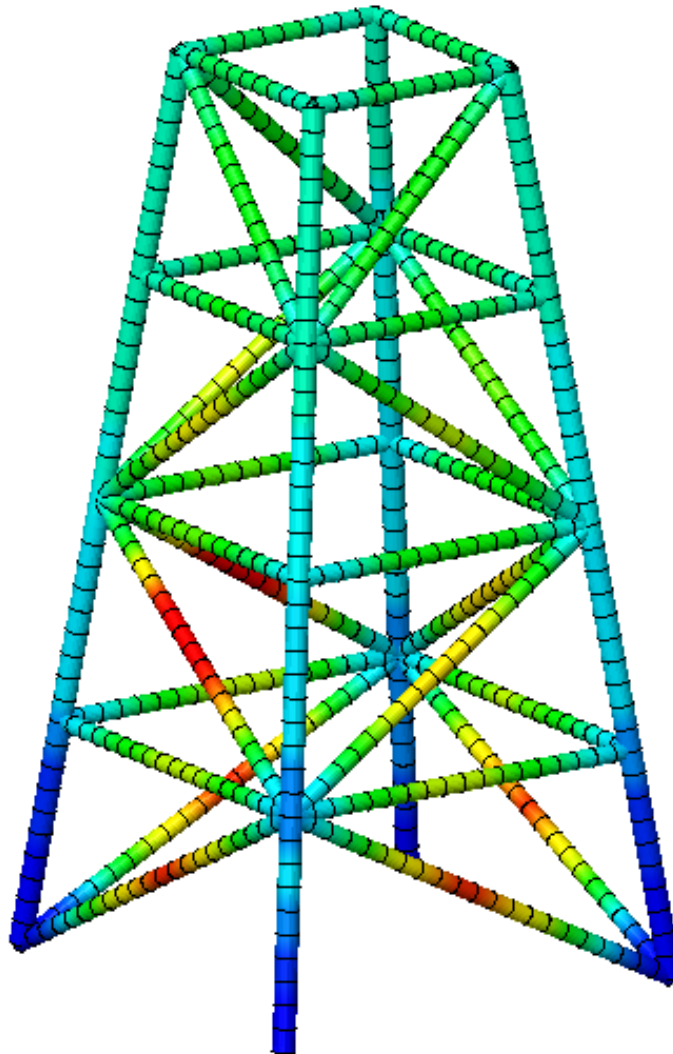


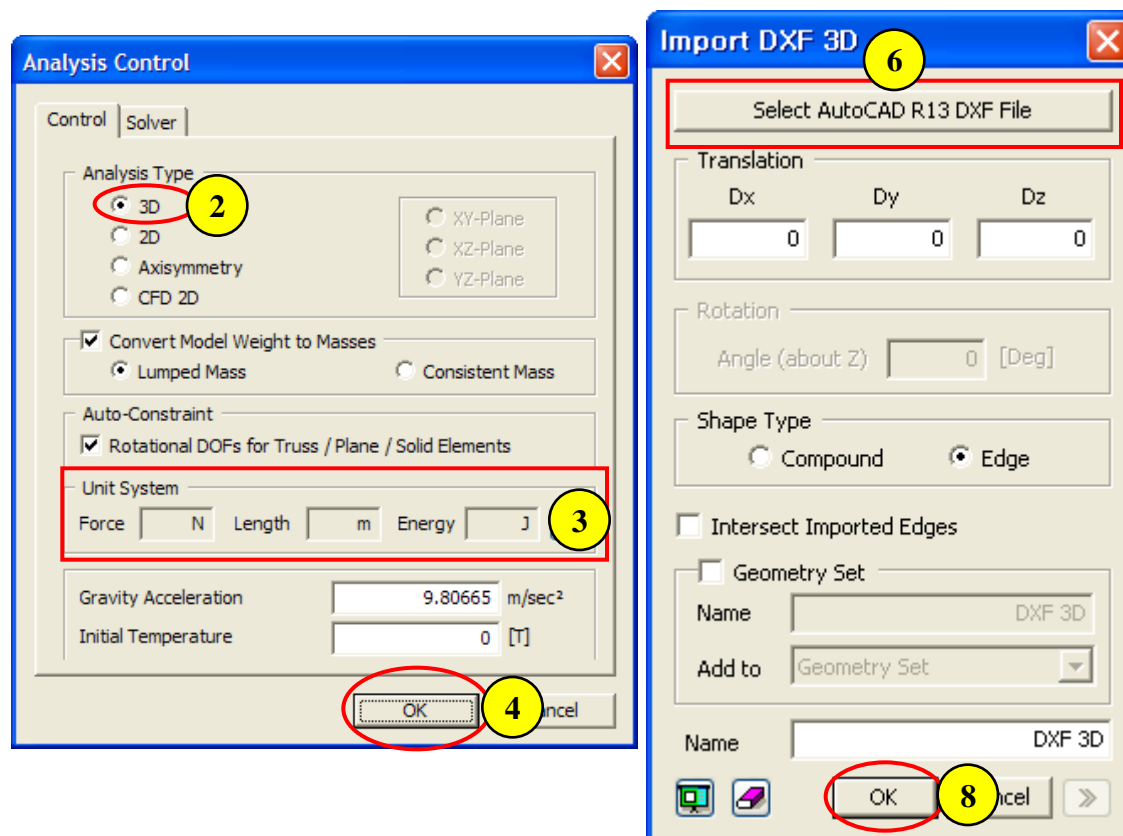
LS-10. Analysis of a Frame Tower



Overview

- 3-D Linear Static Analysis
- Model
 - Unit : N, m
 - Isotropic Elastic Material
 - Beam , Plate Element
 - Rigid Link Element
- Load & Boundary Condition
 - Body Force
 - Force
 - Constraint

Step 1.



