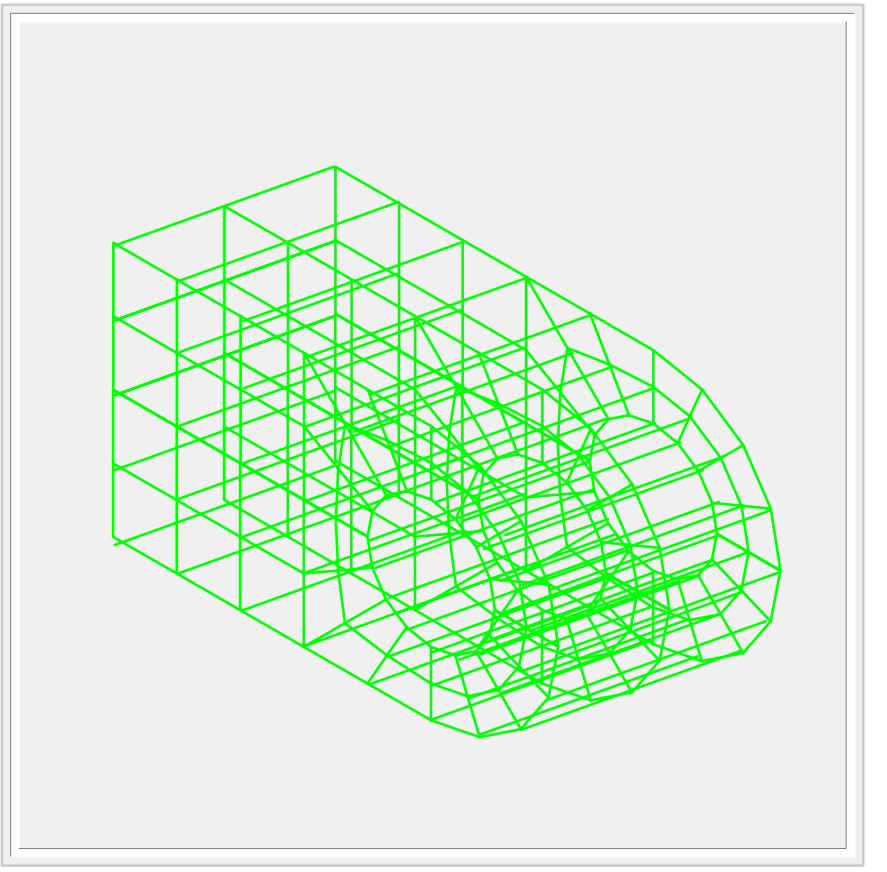


Manually Creating Nodes and Elements

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–

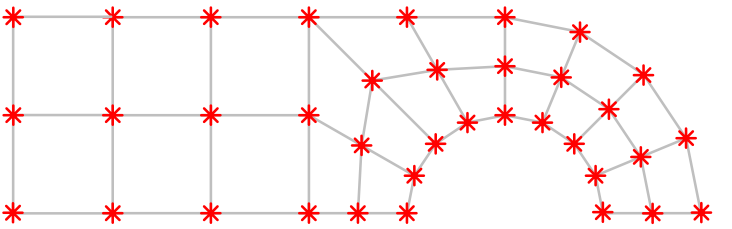
  Quick Tips to Using I-DEAS
  –and–
  Creating Parts
- Introduction to Simulation

Key Tasks

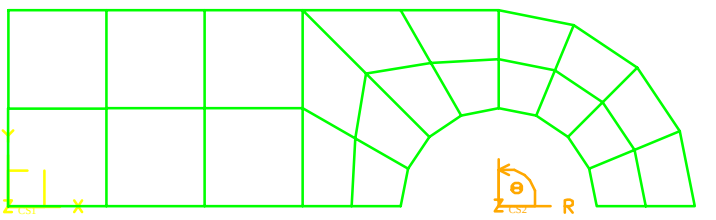
Do not start building the FE model yet!
This Key Tasks page gives you an overview of what to expect in this tutorial.

