response. This study focused on discontinuities associated with changes in the geometry of the cross... [\(more\)](#)

**Sponsor:** ERICO International Corporation - n/a - Experiments 1 through 6

**Website(s):** Seismic response of RC walls with discontinuities [\(view\)](#)  
Seismic response of structural walls with discontinuities [\(view\)](#)  
Seismic Response of Structural Walls with Discontinuities [\(view\)](#)

**Group Space:** [Project:Seismic Response of Structural Walls with Geometric and Reinforcement Discontinuities](#)



Wall with lap splices of length of 60 bar diameters and unconfined boundary elements

1268 Views

5624 Downloads










# Project Warehouse

Project Experiments Team Members File Browser Reviews  GO

To compare experiments, please select at most four experiments from the experiment list below.

[Compare Experiments](#) Sort By:

- Experiment-1:** [Specimen W-MC-C: Structural wall with mechanical couplers at the base and with boundary-element confinement subjected to lateral displacement reversals of increasing amplitude up to failure](#) [OPEN DATA](#)  
**Dates:** August 01, 2011 - September 01, 2011  
**Description:** The longitudinal reinforcement was spliced with mechanical couplers at the base of the wall. It had boundary-element confinement (1.2% volumetric confining reinforcement ratio).  
**Facility:** Purdue University at West Lafayette, IN, United States  
  
[Trial-1,Rep-1 Launch](#)  
1 Interactive Files  
[view data](#)
- Experiment-2:** [Specimen W-MC-N: Structural wall with mechanical couplers at the base and without boundary-element confinement subjected to lateral displacement reversals of increasing amplitude up to failure](#) [OPEN DATA](#)  
**Dates:** August 23, 2011 - December 05, 2011  
**Description:** The longitudinal reinforcement was spliced with mechanical couplers at the base of the wall. It did not have boundary-element confinement.  
The wall was ...  
**Facility:** Purdue University at West Lafayette, IN, United States  
  
[Trial-1,Rep-1 Launch](#)  
1 Interactive Files  
[view data](#)
- Experiment-3:** [Specimen W-60-N: Structural wall with 60db lap splices at the base and without boundary-element confinement subjected to lateral displacement reversals of increasing amplitude up to failure](#) [OPEN DATA](#)  
**Dates:** May 19, 2012 - June 11, 2012  
**Description:** The longitudinal reinforcement was lap spliced at the base of the wall. The length of the lap splices was 60 bar diameters. It did not ...  
**Facility:** Purdue University at West Lafayette, IN, United States  
  
[Trial-1,Rep-1 Launch](#)





# Try It!!!

- ◆ Getting Started
  - ◆ Register for a NEEShub account (Free)
  - ◆ Request access to workspace (Support Ticket)
  - ◆ Request access to HPC access group (Support Ticket)
  
- ◆ Download SynchroNEES
  - ◆ <https://nees.org/topics/synchronees>
  
- ◆ Run batchsubmit
  - ◆ <https://nees.org/resources/batchsubmit/about>
  
- ◆ Share results with peers
  - ◆ <https://nees.org/warehouse/welcome>

