

Manually Creating Nodes and Elements

I-DEAS™ Tutorials: Fundamental Skills

Develop a finite element (FE) model by manually creating nodes and elements.

Learn how to:

- display the part coordinate system
- create and copy nodes
- create and copy elements
- reflect and extrude elements

Before you begin...

Prerequisite tutorials:

- Getting Started (I-DEAS™ Multimedia Training)

—or—

Quick Tips to Using I-DEAS

—and—

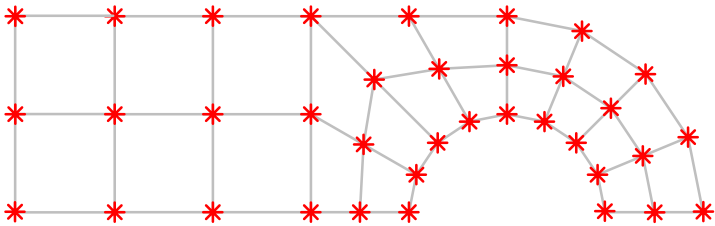
Creating Parts

- Introduction to Simulation

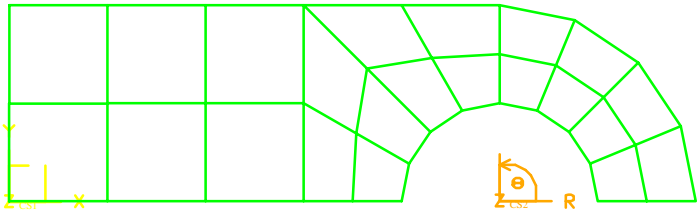
Key Tasks

Do not start building the FE model yet!
This Key Tasks page gives you an overview of what to expect in this tutorial.

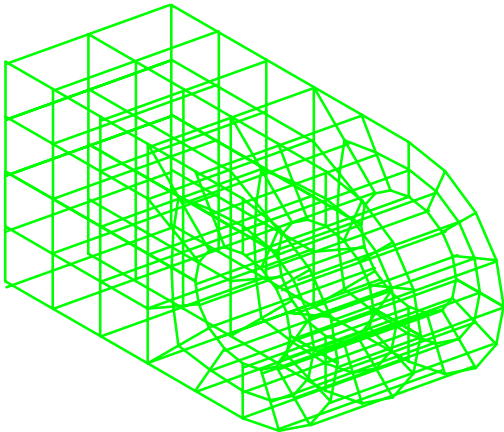
In this tutorial, you'll create a mesh on a non-existent (null) part in stages to help illustrate the following skills:
Create and copy nodes in cartesian and cylindrical coordinate systems.



Create and copy elements.



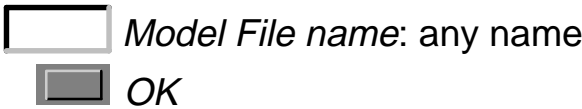
Reflect and extrude elements.



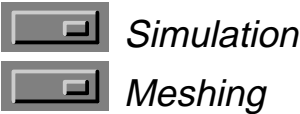
If you didn't start I-DEAS with a new (empty) model file, open a new one now and give it a unique name.



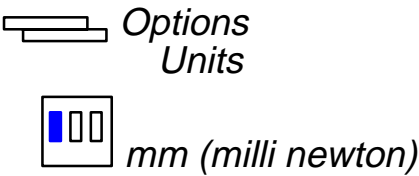
Open Model File form



Make sure you're in this application and task:



Set the units to mm.



Save your model file.



Warning!

If you are prompted by I-DEAS to save your model file, respond:



Save only when the tutorial instructions tell you to—not when I-DEAS prompts for a save.