1. Analysis > Analysis Control – “Control” tab

2. Analysis Type : 3D

3. Unit System : N , m

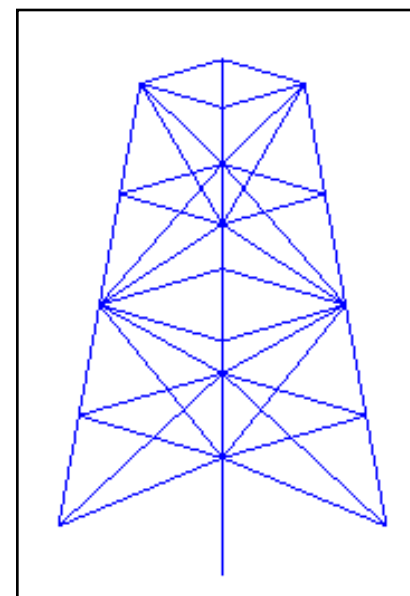
4. Click [OK] Button

5. File > Import > DXF 3D (Wireframe) ...

6. Click [Select AutoCAD R13 DXF file] Button

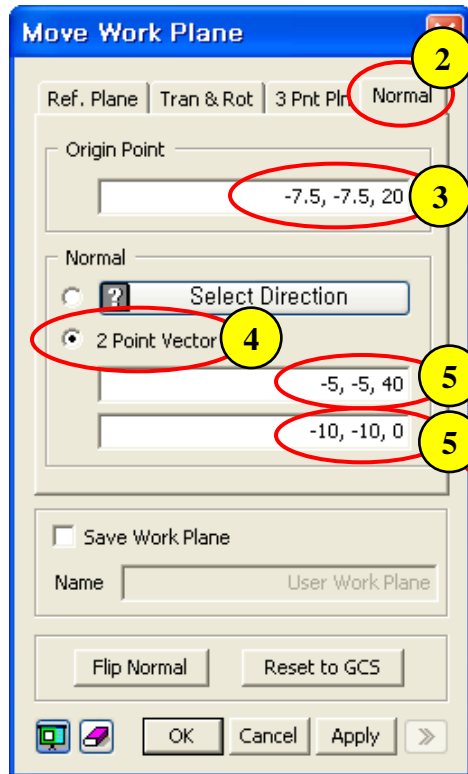
7. Select “Geometry of Frame Tower.Dxf” File

8. Click [OK] Button

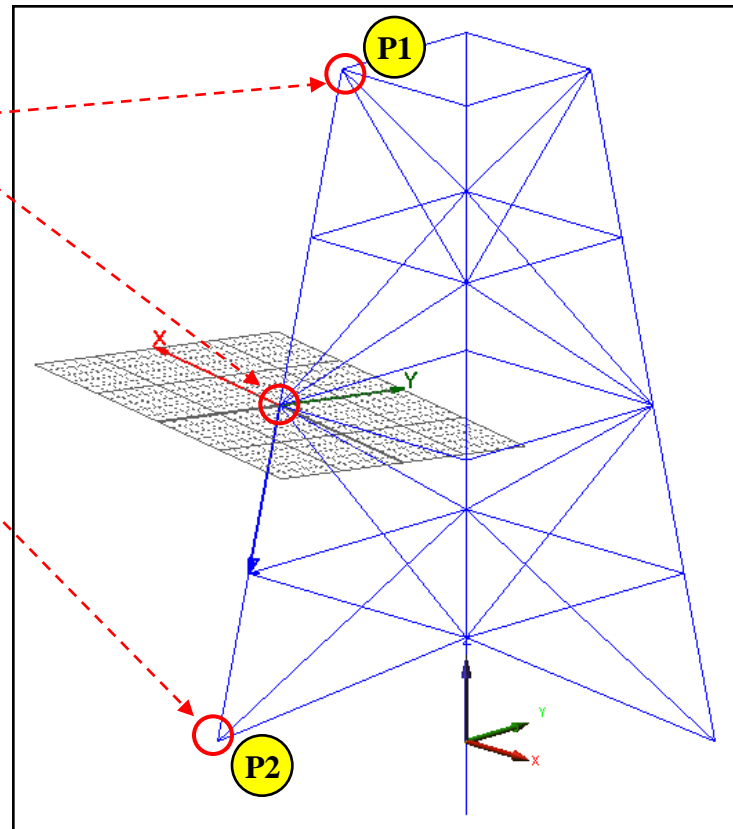


⚙️ Analysis Control Dialog is automatically activated at startup.

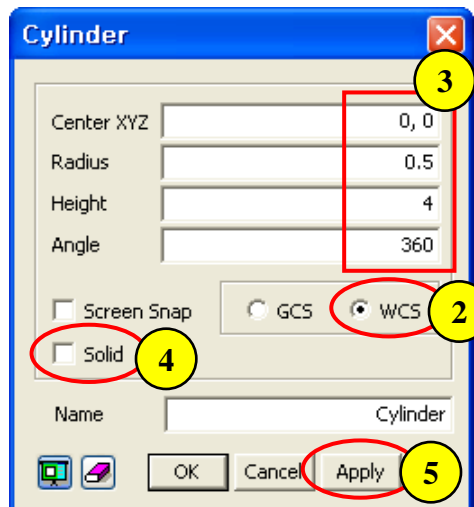
Step 2.



