OpenSees Navigator

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OpenSees Navigator

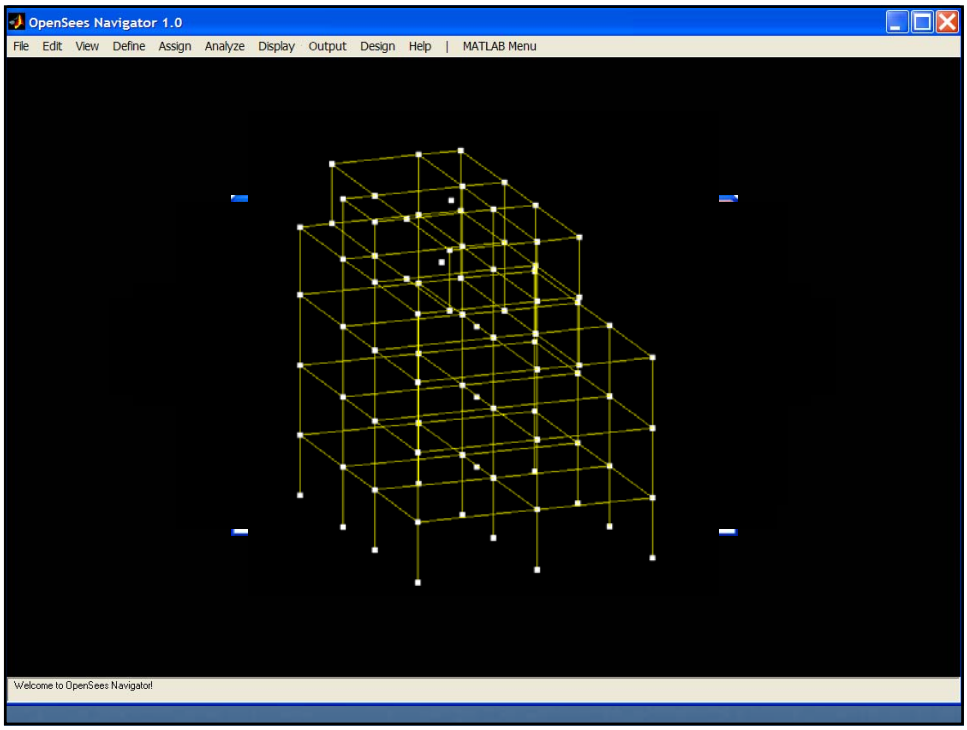
Introduction:

- MATLAB based Graphical User Interface
- Create 2D/3D structural models for OpenSees
- Post processing for OpenSees
- Design toolboxes: NSP, AISC design checks, ...

OpenSees Navigator

Motivation:

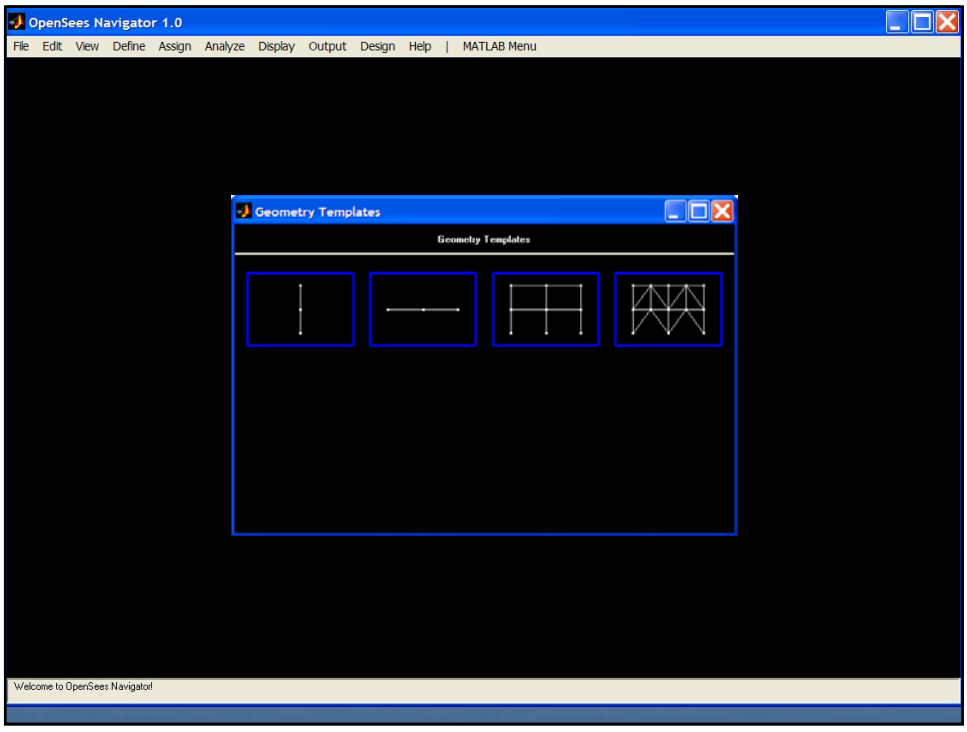
- Graphical input is more flexible than TCL text input
- Use MATLAB to do the post processing
- OpenSees Navigator creates the OpenSees model and does the post processing graphically
- Flexible to use and requires no programming skills