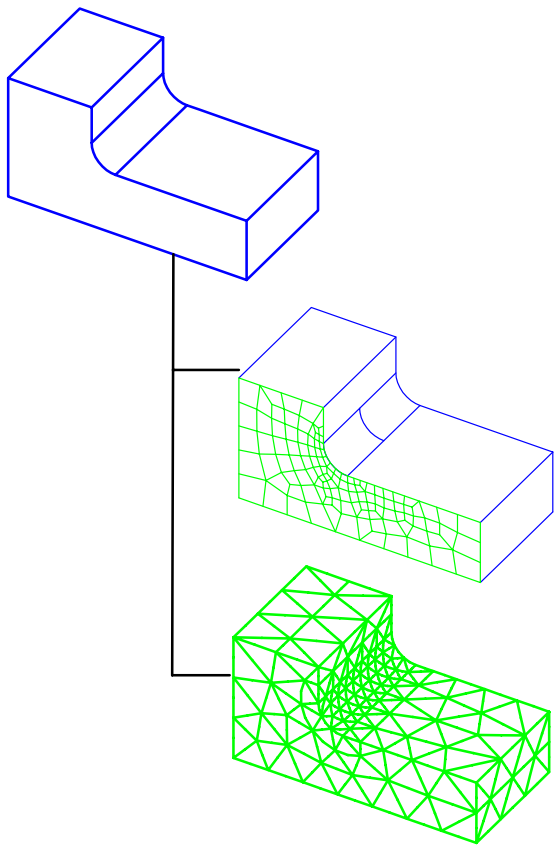
Why:

If you make a mistake at any time between saves and can't recover, you can reopen your model file to the last save and start over from that point.

Hint

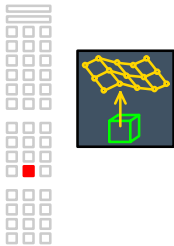
To reopen your model file to the previous save, press Control-Z.

An FE-model is always associated with a part. When an FE-model is named without a part, a null part is created. The null part is only a coordinate system.



What: Create an FE-model.

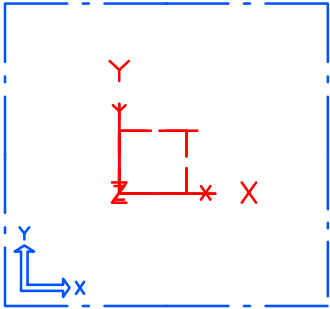
How:



FE Model Create form

Part or Assembly: any unique name

FE Model Name: Manual Mesh



Things to notice .

Use *Manage Bins* to see that the FE model “Manual Mesh” is associated with the part.

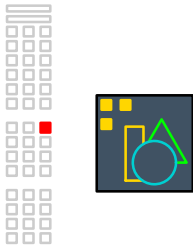
Hint



Double-click on the part name.

What: Turn on the label display for the part coordinate system and for nodes.

How:



Display Filter form



Part Display Filter form

Label

☒ Coordinate Systems (toggle on)

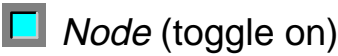
 Don't close the Display Filter form yet.

Display Filter form

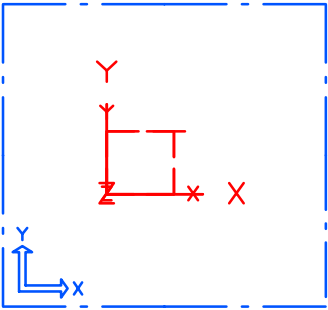


FEM Display Filter form

Label



Display Filter form



Recovery Point

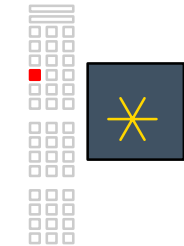


Things to notice

When you create nodes later in this tutorial, node label numbers will be shown on your display. For clarity, they are not shown in this tutorial.

What: Create nodes at 0,0,0; 0,20,0; and 0,40,0.

How:

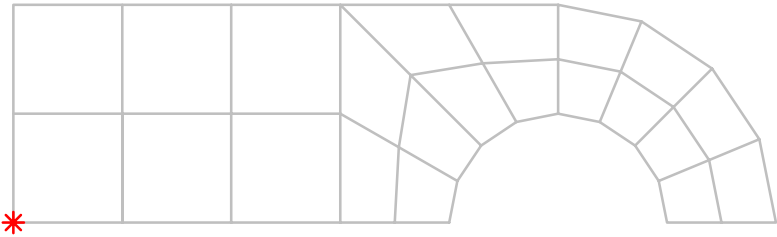


Node form



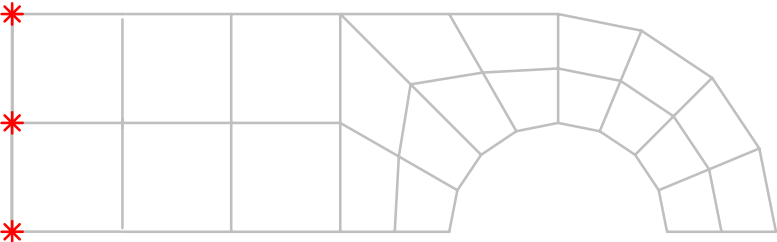
 **Check I-DEAS Prompt.**

X,Y,Z: 0 0 0



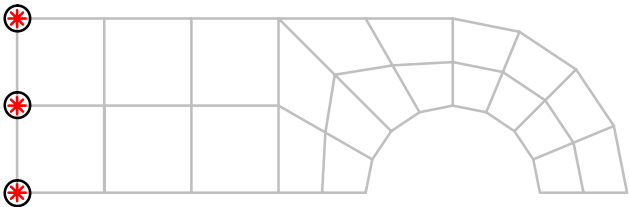
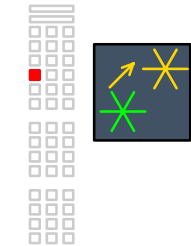
X,Y,Z: 0 20 0

X,Y,Z: 0 40 0



What: Copy these 3 nodes in the X direction.

How:

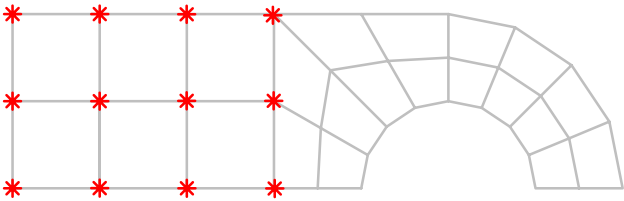


Check I-DEAS Prompt.

number of copies: 3

node start label,inc: 4,1

delta X,Y,Z: 20 0 0



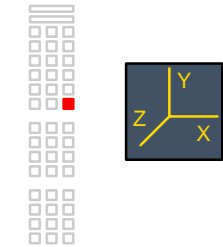
Recovery Point

*File
Save*

What: Create a second coordinate system.

Why: This coordinate system can be used to create nodes and to define radial boundary conditions.

How:



pick the coordinate system



Origin



Key In



Check I-DEAS Prompt.



X,Y,Z of origin: 100 0 0



Options

Coordinate System Options form

Coordinates:



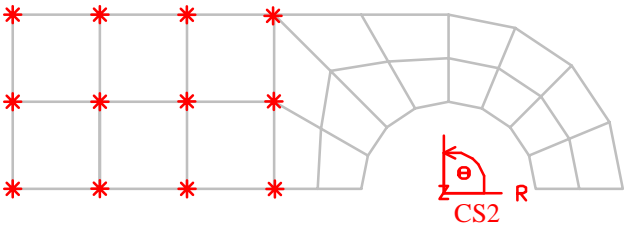
Cylindrical



OK

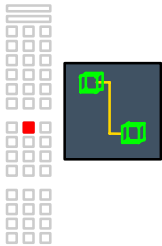


Done



What: Align the workplane with the R-Theta plane of the coordinate system.

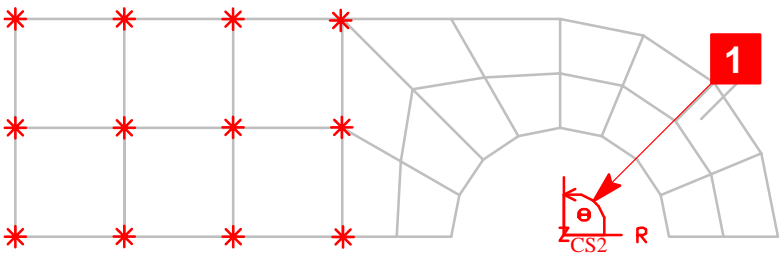
How:



pick the blue workplane

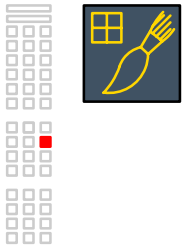
1

pick the R-Theta plane of CS2



Done

What: Change the workplane to cylindrical coordinates.



Workplane Attributes form

Coordinates



Cylindrical



OK

What: Create a node at R=20.