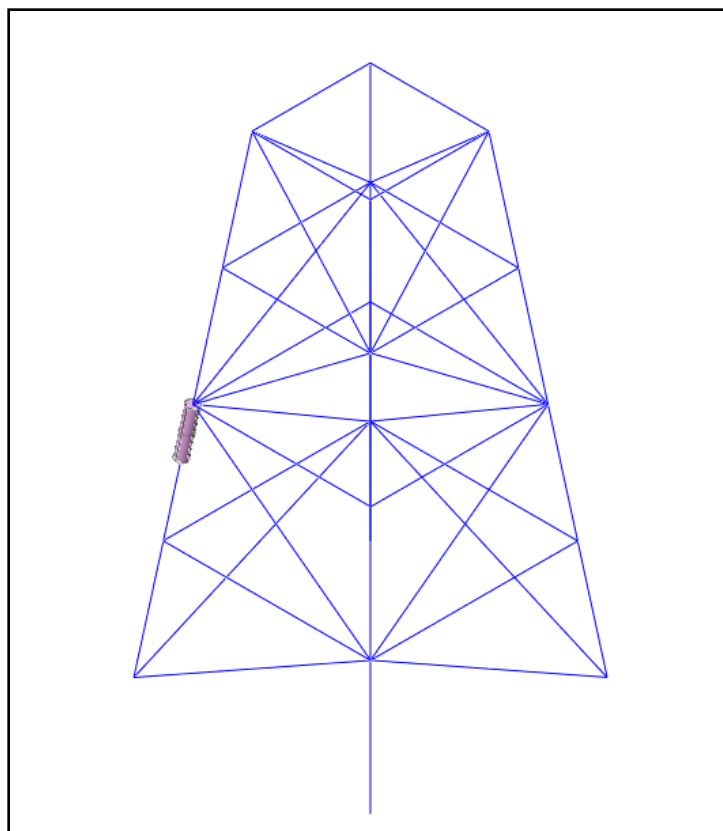
1. Geometry > Work Plane > Move ...
2. Select "Normal" Tab
3. Select Point marked by "O" for Origin Point (See Figure)
4. Check on "2 Point Vector"
5. Select P1 and P2
6. Click [OK] Button



Step 3.



1. *Geometry > Primitive Feature > Cylinder ...*
2. *Check on "WCS"*
3. *Radius (0.5) , Height (4)*
4. *Check off "Solid"*
5. *Click [Apply] Button*
6. *Repeat step 2~4 for Radius (0.4) , Height (2)*
7. *Click [OK] Button*



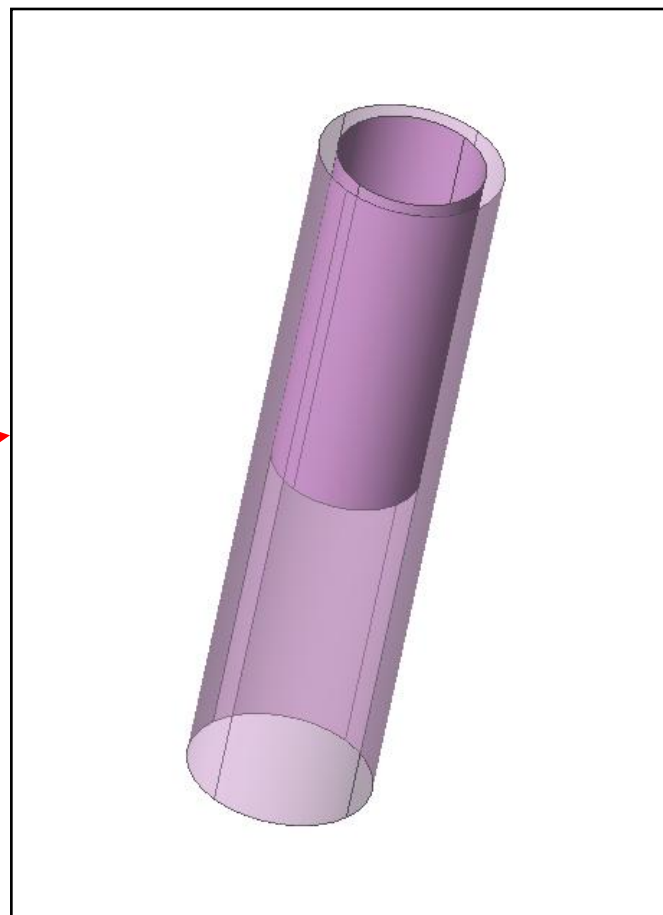
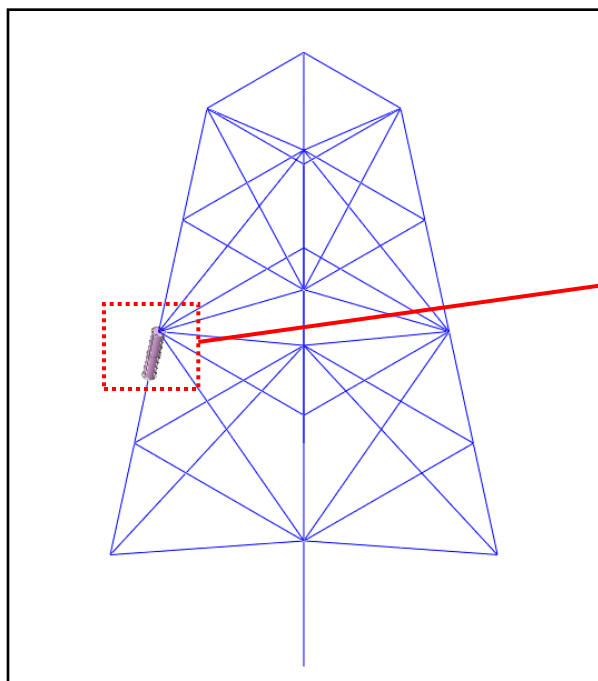
Step 4.