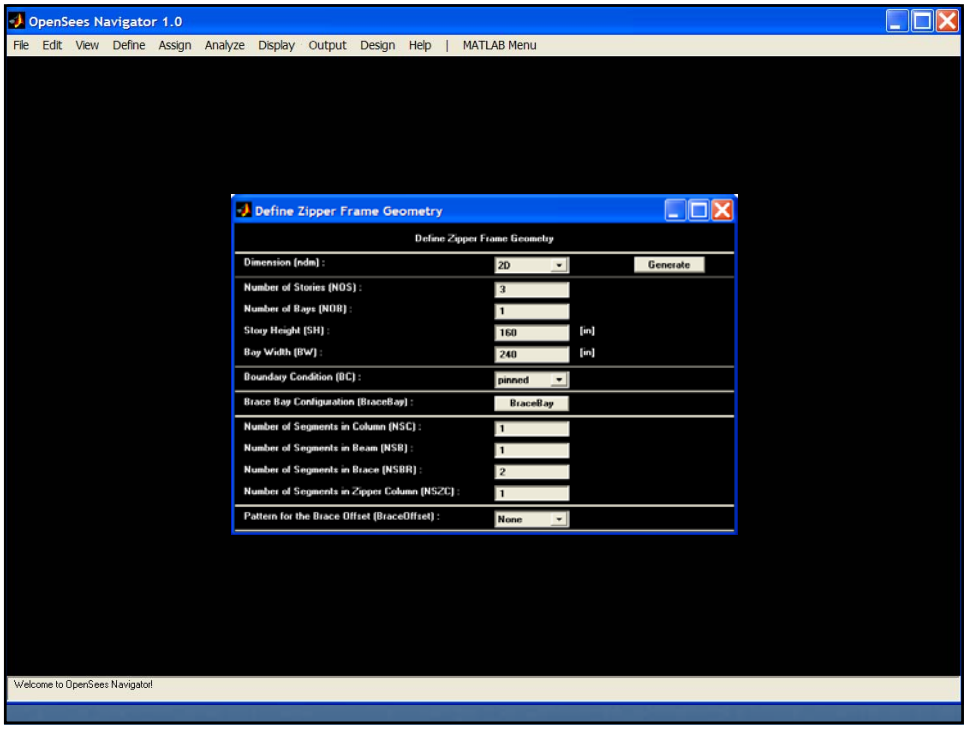


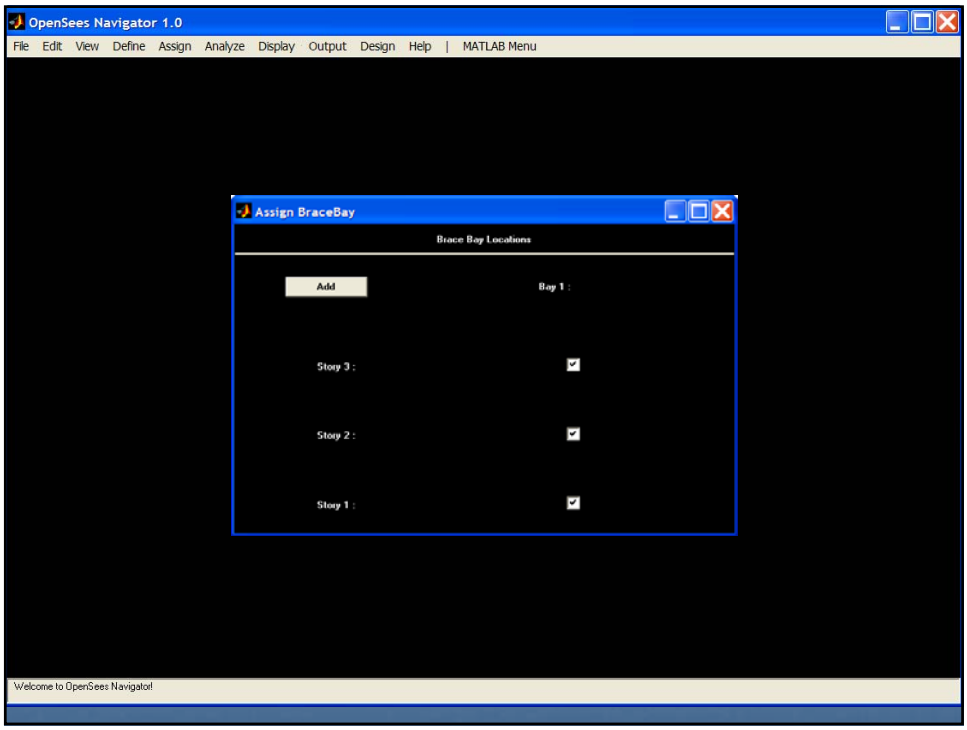
OpenSees Navigator

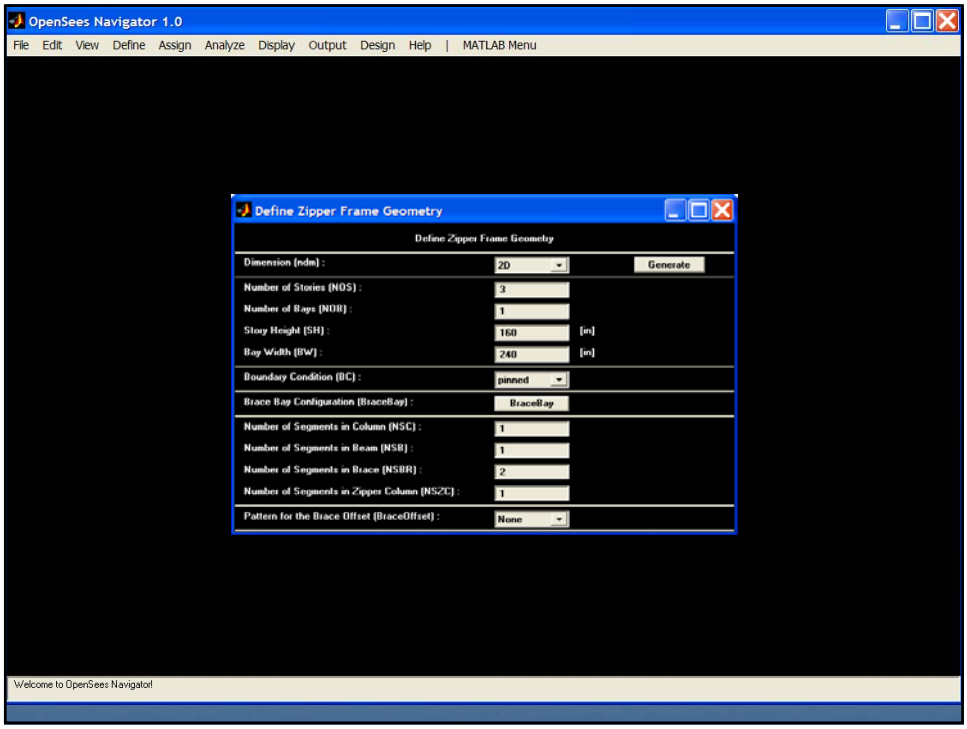
Define Geometry:

- New Model from Template:
  - 3D Stick Model
  - Multi Span Beam
  - Moment Frame
  - Zipper Frame
  - ....
- Load Model from File
  - Previously defined model
  - M-file (text input from MATLAB)




OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define Zipper Frame Geometry
Define Zipper Frame Geometry
Dimension (ndm) :
2D
Generate
Number of Stories (NOS) :
3
Number of Bays (NOB) :
1
Story Height (SH) :
160
[in]
Bay Width (BW) :
240
[in]
Boundary Condition (BC) :
pinned
Brace Bay Configuration (BraceBay) :
BraceBay
Number of Segments in Column (NSC) :
1
Number of Segments in Beam (NSB) :
1
Number of Segments in Brace (NSBR) :
2
Number of Segments in Zipper Column (NSZC) :
1
Pattern for the Brace Offset (BraceOffset) :
None
Welcome to OpenSees Navigator!


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Assign BraceBay
Brace Bay Locations
Add
Bay 1 :
Story 3 :
Story 2 :
Story 1 :
Welcome to OpenSees Navigator!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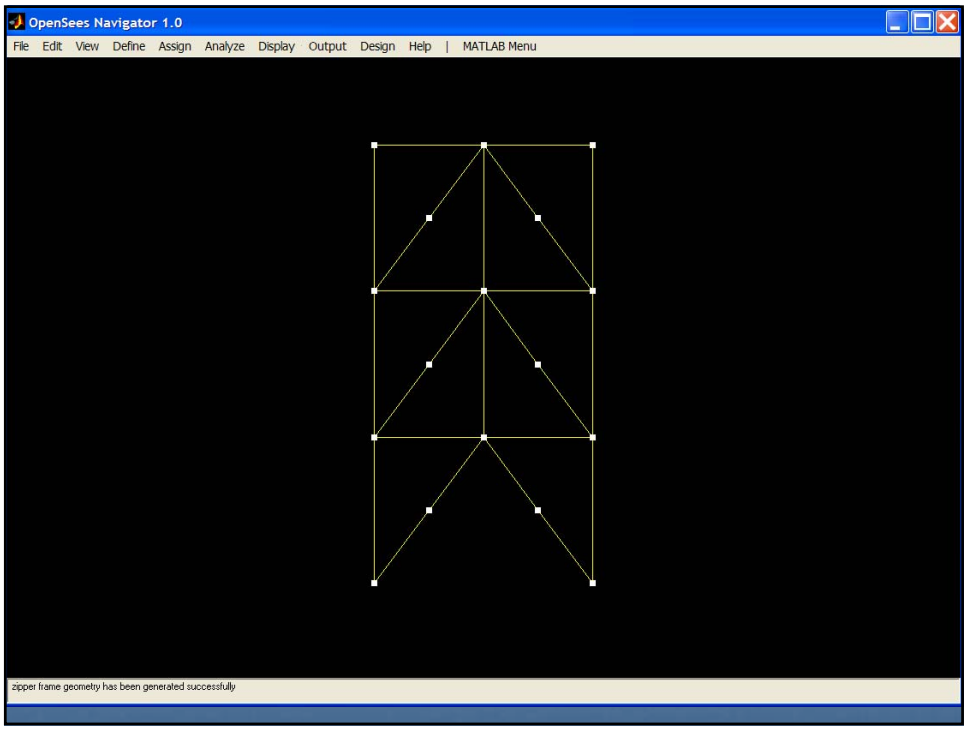
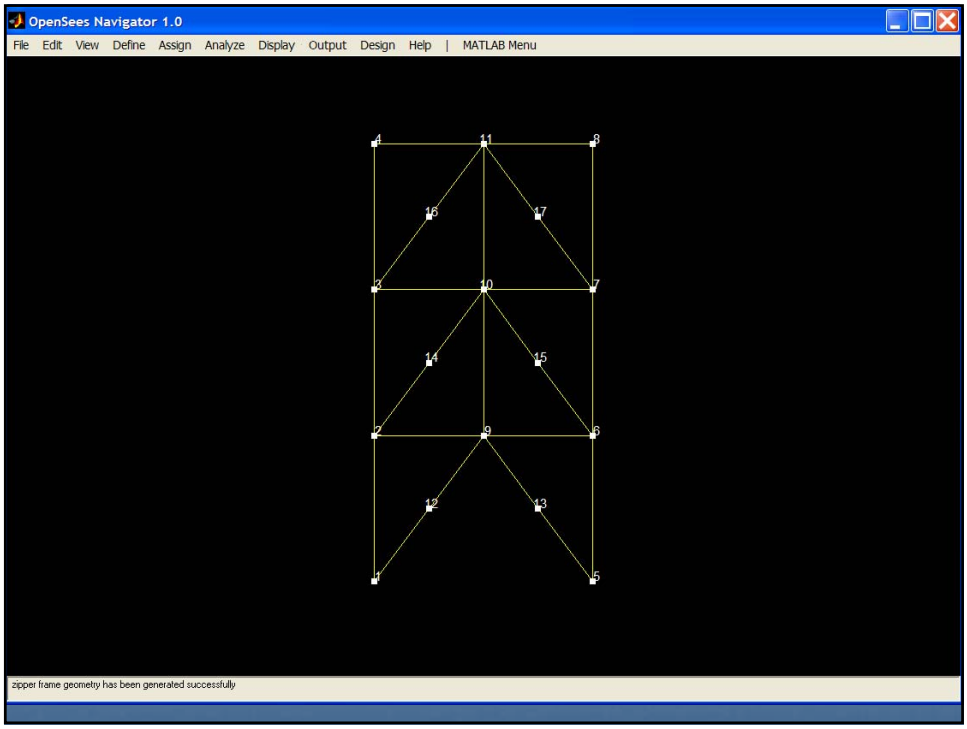
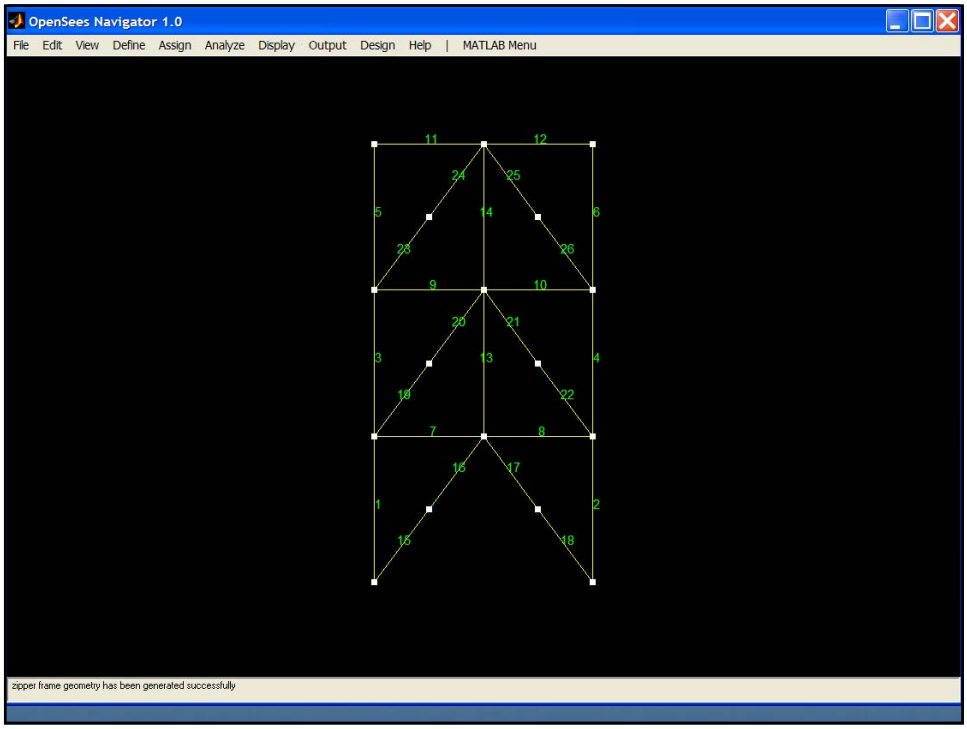
Welcome to OpenSees Navigator!