How:



Node form

Label: 70



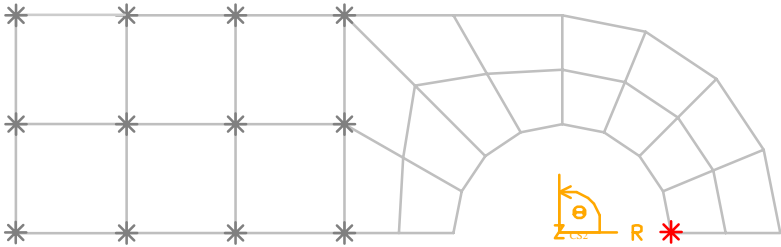
Reference CS:

CS2



OK

R,Theta,Z: 20 0 0



Done

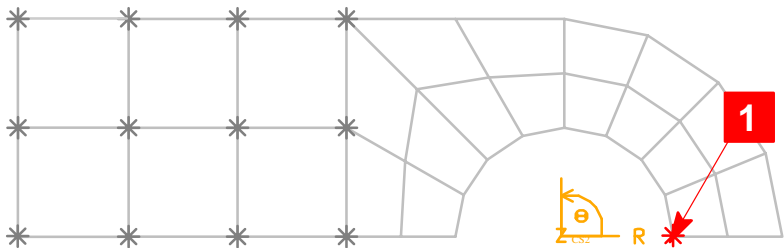
Hint
Nodes can be created starting with any number to help organize the model.

What: Copy the node 2 times in the R direction.

Hint



1

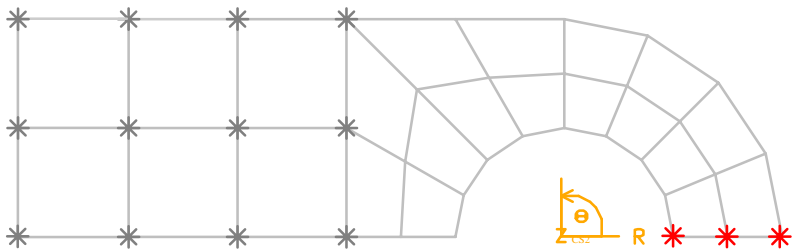


Done

number of copies: 2

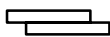
node start label,inc: <Return>

delta R,Theta,Z: 10 0 0



Yes

Recovery Point



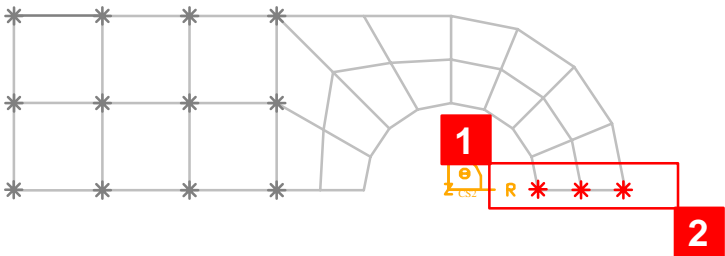
File
Save

What: Make 4 copies of these 3 nodes at an angle of 22.5 degrees.

How:



use area-select to pick the nodes

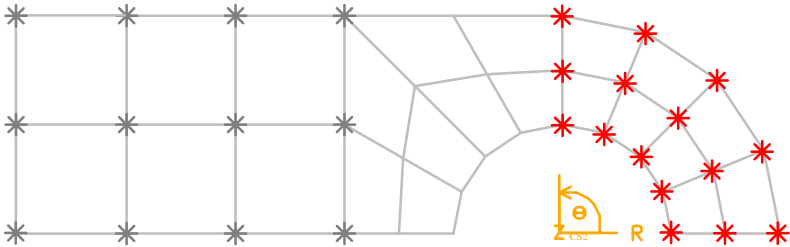


Done

number of copies: 4

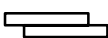
node start label,inc: <Return>

delta R,Theta,Z: 0 22.5 0



YES

Recovery Point



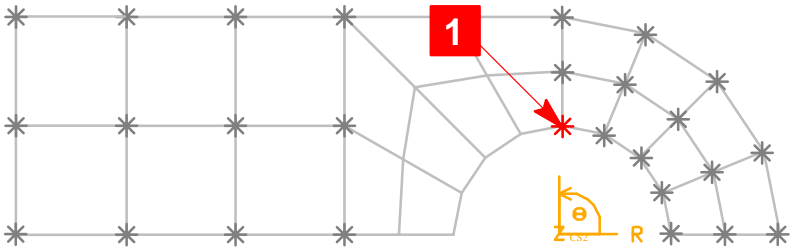
File
Save

What: Complete the model by finishing the bottom arch and placing the intermediate nodes.