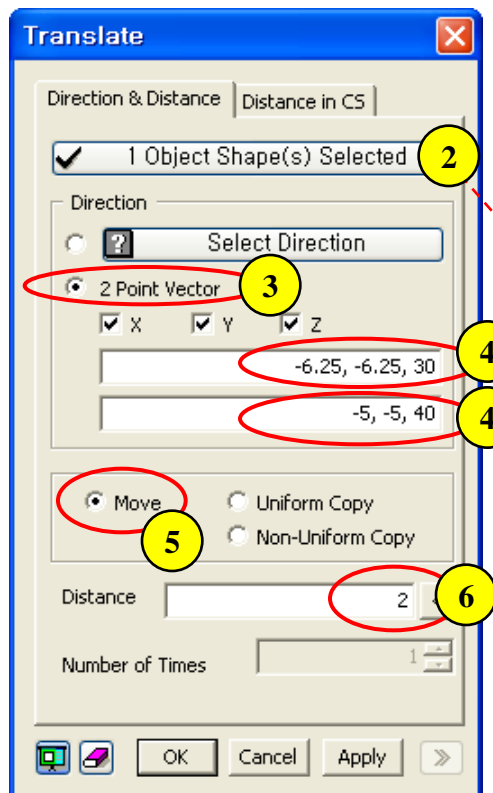
1. *Geometry > Remove > Sub-Face ...*

2. *Select Top & Bottom Faces of Cylinder Shells (See Figure)*

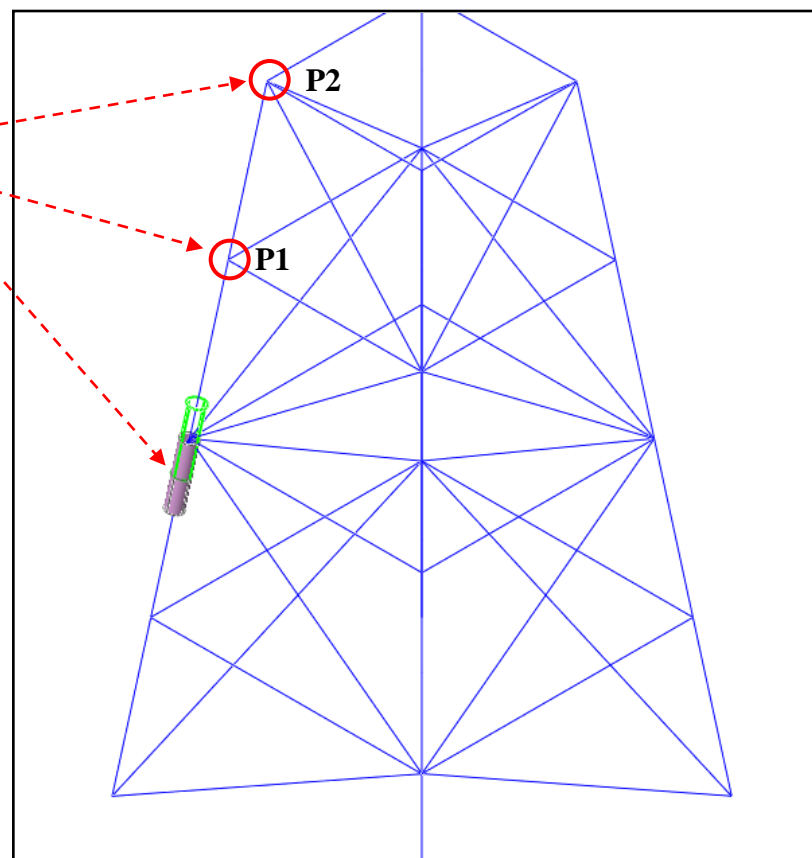
3. *Click [OK] Button*



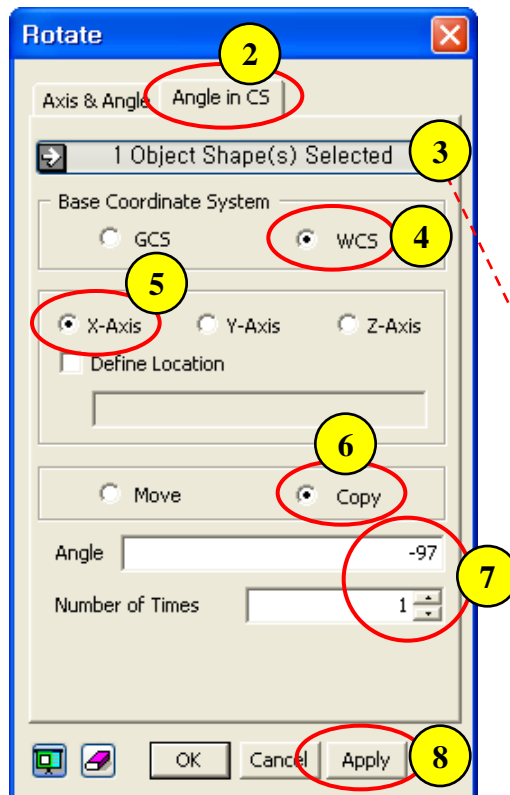
Step 5.