In this tutorial, you'll create a mesh on a non–existent (null) part in stages to help illustrate the following skills:

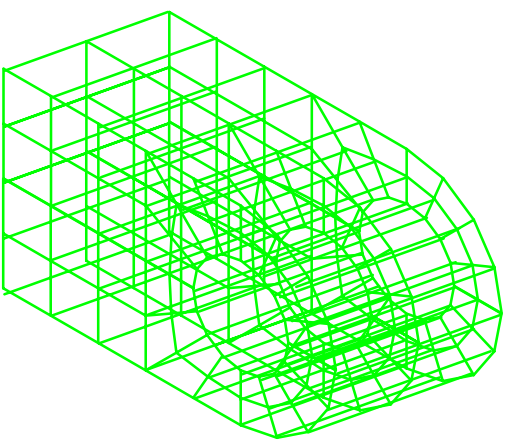
Create and copy nodes in cartesian and cylindrical coordinate systems.



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.

File
Open

Open Model File form

Model File name: any name
OK

Make sure you're in this application and task:

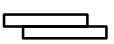
Simulation
Meshing

Set the units to mm.

Options
Units

mm (milli newton)

Save your model file.



File
Save

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

No

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

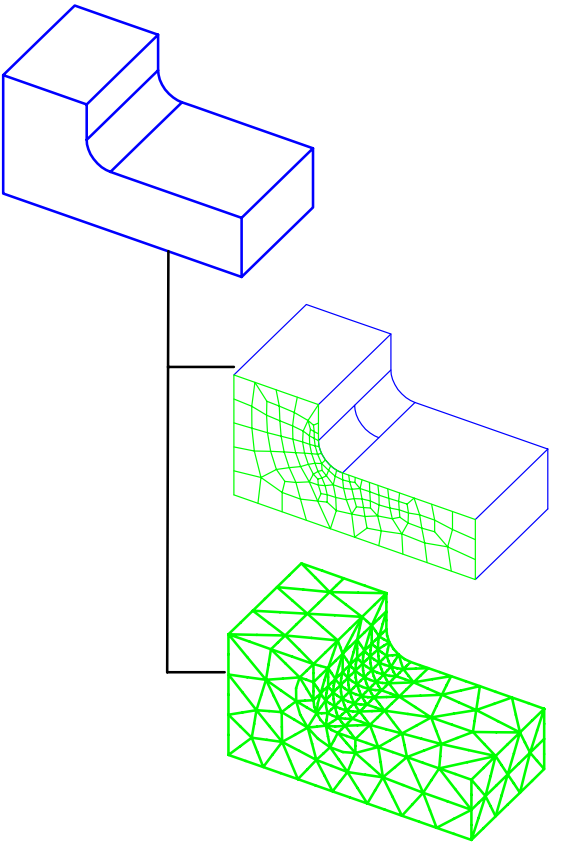
Why:
If you make a mistake at any time between saves and can't recover, you can reopen your model file to the last save and start over from that point.

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

Display the part coordinate system 1 of 4

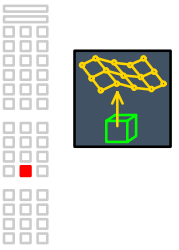
An FE-model is always associated with a part. When an FE-model is named without a part, a null part is created.

The null part is only a coordinate system.



What: Create an FE-model.

How:

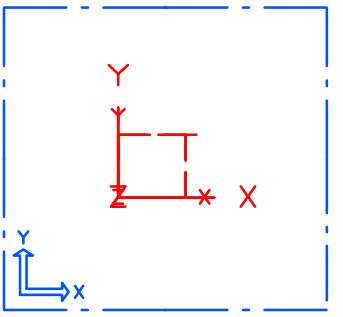


FE Model Create form

Part or Assembly: any unique name

FE Model Name: Manual Mesh

OK



Things to notice .

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

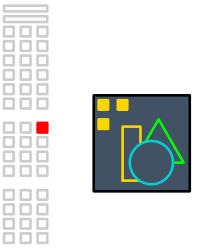
Hint

Double-click on the part name.

Display the part coordinate system 3 of 4

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

How:



Display Filter form

Parts...

Part Display Filter form

Label

Coordinate Systems (toggle on)

OK

Don’t close the Display Filter form yet.

Display Filter form

FE Models...