How:



1

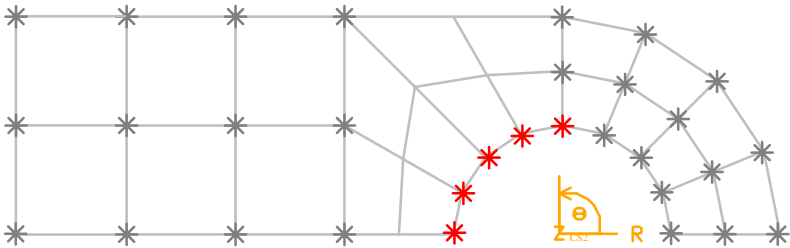


Done

number of copies: 4

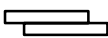
node start label,inc: <Return>

delta R,Theta Z: 0 22.5 0



Yes

Recovery Point



File
Save

What: Change the workplane coordinates back to Cartesian.

Hint



Coordinates



Cartesian

What: Create a node between the 2 nodes shown.

How:



1

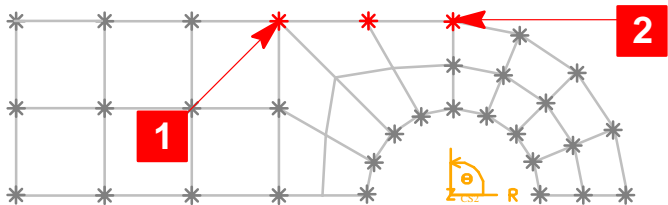


Done

2



Done



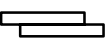
number of copies between sets: 1

node start label,inc: 50,1



Yes

Recovery Point



File

Save

What: Generate nodes between the 2 sets of nodes shown.

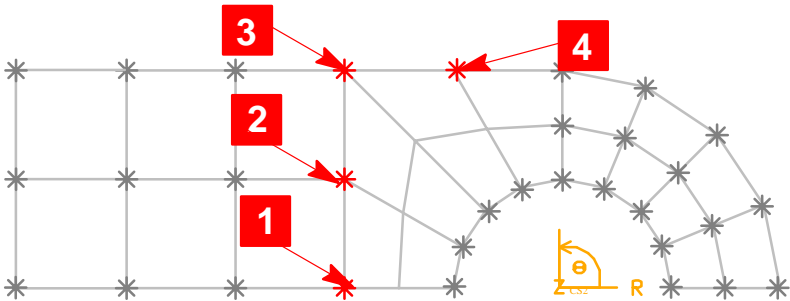
Hint



Nodes required for 1st master set:



shift-pick 1–4

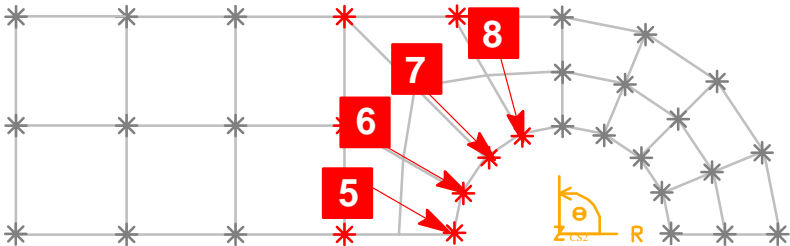


Done

Nodes required for 2nd master set:



shift pick 5–8

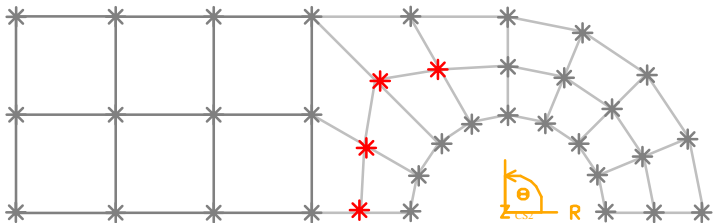


Done

number of copies: 1

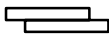
node start label,inc: <Return>

Result



Yes

Recovery Point

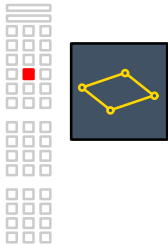


File
Save

Elements are defined by nodes (usually at the corners). They display with connecting lines.

What: Create 1 thin-shell element.