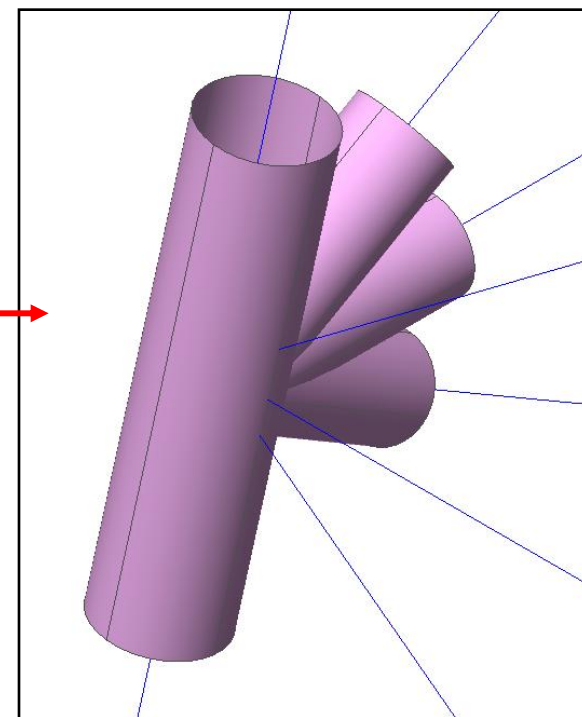
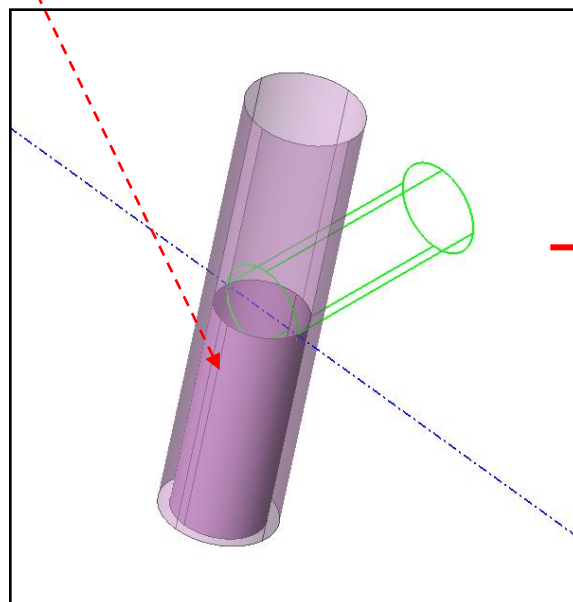
1. Geometry > Transform > Translate ...
2. Select Cylinder Shell (Long)
3. Check on "2 Point Vector"
4. Select P1 and P2
5. Check on "Move"
6. Distance : 2
7. Click [OK] Button



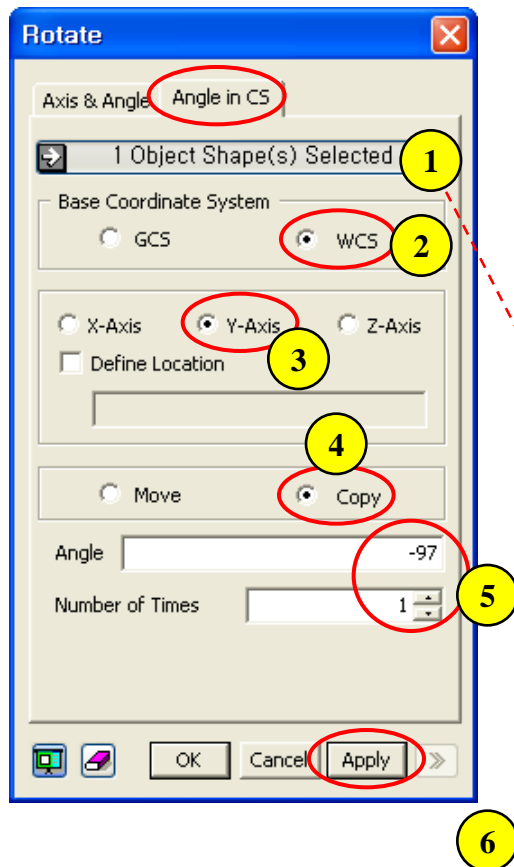
Step 6.