FEM Display Filter form

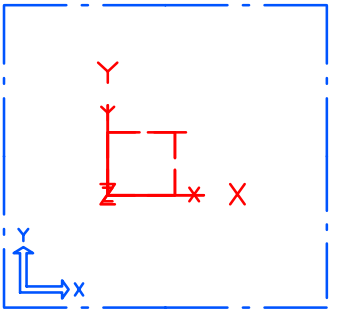
Label

Node (toggle on)

OK

Display Filter form

OK



Recovery Point

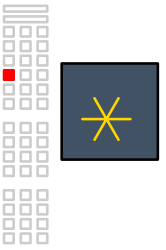
File
Save

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:

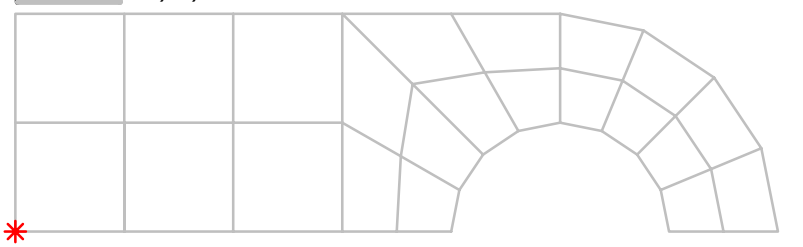


Node form

OK

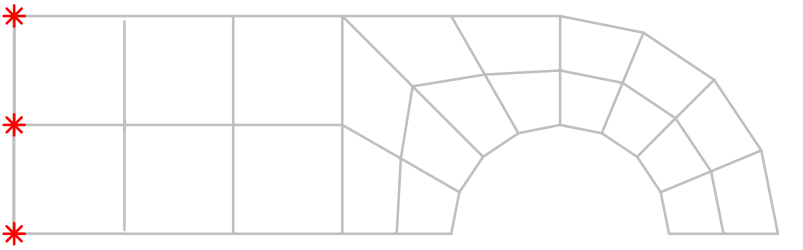
Check *I-DEAS Prompt*.

X,Y,Z: 0 0 0



X,Y,Z: 0 20 0

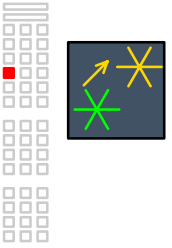
X,Y,Z: 0 40 0



Done

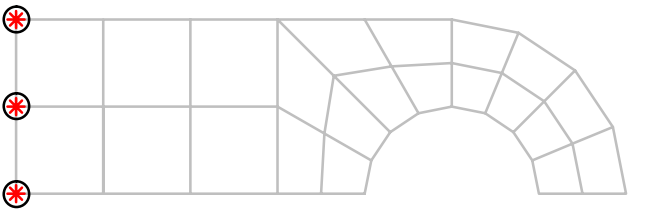
What: Copy these 3 nodes in the X direction.

How:



All

Done

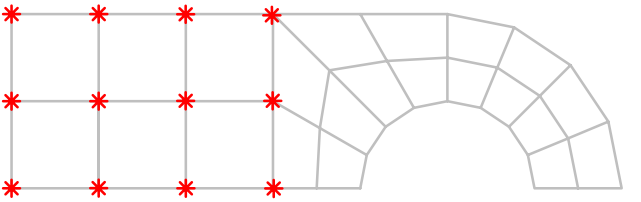


Check *I-DEAS Prompt*.

number of copies: 3

node start label,inc: 4,1

delta X,Y,Z: 20 0 0



Yes

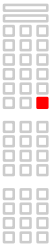
Recovery Point

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

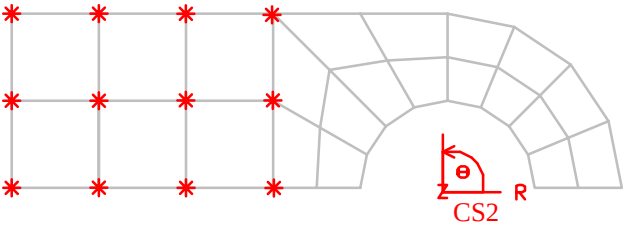
Coordinate System Options form

Coordinates:

Cylindrical

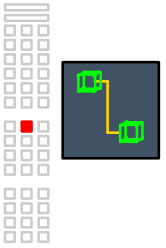
OK

Done



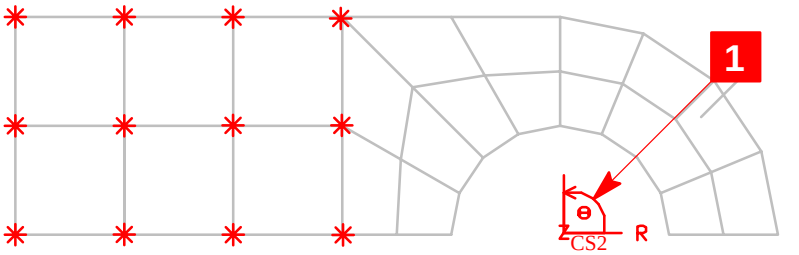
What: Align the workplane with the R-Theta plane of the coordinate system.