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
zipper frame geometry has been generated successfully


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
zipper frame geometry has been generated successfully


OpenSees Navigator 1.0
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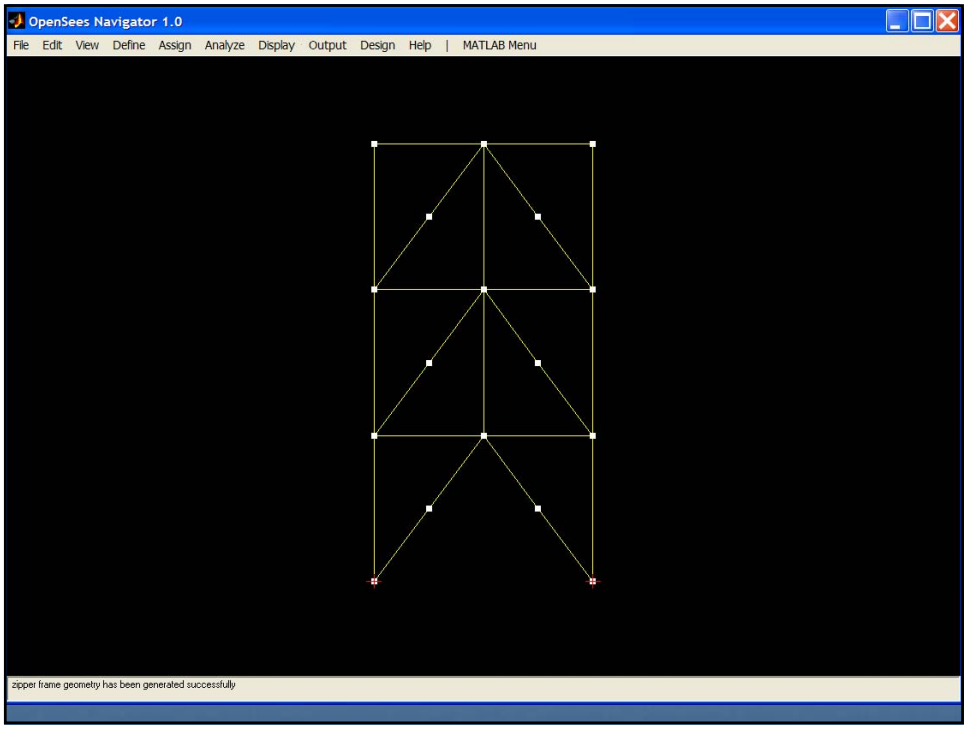
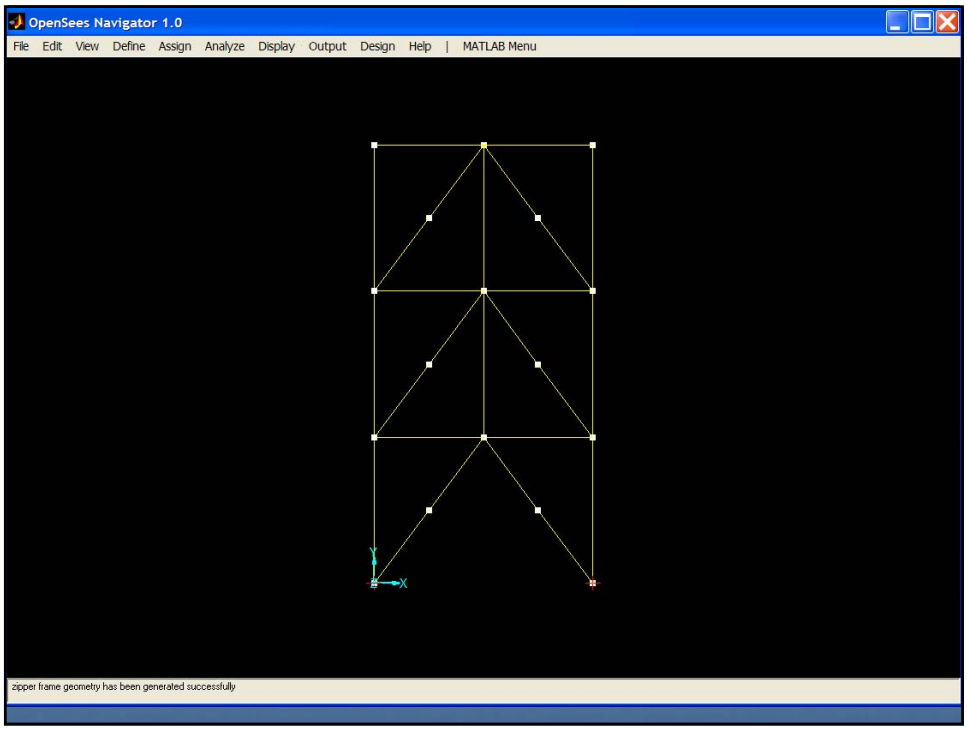
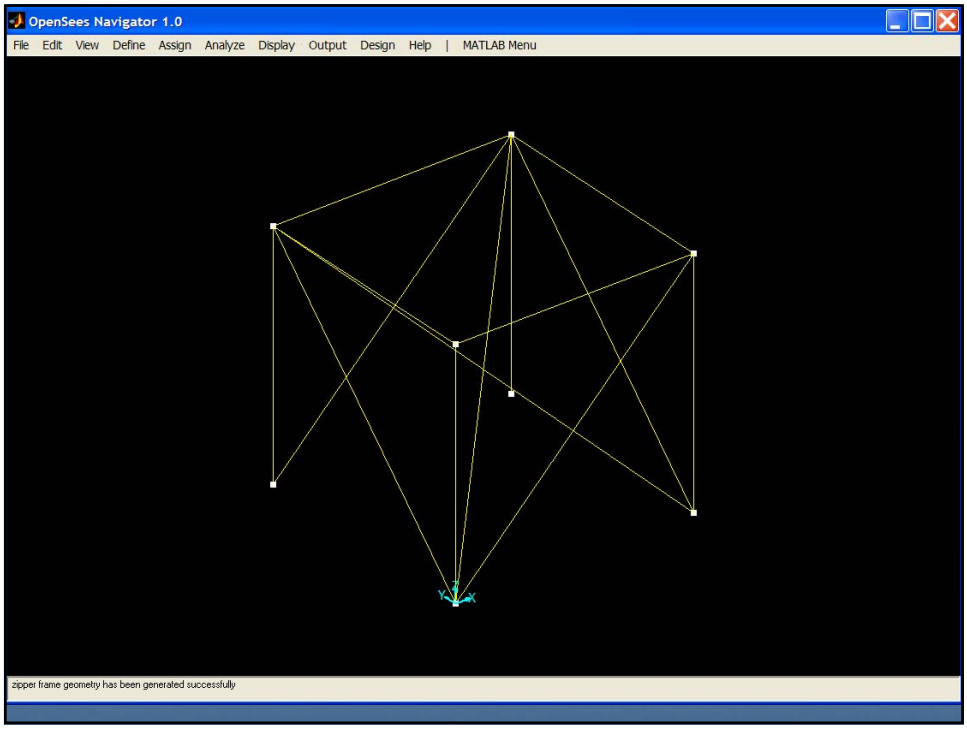
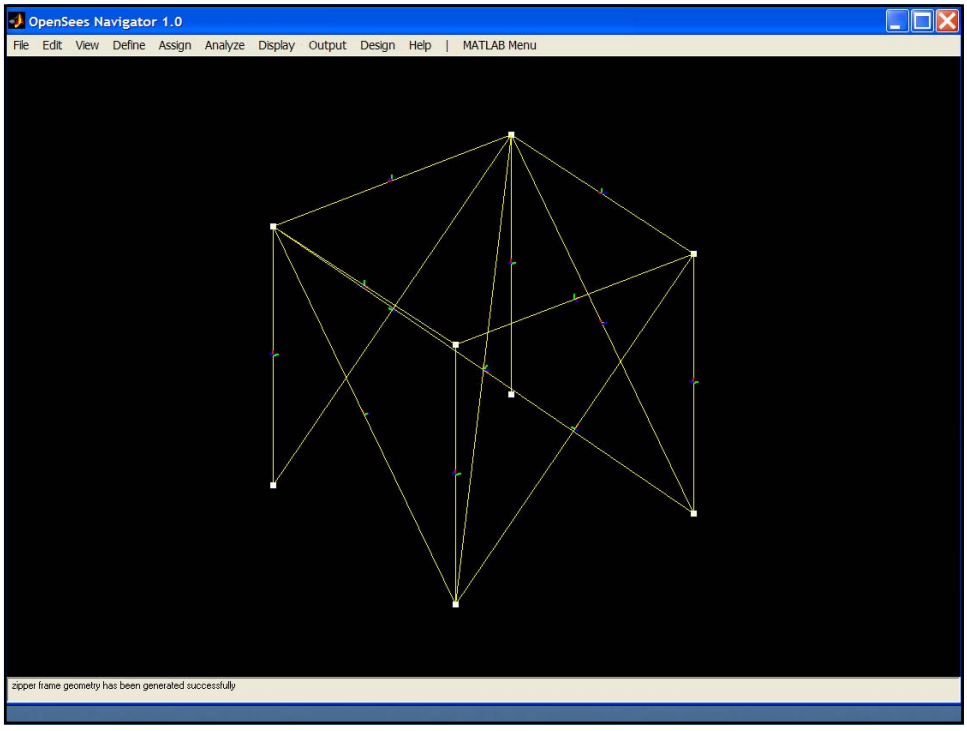
zipper frame geometry has been generated successfully