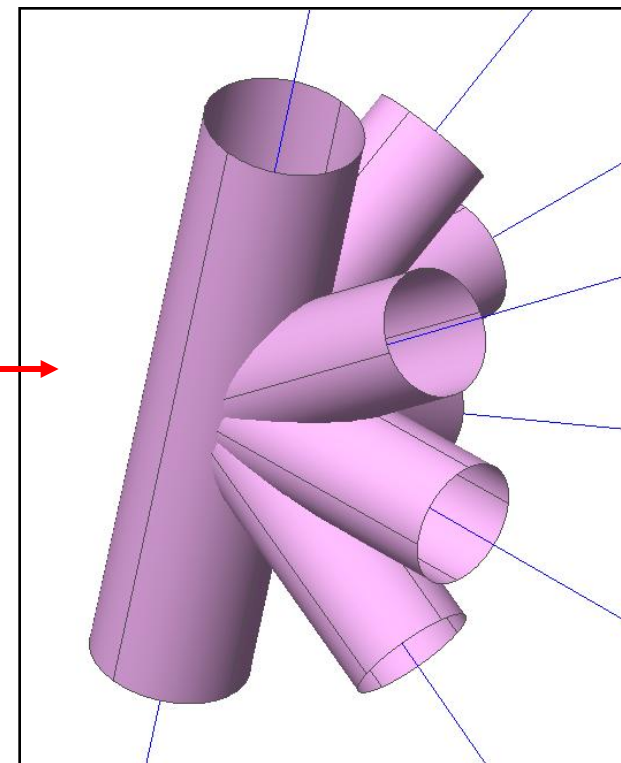
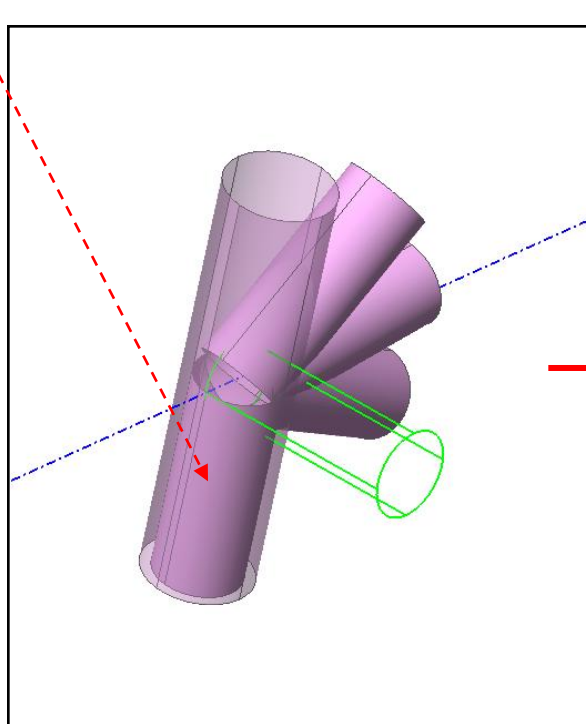
1. Geometry > Transform > Rotate ...
2. Select "Angle in CS" Tab
3. Select Cylinder Shell (Short)
4. Check on "WCS"
5. Check on "X-Axis"
6. Check on "Copy"
7. Angle : -97 , Number of Times : 1
8. Click [Apply] Button
9. Repeat for Angle "-133" & "-65"



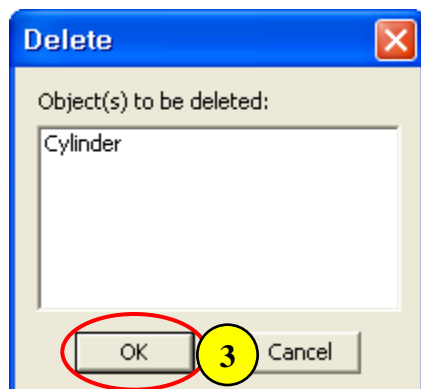
Step 7.



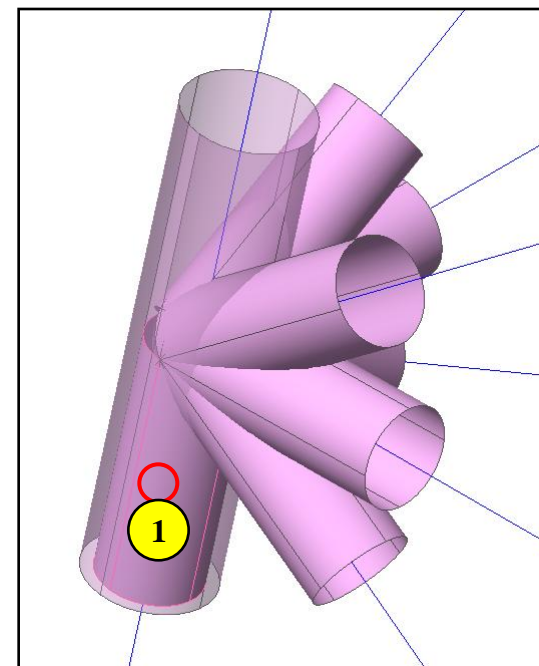
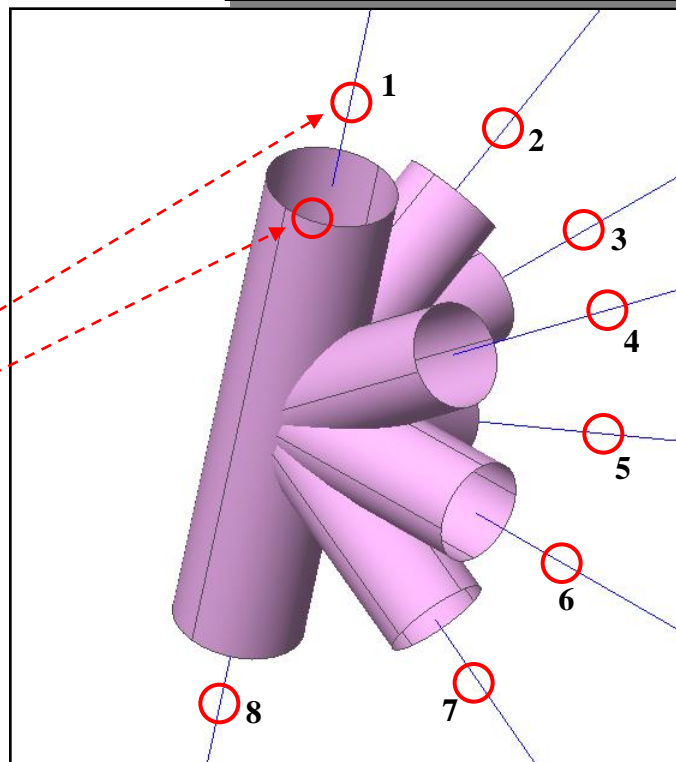
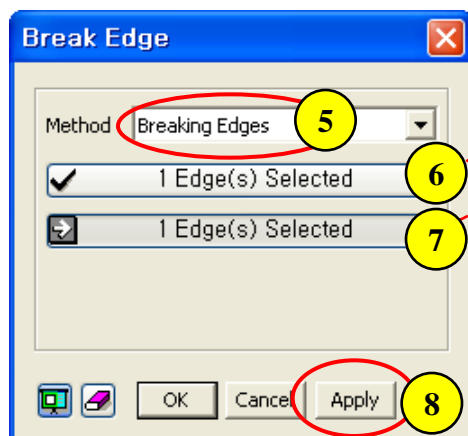
1. Select Cylinder Shell (Short)
2. Check on "WCS"
3. Check on "Y-Axis"
4. Check on "Copy"
5. Angle : -97 , Number of Times : 1
6. Click "Apply" Button
7. Repeat for Angle "-133" & "-65"