How:



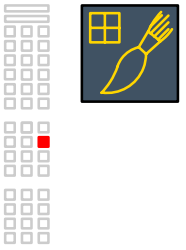
pick the blue workplane

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

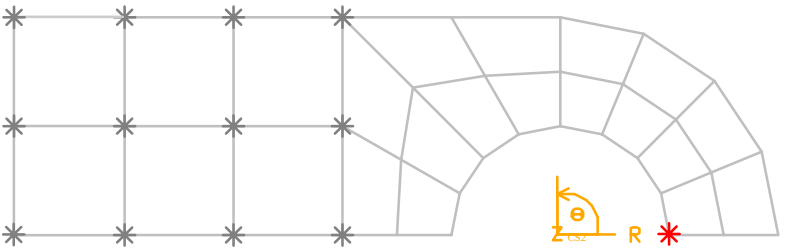
Label: 70

Reference CS:

CS2

OK

R,Theta,Z: 20 0 0



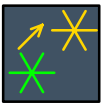
Done

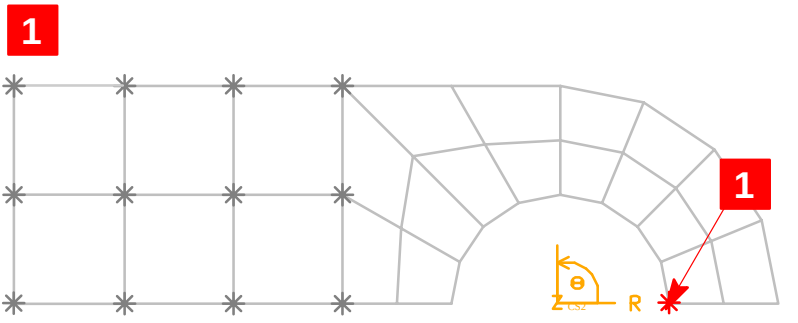
Hint

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

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

Hint



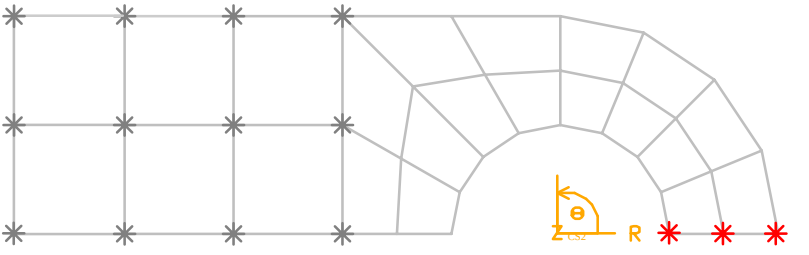


Done

number of copies: 2

node start label,inc: <Return>

delta R,Theta,Z: 10 0 0



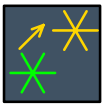
Yes

Recovery Point

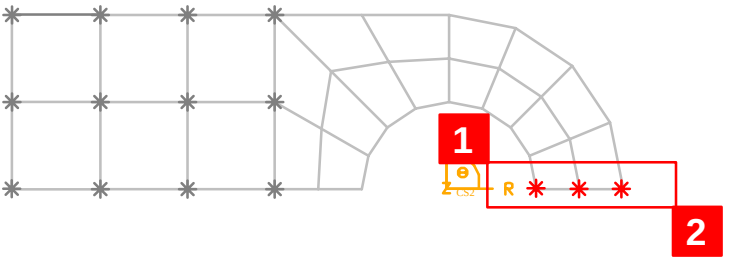
File
Save

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

How:



use area-select to pick the nodes



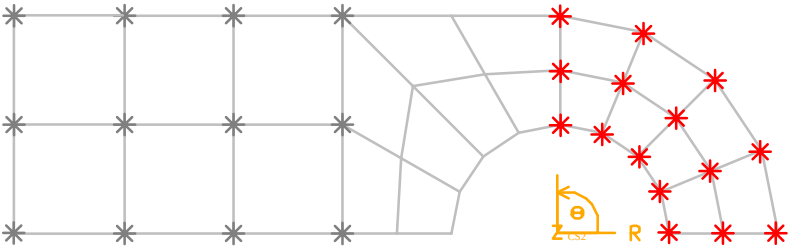
Done

---

number of copies: 4

node start label,inc: <Return>

delta R,Theta,Z: 0 22.5 0



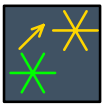
YES

Recovery Point

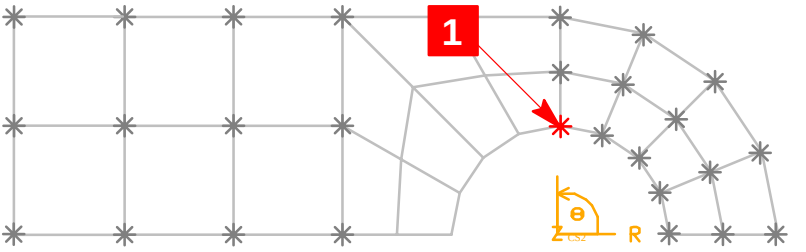
File
Save

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

How:



1

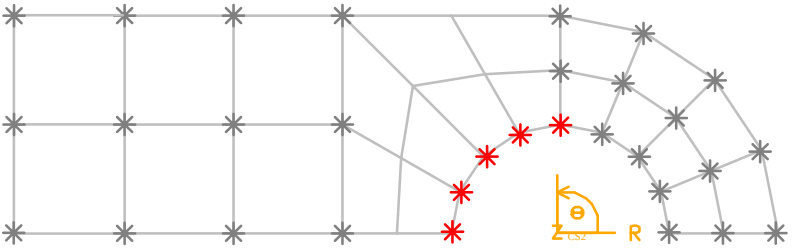


Done

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.

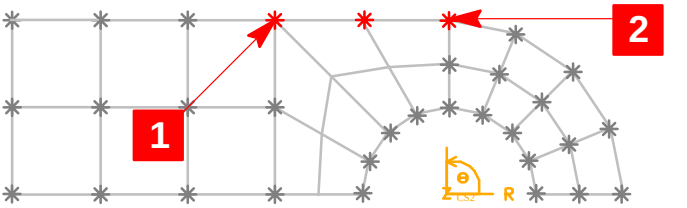
How:

1

Done

2

Done

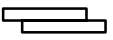


number of copies between sets: 1

node start label,inc: 50,1

Yes

Recovery Point



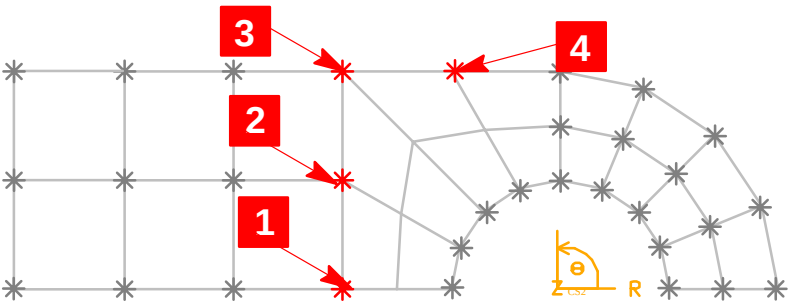
File
Save

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

Hint

Nodes required for 1st master set:

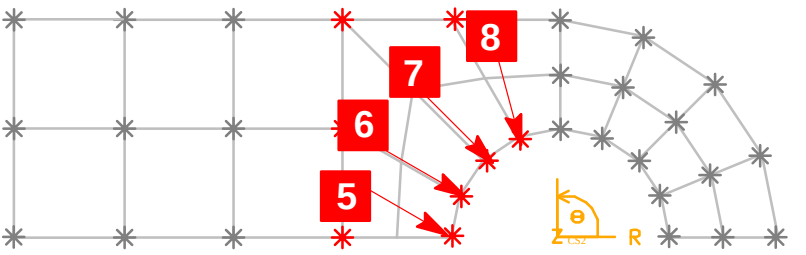
shift-pick 1–4



Done

Nodes required for 2nd master set:

shift pick 5–8

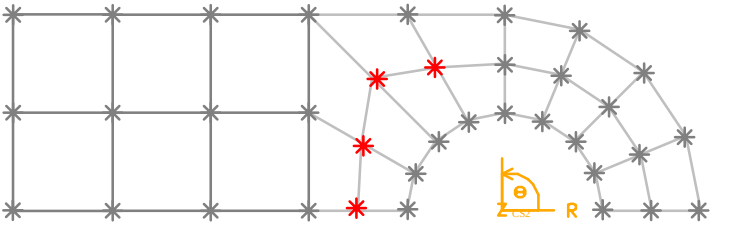


Done

number of copies: 1

node start label,inc: <Return>

Result



Yes

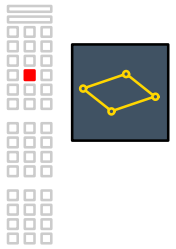
Recovery Point

File
Save

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

What: Create 1 thin-shell element.