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
zipper frame geometry has been generated successfully


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Y
X
zipper frame geometry has been generated successfully


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
zipper frame geometry has been generated successfully


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
zipper frame geometry has been generated successfully

OpenSees Navigator

Define Material:

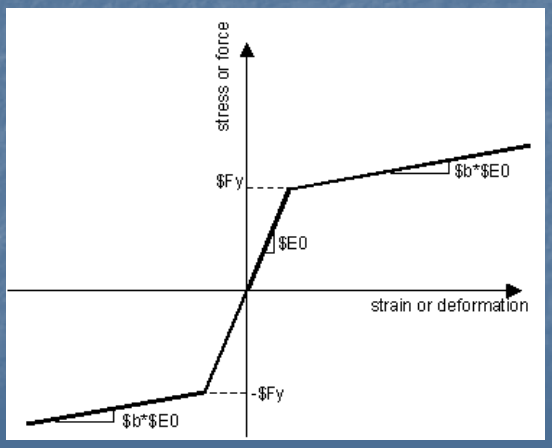
- Templates:
  - Steel01
  - Steel02
  - EPP
  - Hardening Material
  - Elastic
  - Concrete01
  - ....

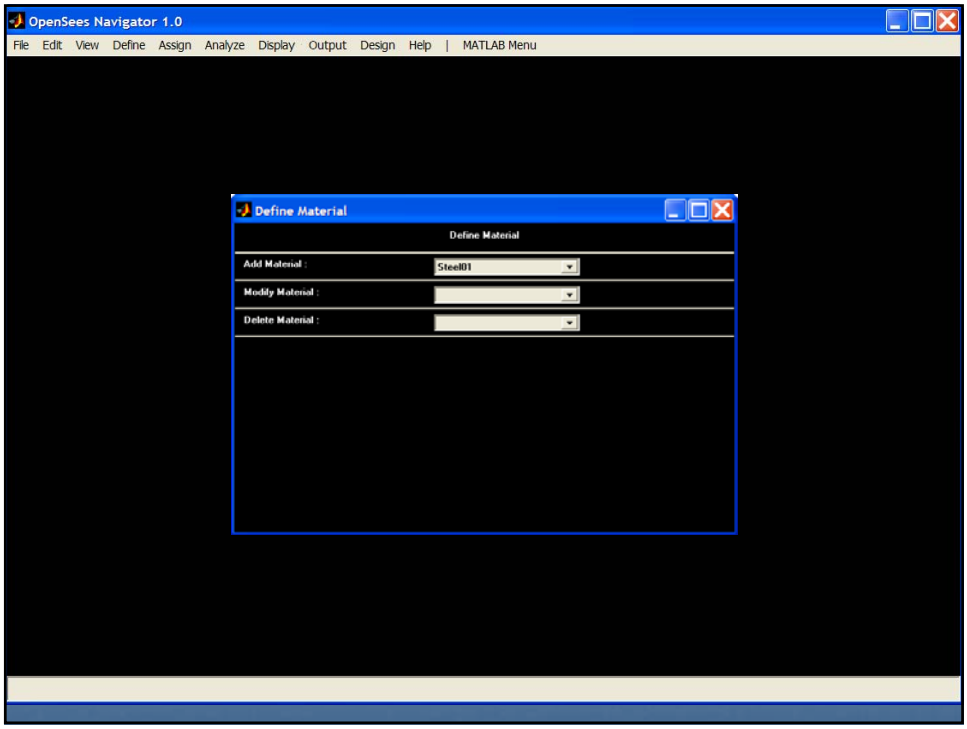
OpenSees Navigator

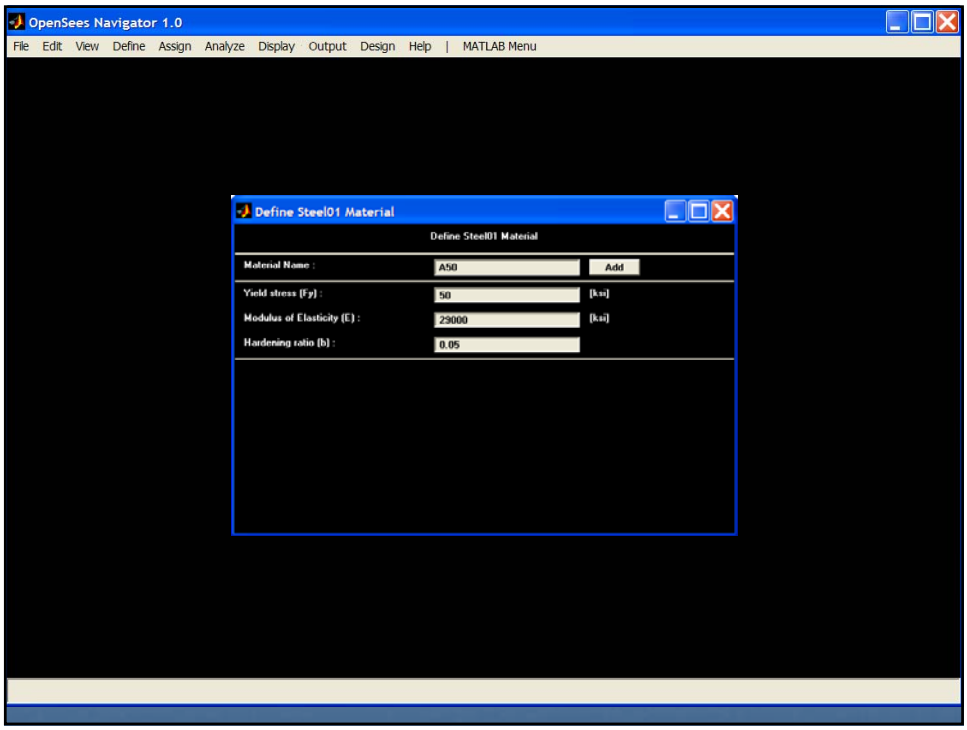
Define Material:

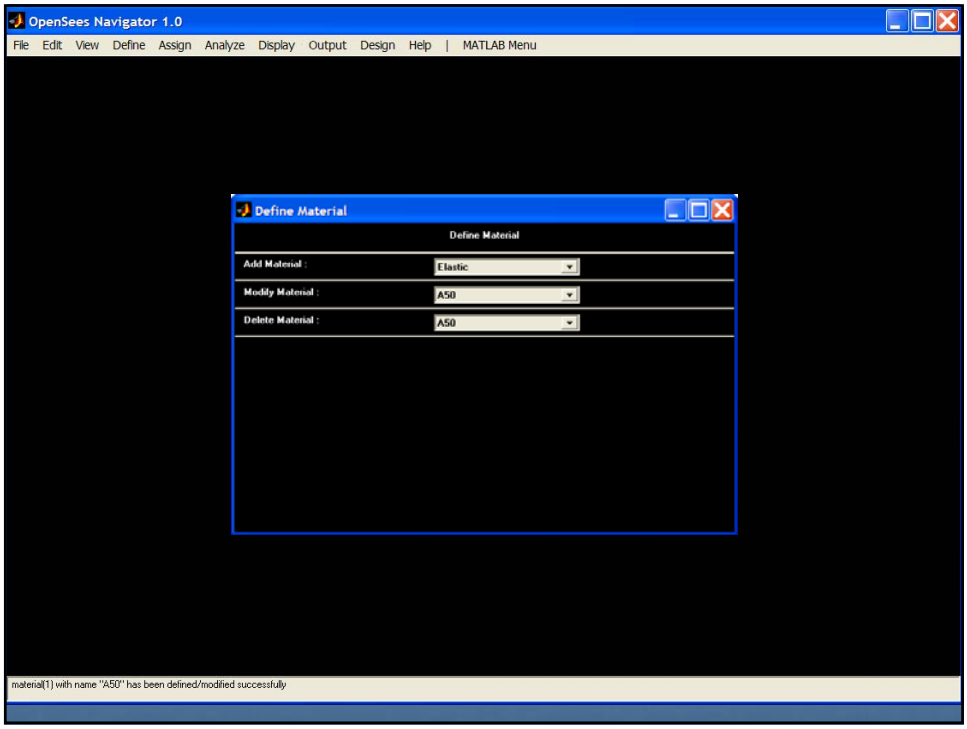
- Steel01
  - Fy = 50 ksi
  - E = 29000 ksi
  - b = 0.05

Name : A50




OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define Material
Define Material
Add Material :
Steel01
Modify Material :
Delete Material :

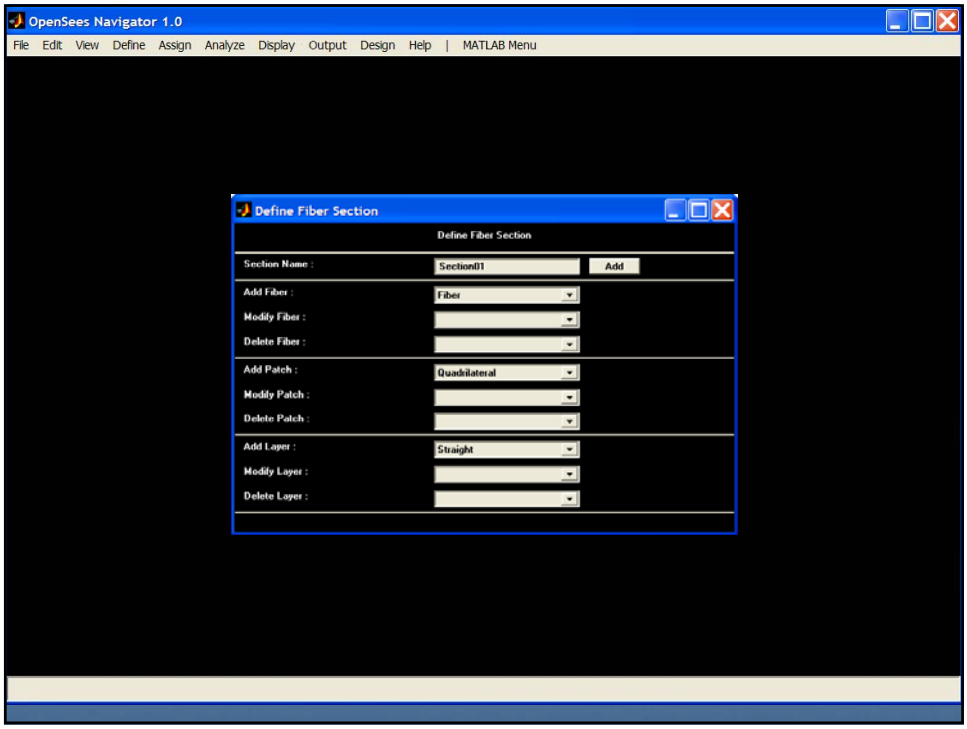

OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define Steel01 Material
Define Steel01 Material
Material Name :
A50
Add
Yield stress (Fy) :
50
[ksi]
Modulus of Elasticity (E) :
29000
[ksi]
Hardening ratio (b) :
0.05