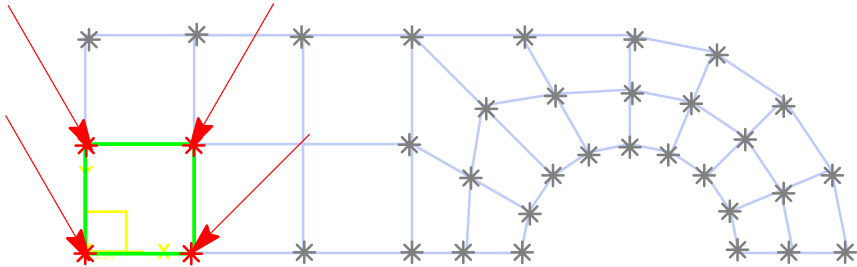
How:



Element form



shift-pick the 4 nodes in clockwise or counter-clockwise order



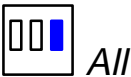
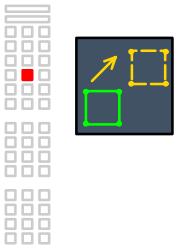
Done

Recovery Point



What: Copy the element to create another element.

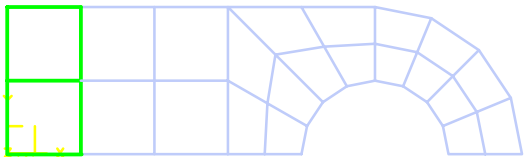
How:



number of copies <Return>

new element start label,inc <Return>

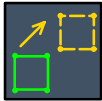
node increment between copies: 1



Why: The node increment of 1 means that every node on element 2 is one higher than element 1. The first node of element 1 is 1, the first node of element 2 is 2. This only works if the nodes are numbered in a logical pattern.

What: Copy these 2 elements to the right.

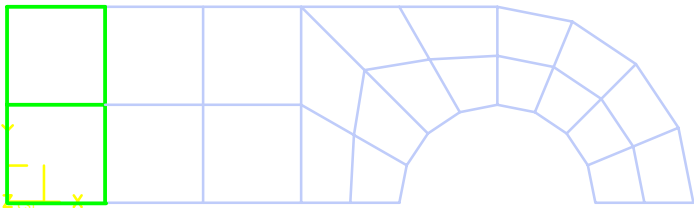
Hint



All



Done

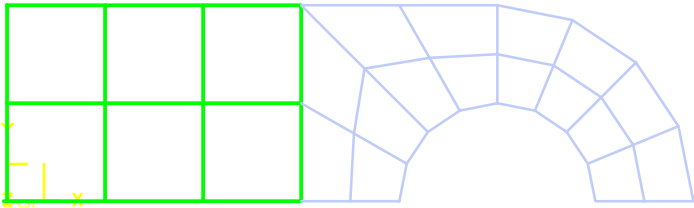


number of copies: 2

new element start label,inc: <Return>

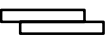
node increment between copies: 3

Why: The nodes at the left are vertically N1, N2, and N3. The node to the right of N1 is N4, which is an increment of 3.



Yes

Recovery Point

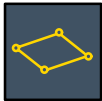


File

Save

What: Create an element on the radial section.

How:



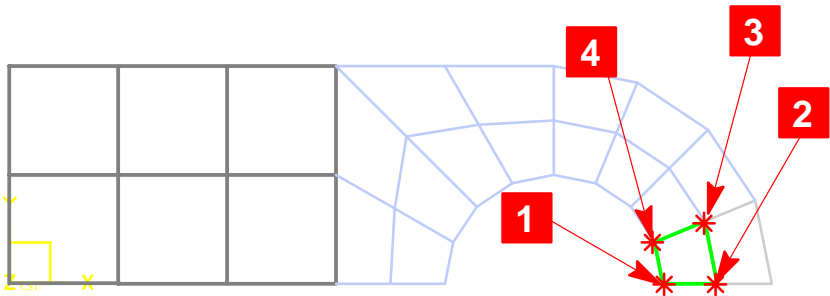
Element form



shift-pick 4 nodes in order

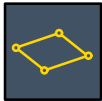


Done

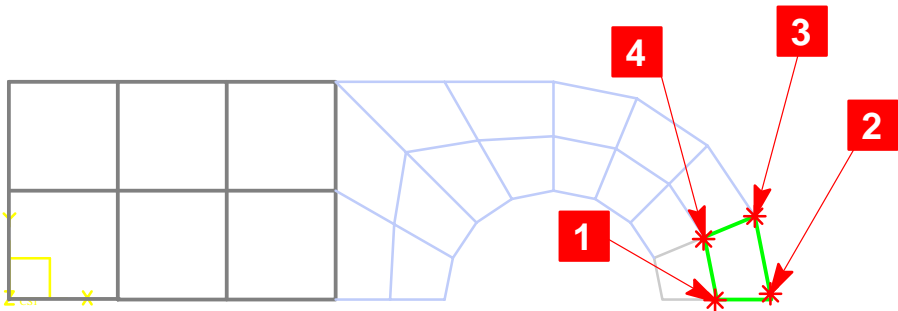


What: Create a second element on the radial section.