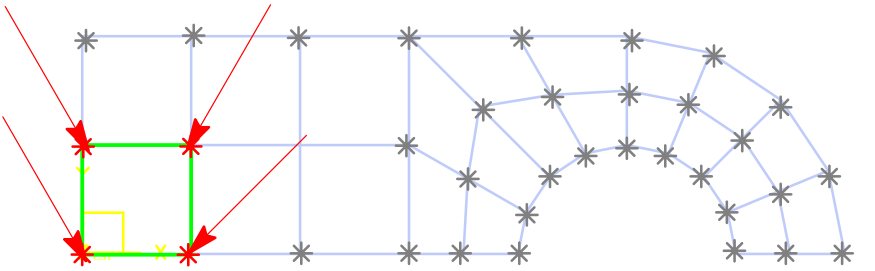
How:



Element form

OK

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



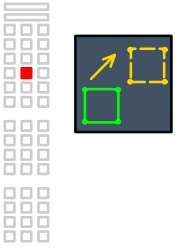
Done

Recovery Point

File
Save

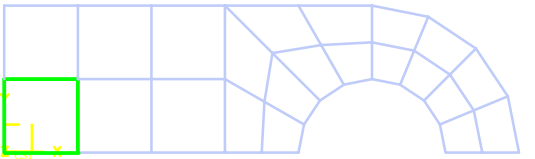
What: Copy the element to create another element.

How:



All

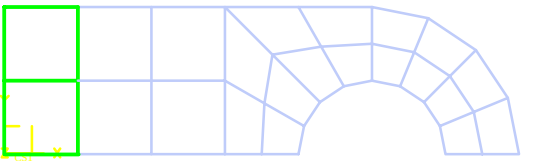
Done



number of copies <Return>

new element start label,inc <Return>

node increment between copies: 1

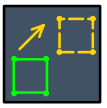


Yes

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.

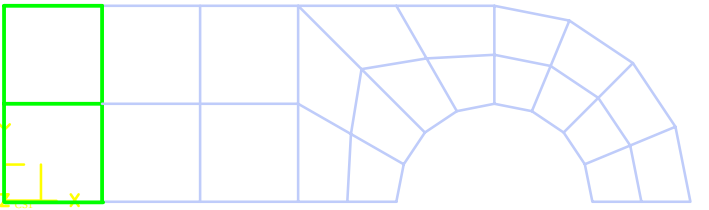
What: Copy these 2 elements to the right.

Hint



 *All*

 *Done*

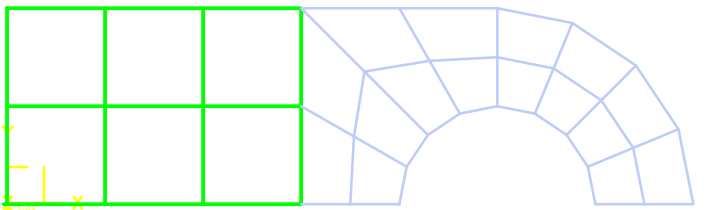


 *number of copies*: 2

 *new element start label,inc*: <Return>

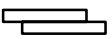
 *node increment between copies*: 3

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.



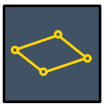
 *Yes*

Recovery Point

 *File*
Save

What: Create an element on the radial section.

How:

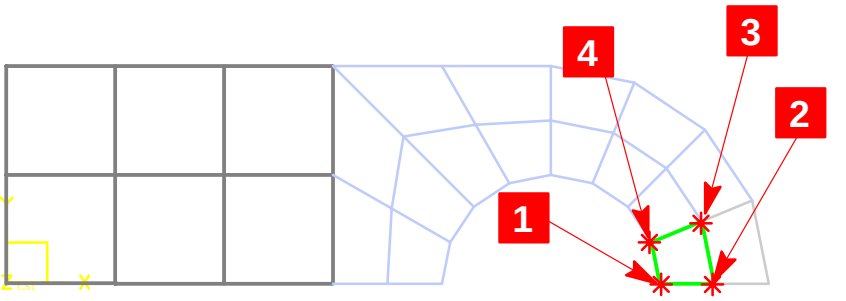


Element form

 *OK*

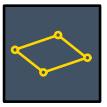
 shift-pick 4 nodes in order

 *Done*

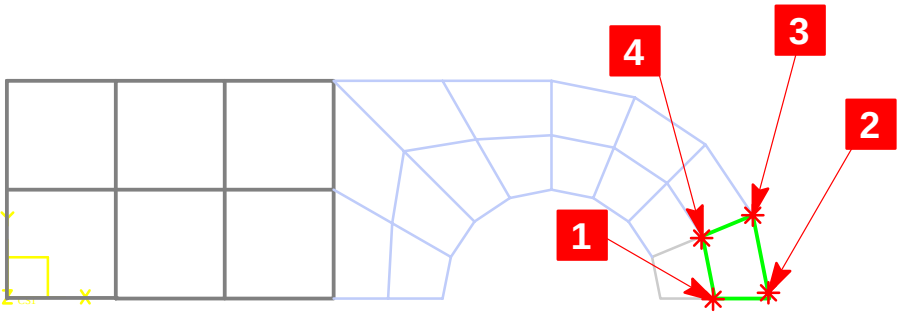


What: Create a second element on the radial section.

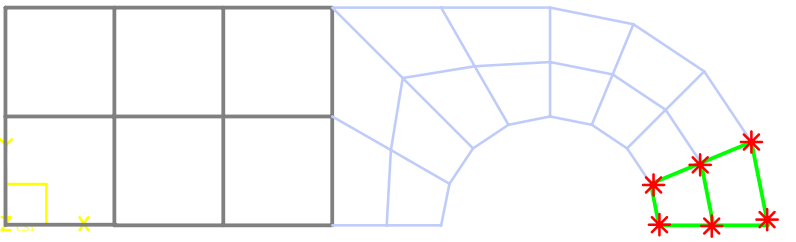
Hint



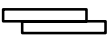
shift-pick 4 nodes in order



Done



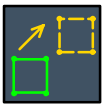
Recovery Point



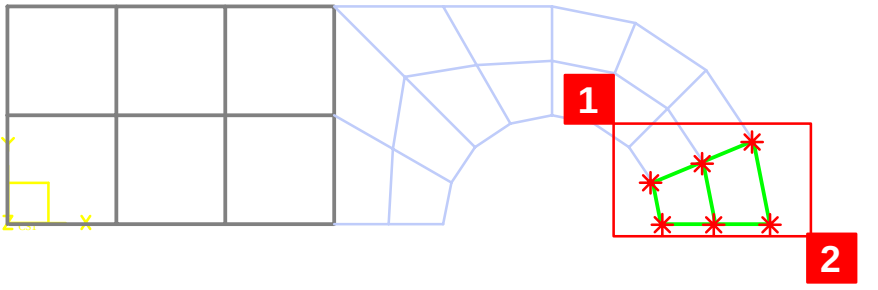
File
Save

What: Copy these 2 elements.

Hint



use area-select to pick both elements

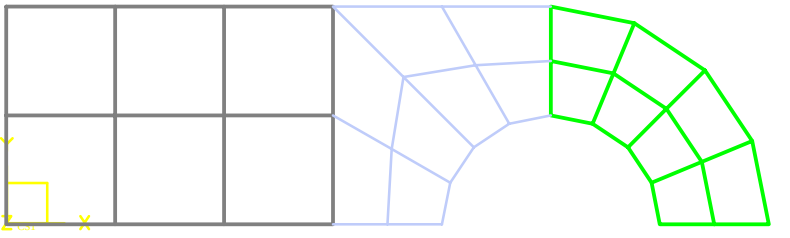


Done

number of copies: 3

new element start label,inc: <Return>

node increment between copies: 3



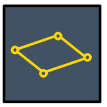
Yes

Recovery Point

File
Save

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

How:



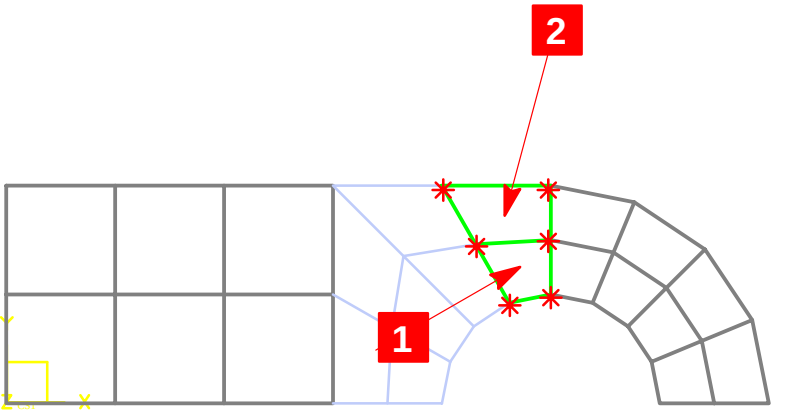
Element form

 *OK*

 *Closest Nodes*

1 pick close to the center

2 pick close to the center



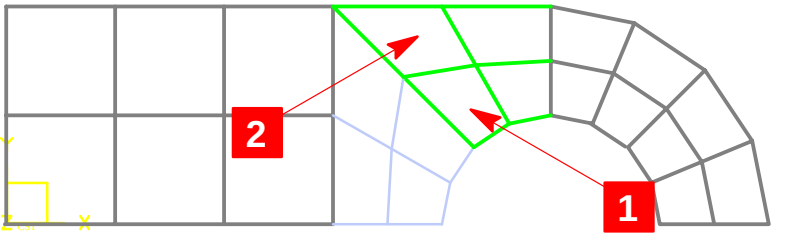
If an element does not align to the desired nodes, click the right mouse button and select *Backup*. Re-display the mesh, re-select *Element* and repeat.

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

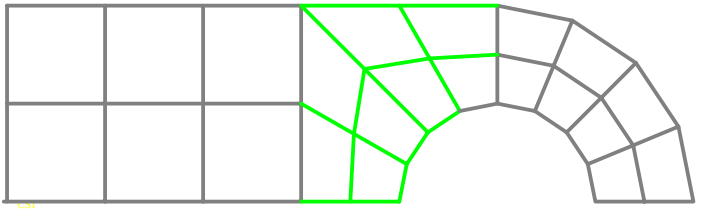
What: Create 2 more elements.

1. pick close to the center
2. pick close to the center

Done



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

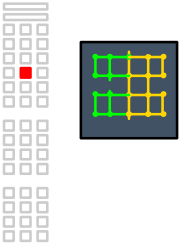


Recovery Point

File
Save

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

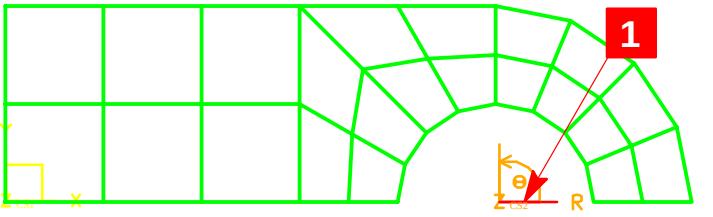
How:



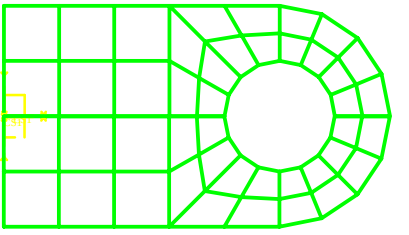
All

Done

1 pick the RZ plane



accept all defaults

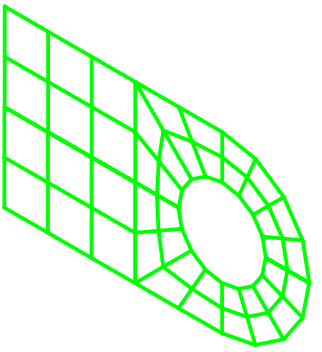


Yes

Recovery Point

File
Save

What: Switch to an isometric view.



What: Turn on menus.

Options
Preferences...

Preferences form

Menus...

Menu Preferences form

Menu display (toggle on)
Type
All
OK

OK

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>

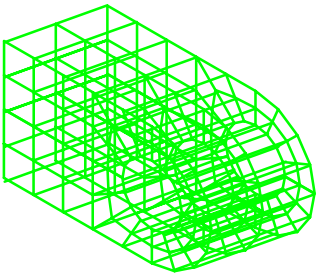
number of copies: 2

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!
Do not use the menu in the *I-DEAS Icons* window to exit. Use the menu in the Acrobat Reader window.

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