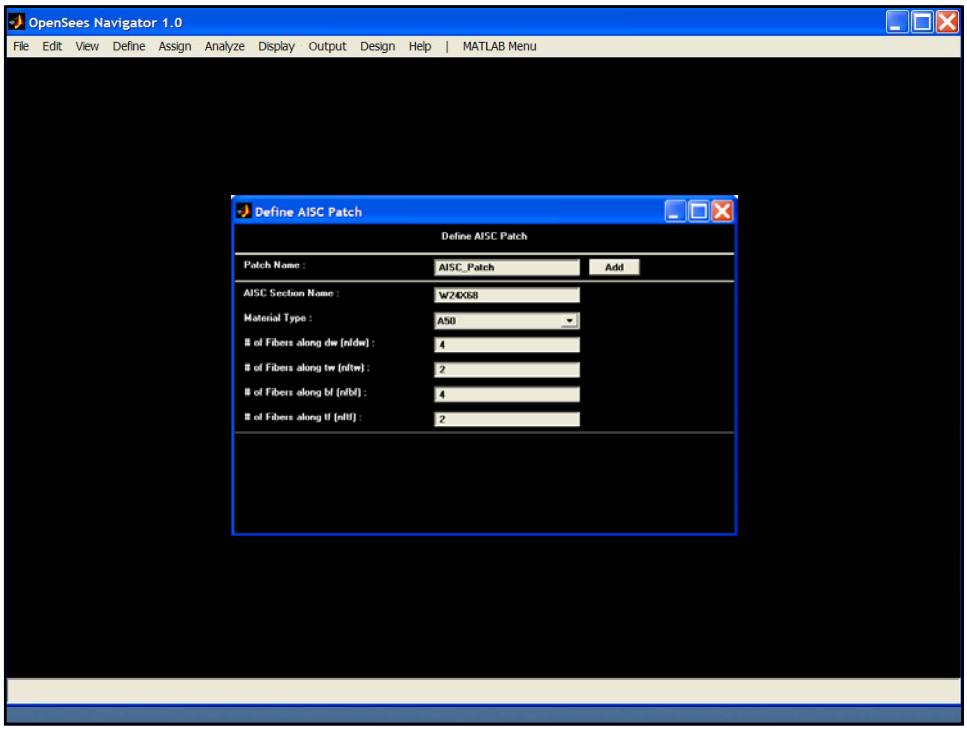


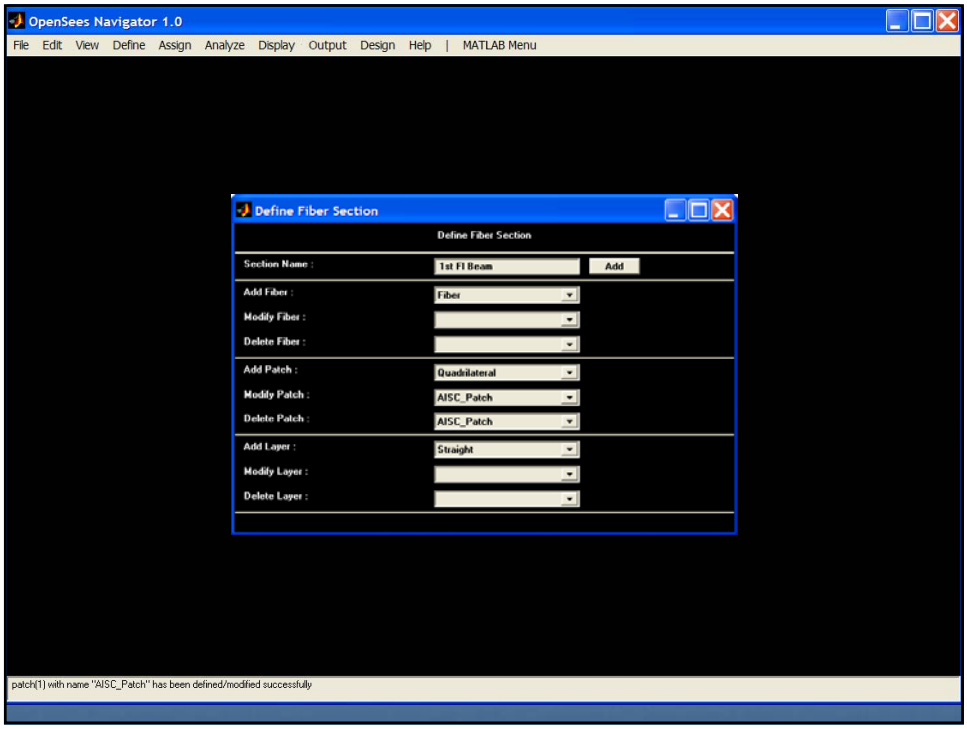
OpenSees Navigator

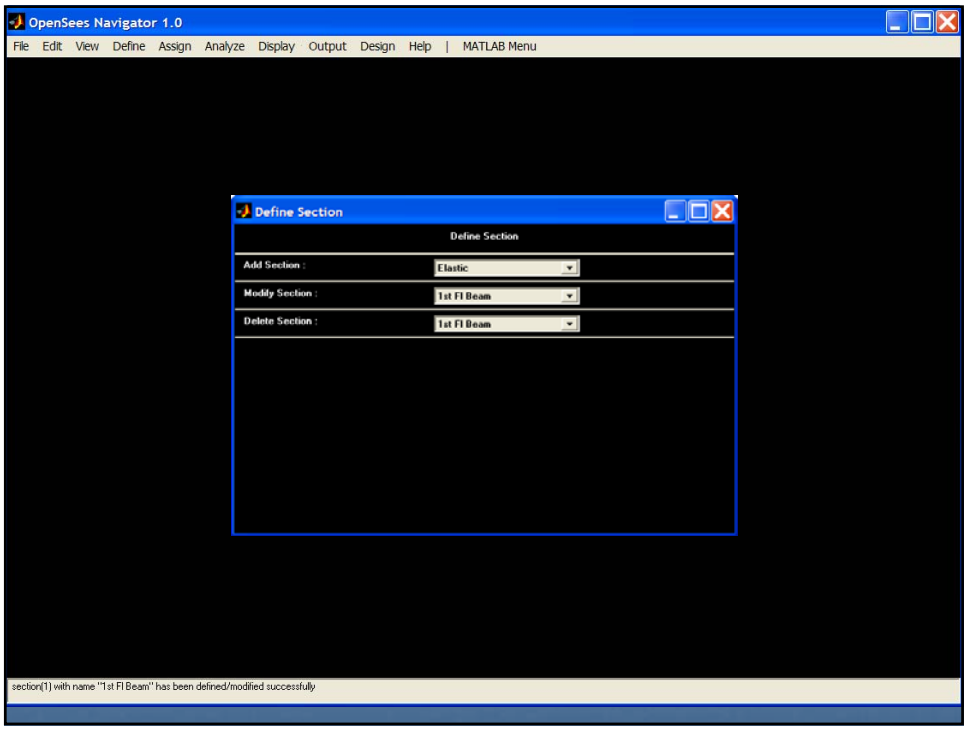
Define Section:

- Templates:
  - Elastic Section
  - Fiber Section
  - Aggregator Section
  - .....


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define Fiber Section
Define Fiber Section
Section Name :
Section01
Add
Add Fiber :
Fiber
Modify Fiber :
Delete Fiber :
Add Patch :
Quadrilateral
Modify Patch :
Delete Patch :
Add Layer :
Straight
Modify Layer :
Delete Layer :


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define AISC Patch
Define AISC Patch
Patch Name :
AISC_Patch
Add
AISC Section Name :
W24X68
Material Type :
A50
# of Fibers along dw (nfdw) :
4
# of Fibers along tw (nftw) :
2
# of Fibers along bf (nfbf) :
4
# of Fibers along tf (nftf) :
2

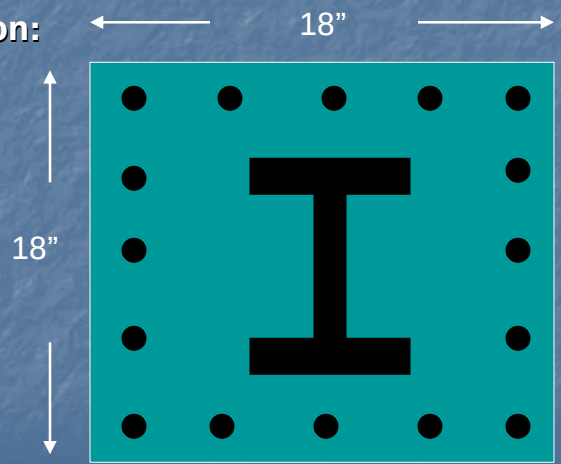

OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define Fiber Section
Define Fiber Section
Section Name :
1st Fl Beam
Add
Add Fiber :
Fiber
Modify Fiber :
Delete Fiber :
Add Patch :
Quadrilateral
Modify Patch :
AISC_Patch
Delete Patch :
AISC_Patch
Add Layer :
Straight
Modify Layer :
Delete Layer :
patch(1) with name "AISC_Patch" has been defined/modified successfully


OpenSees Navigator 1.0
File Edit View Define Assign Analyze Display Output Design Help | MATLAB Menu
Define Section
Define Section
Add Section :
Elastic
Modify Section :
1st Fl Beam
Delete Section :
1st Fl Beam
section(1) with name "1st Fl Beam" has been defined/modified successfully

OpenSees Navigator

Define Fiber Section:

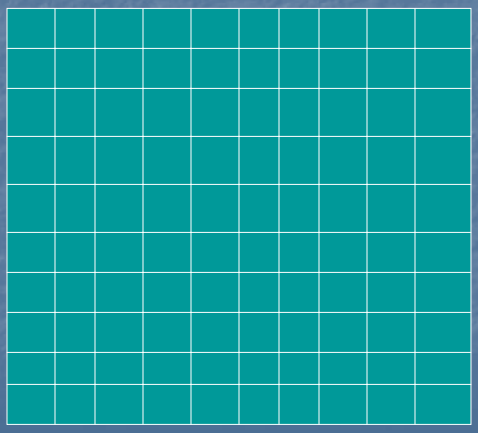
- Column Section
  - 18” x 18”
  - W14x68
  - 16 rebars



OpenSees Navigator

Define Fiber Section:

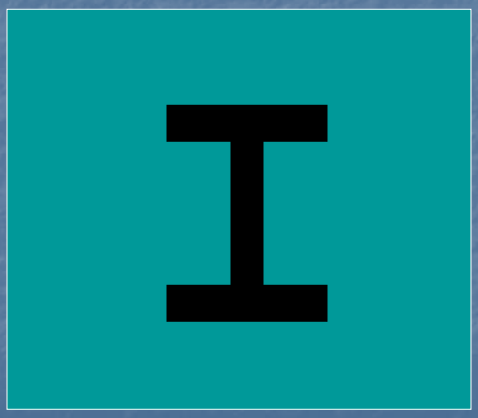
- Add Quadrilateral Patch
  - 18” x 18”
  - Material : Concrete_8
  - 10 x 10



OpenSees Navigator

Define Fiber Section:

- Add AISC Patch
  - W14x68
  - Material: Steel_60
  - Discretization

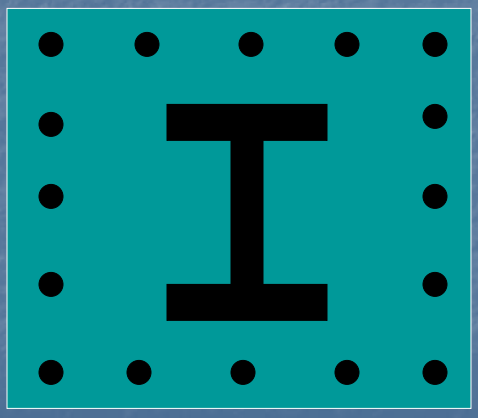


OpenSees Navigator

Define Fiber Section:

- Add Straight layers
  - Add the rebars
  - Material: Steel_60
  - 16 rebars

Name : Column Section



OpenSees Navigator

Define Element:

- Templates:
  - Truss
  - Elastic Beam Column
  - Nonlinear Beam Column
  - Zero Length Element
  - ....