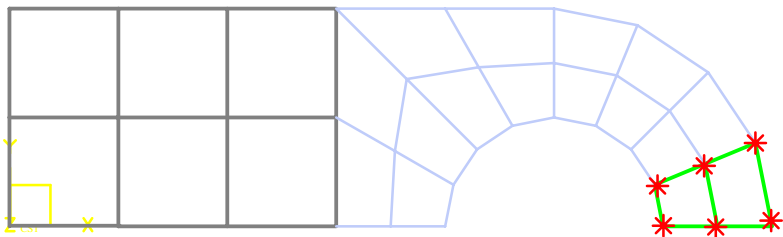
Hint



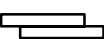
shift-pick 4 nodes in order



Done



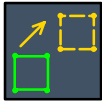
Recovery Point



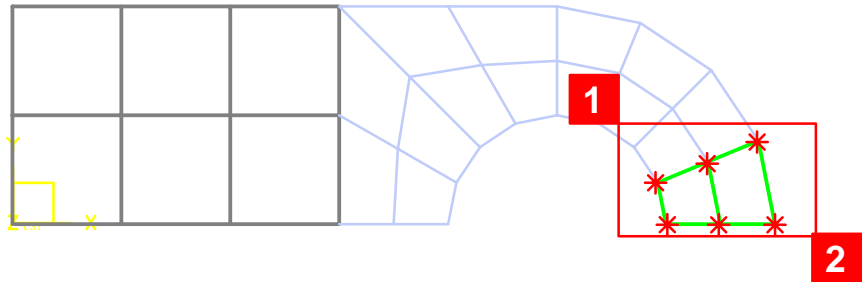
File
Save

What: Copy these 2 elements.

Hint



use area-select to pick both elements

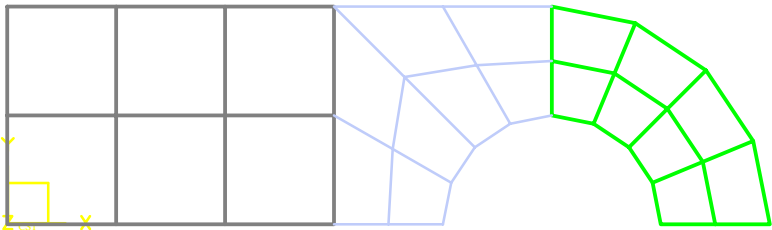


Done

number of copies: 3

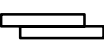
new element start label,inc: <Return>

node increment between copies: 3



Yes

Recovery Point

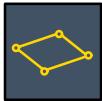


File

Save

What: Create elements in the transition with *Closest Nodes*.

How:

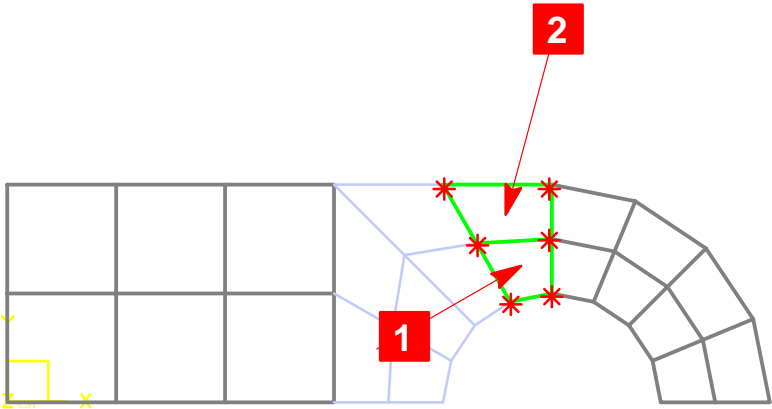



Element form



Closest Nodes

- 1** pick close to the center
- 2** pick close to the center

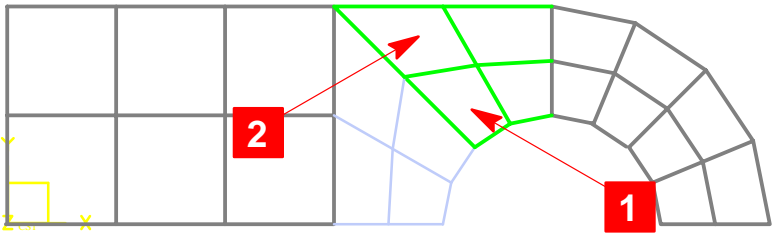


 If an element does not align to the desired nodes, click the right mouse button and select *Backup*. Re-display the mesh, re-select *Element* and repeat.