Step 8.

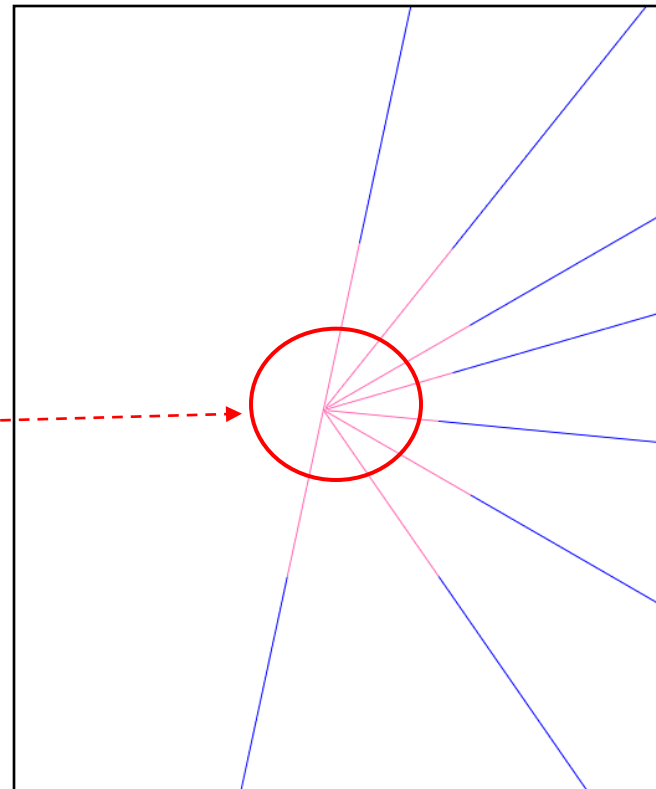
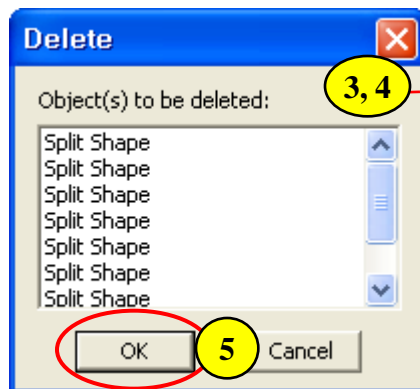
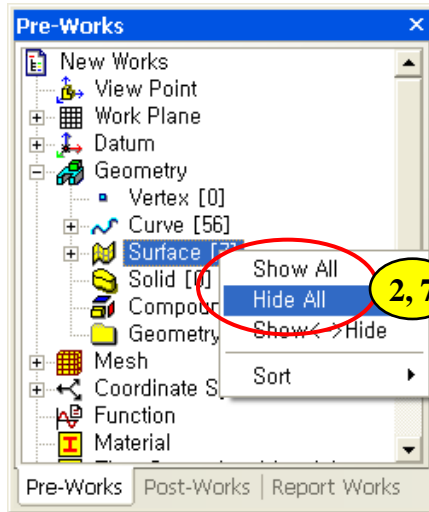


1. Select Cylinder Shell (Short)
2. Press "Delete" Key
3. Click [OK] Button
4. Geometry > Curve > Break ...
5. Method : Breaking Edges
6. Select Edge marked by "O" (See Figure)
7. Select Edge of Shell marked by "O" (See Figure)
8. Click [Apply] Button
9. Repeat for other Edges

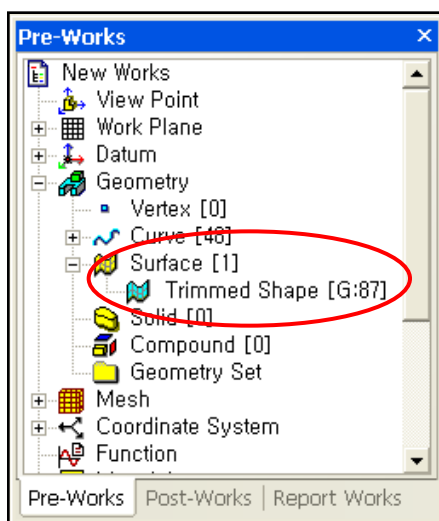
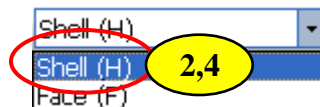
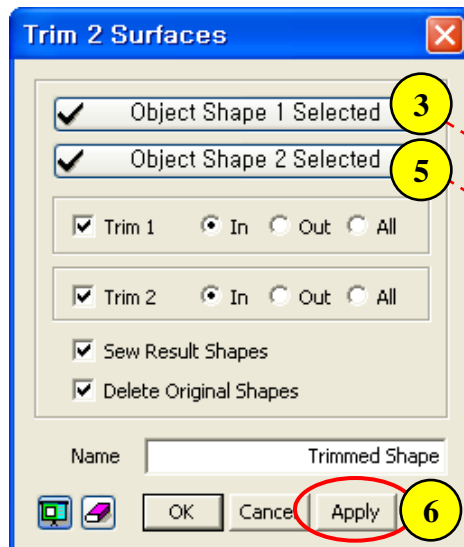