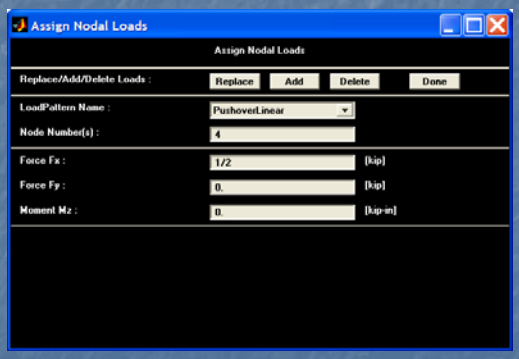
OpenSees Navigator

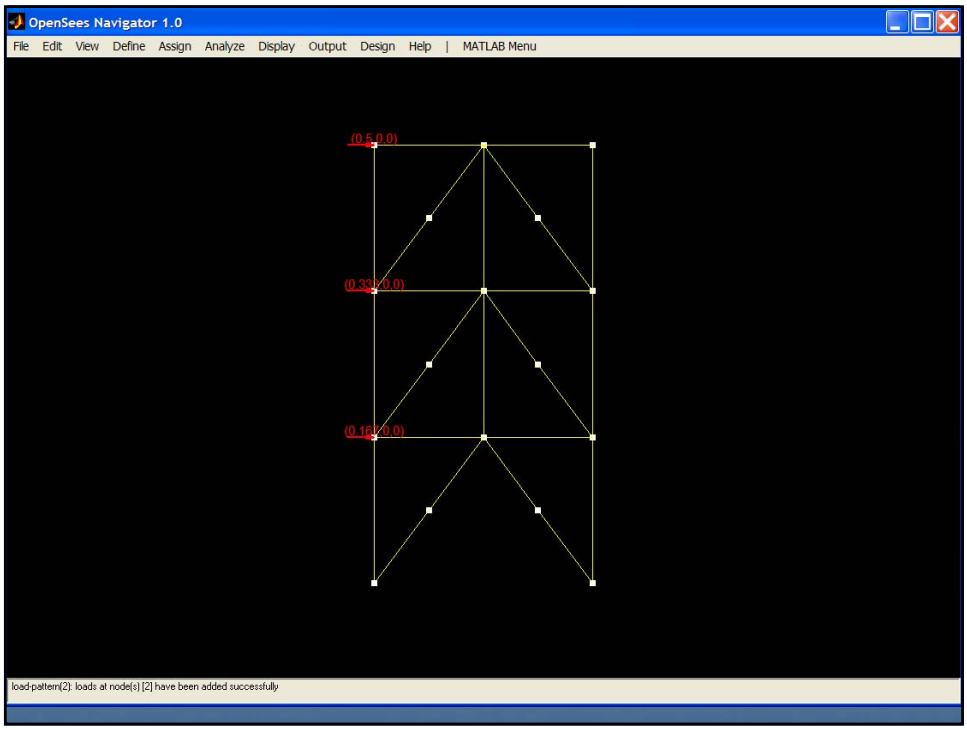
Define Loading:

- Time Series:
  - Constant
  - Linear
  - Rectangular
  - Sine
  - Load from files
- Load Pattern:
  - Plain
  - Uniform Excitation

OpenSees Navigator

Assign Loading:





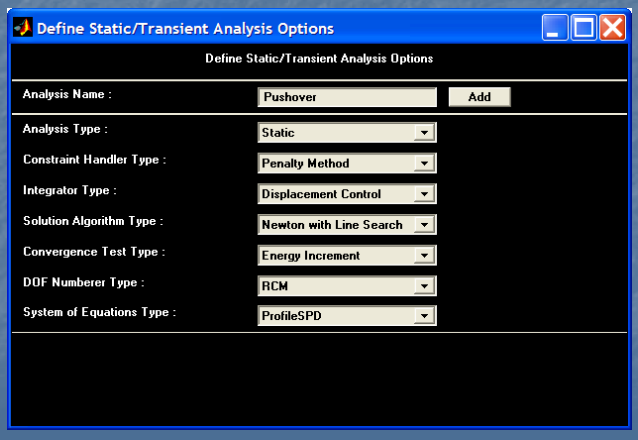
OpenSees Navigator

Define Recorder:

- Node Recorder:
  - Displacement
  - Velocity
  - Acceleration
  - Drifts
  - ...
- Element Recorder:
  - Local Forces
  - Global Forces
  - Section Forces
  - ...

OpenSees Navigator

Define Analysis Options:



OpenSees Navigator

Define:

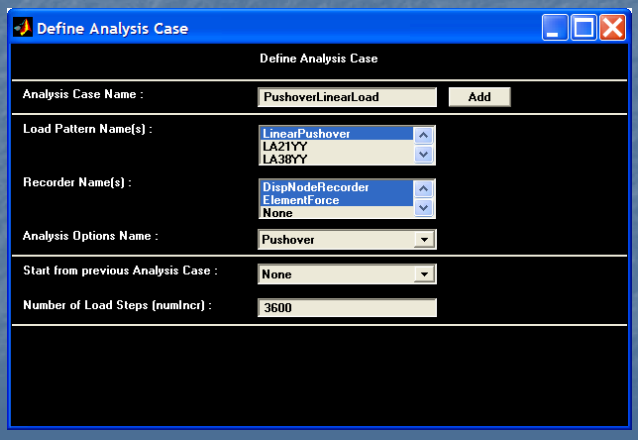
- Geometry
- Material
- Section
- Element
- Loading
- Recorder
- Analysis Option

Assign:

- Element
- Loading

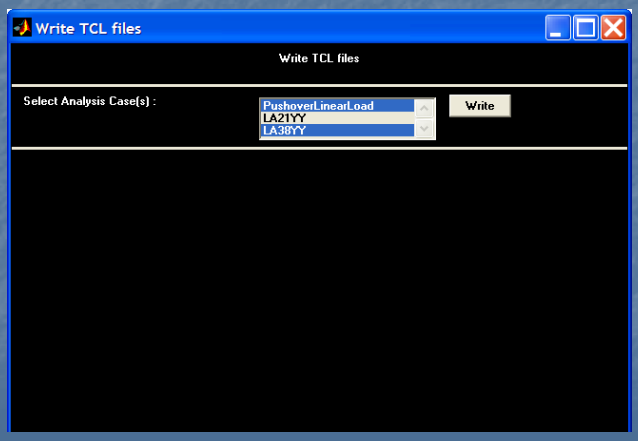
OpenSees Navigator

Define Analysis Cases:



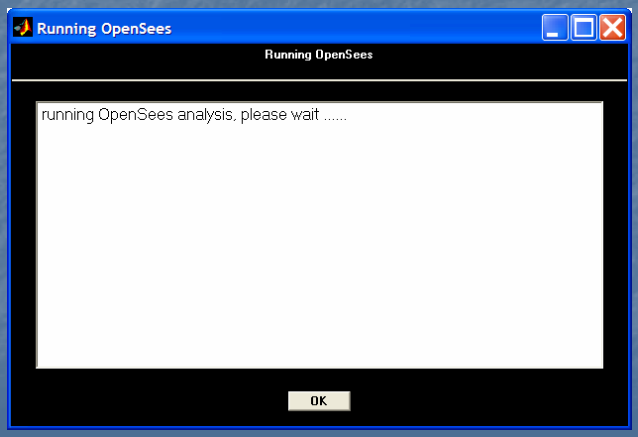
OpenSees Navigator

Define Analysis Cases:



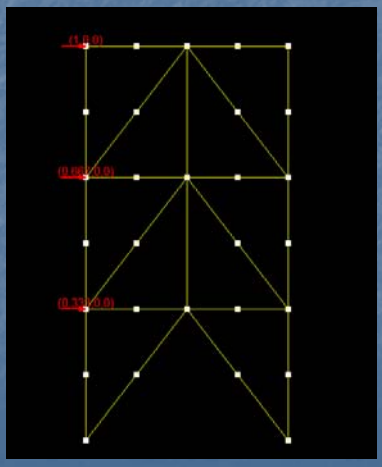
OpenSees Navigator

Run OpenSees:



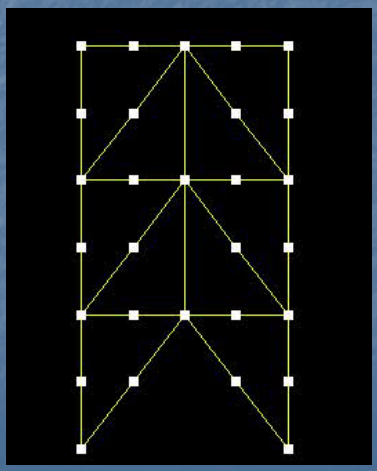
Post Processing

Nonlinear Static Analysis



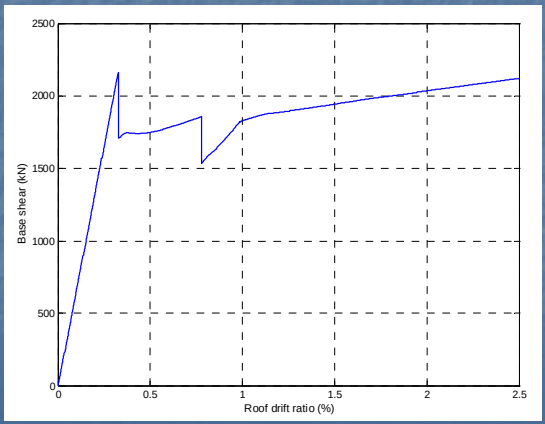
Movie Creator

Nonlinear Static Analysis



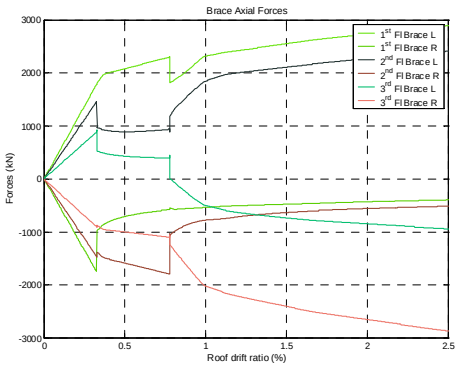
Pushover Curve

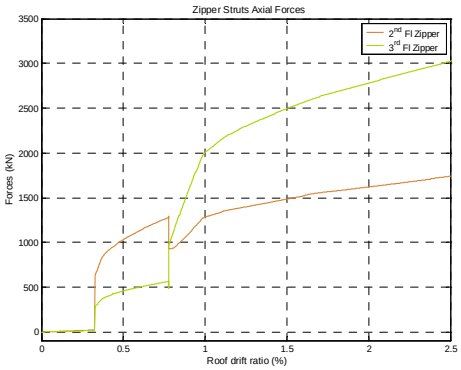
Nonlinear Static Analysis



Element Forces

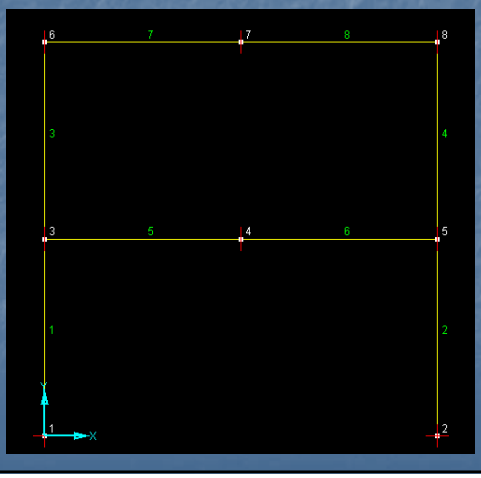
Nonlinear Static Analysis





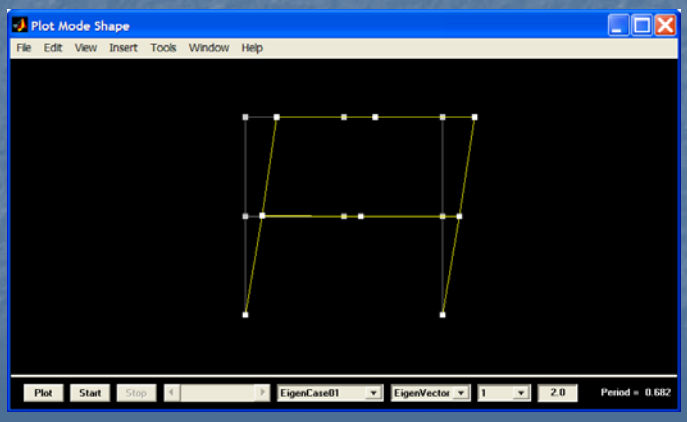
Post Processing

Nonlinear Dynamic Analysis



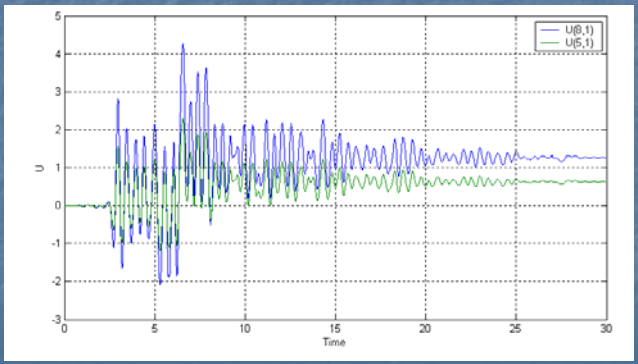
Plot Mode Shapes

Nonlinear Dynamic Analysis



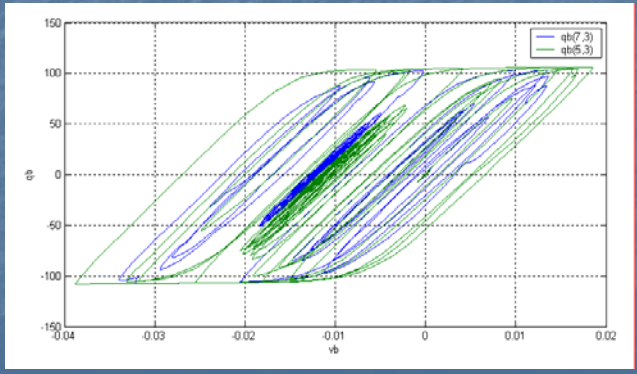
Time History Response

Nonlinear Dynamic Analysis



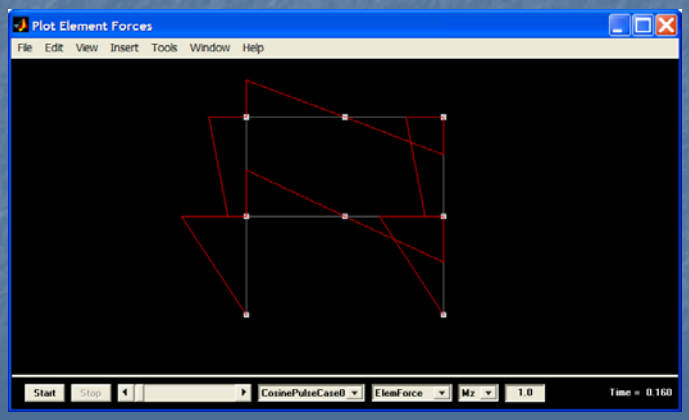
Hysteresis Loops

Nonlinear Dynamic Analysis



Element Forces

Nonlinear Dynamic Analysis



Summary

- OpenSees Navigator provides
  - Flexible and user friendly GUI
  - Many built in post processing toolboxes
  - Easy way to study material, section, element or system behaviors
  - Great tool to visualize structural behavior
  - GUI for AISC steel manual section properties

Summary

- Thinking ahead: OpenSees Navigator 2.0
  - Better graphical visualizations
  - More templates
  - Multiple support excitations
  - Hybrid Simulation
  - More design packages
  - .....

Conclusion

OpenSees Navigator 1.0 will be available at

- http://peer.berkeley.edu/OpenSeesNavigator

Thank you

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Andreas Schellenberg:
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