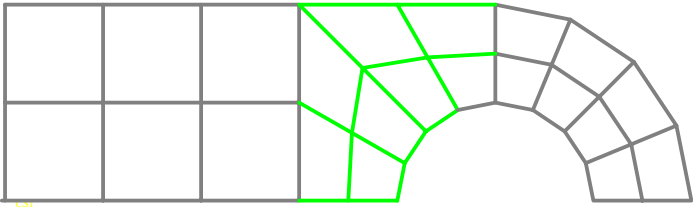
Why: Nodes in the transition area were not numbered in a pattern, so elements can't be copied by incrementing the node numbers.

What: Create 2 more elements.

- 1** pick close to the center
- 2** pick close to the center



What: Complete the last 4 elements using either individual nodes or *Closest Nodes*.

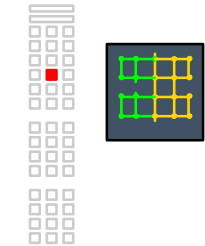


Recovery Point

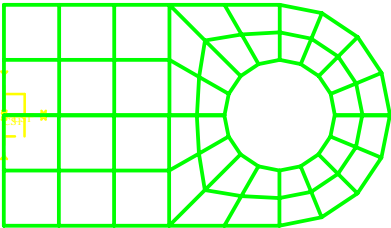
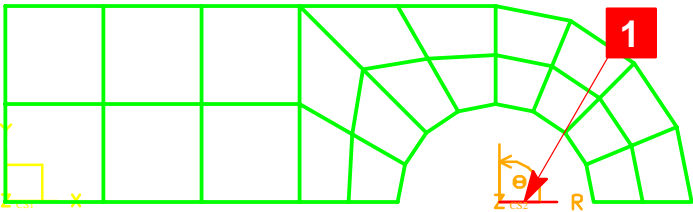


What: *Reflect* all elements to create the second half of the model.

How:



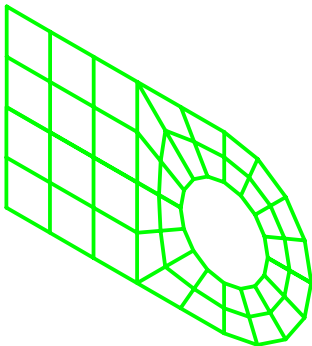
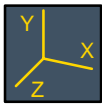
1 pick the RZ plane



Recovery Point



What: Switch to an isometric view.



What: Turn on menus.



Preferences form



Menu Preferences form



Type



What: Extrude the shells into solid elements.

Element
Multiple Create
Extrude
Translate

Solid

All

Done

X,Y,Z translation: 0 0 40

twist angle: <Return>

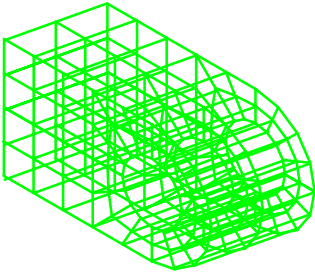
number of copies: 2

accept the default for the rest of the prompts

Materials form

OK

Yes



Things to notice The parent thin-shell elements still exist along with the solid elements.

Options
Menus ON/OFF

Tutorial wrap-up

You have completed the Manually Creating Nodes and Elements tutorial.

Delete the FE model, then delete the part. This part is not used in any other tutorial.

Hint



See also...

For additional information on the concepts covered in this tutorial, see the following:

 *Help, Manuals, Table of Contents*

Simulation: Finite Element Modeling User's Guide

Simulation Techniques and Examples

General Techniques and Examples

Creating Materials

Meshing; Creating Nodes and Elements

Using Simulation Tools

Managing Models in Simulation

Working with Coordinate Systems

Displaying and Deleting Simulation Entities

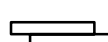
Meshing a Model

Managing Nodes and Elements

What's next?

After exiting, choose the Fundamental Skills tutorial that is next in the learning path you are following.

To exit this tutorial, select:

 *File*
Exit

Warning!

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Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150
(513) 576-2400