Step 9.

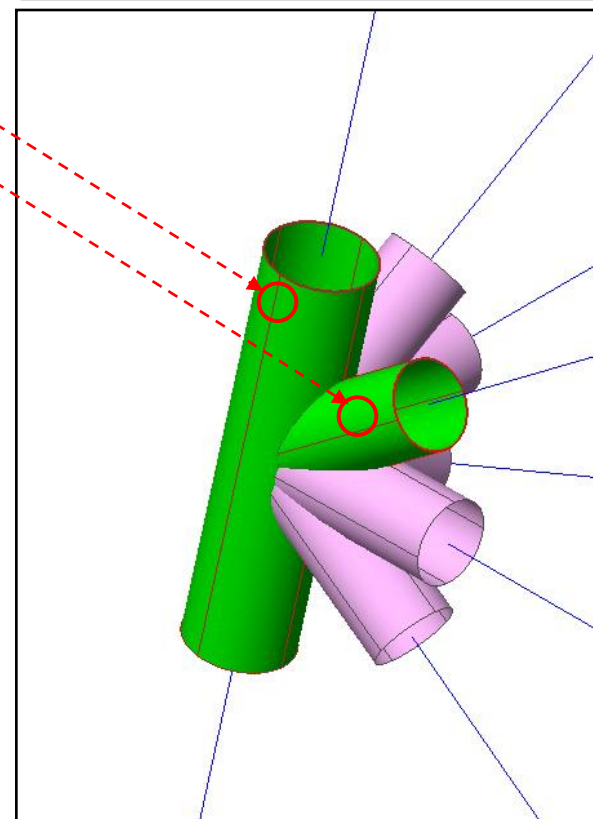
1. Pre-Works Tree : Geometry > Surface
2. Click Right Mouse Button and Select "Hide All"
3. Select 8 Splitted Edges (See Figure)
4. Press "Delete" Key
5. Click [OK] Button
6. Pre-Works Tree : Geometry > Surface
7. Click Right Mouse Button and Select "Show All"



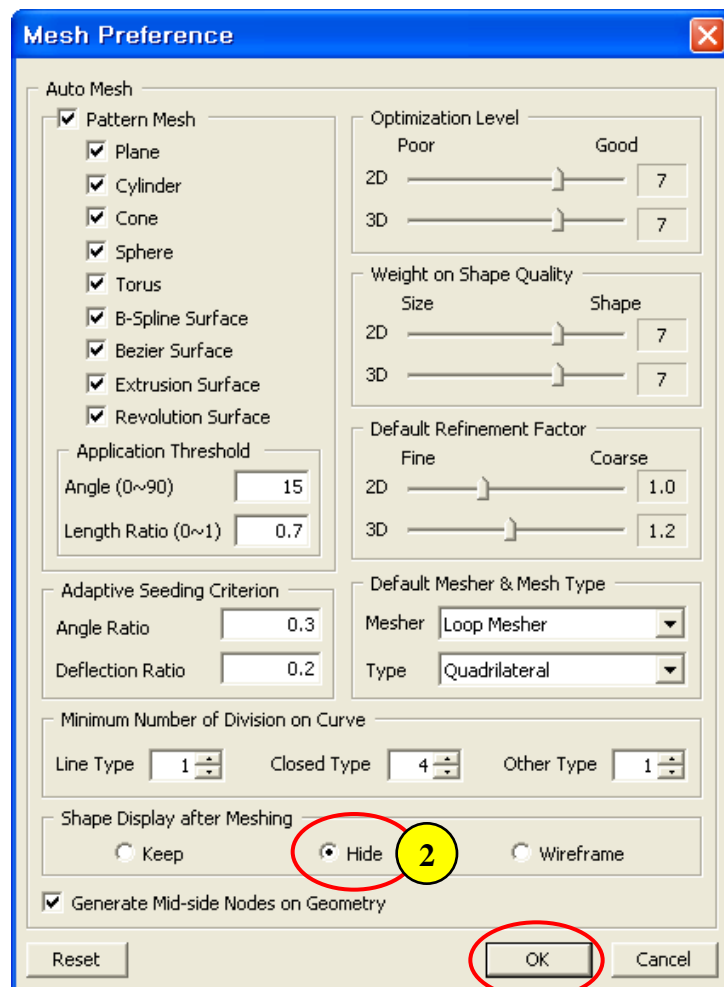
Step 10.



1. Geometry > Surface > Trim 2 Surfaces ...
2. Change Selection Filter to "Shell"
3. Select Shape 1 (See Figure)
4. Change Selection Filter to "Shell"
5. Select Shape 2 (See Figure)
6. Click [Apply] Button
7. Repeat for Residual Cylinder Shells

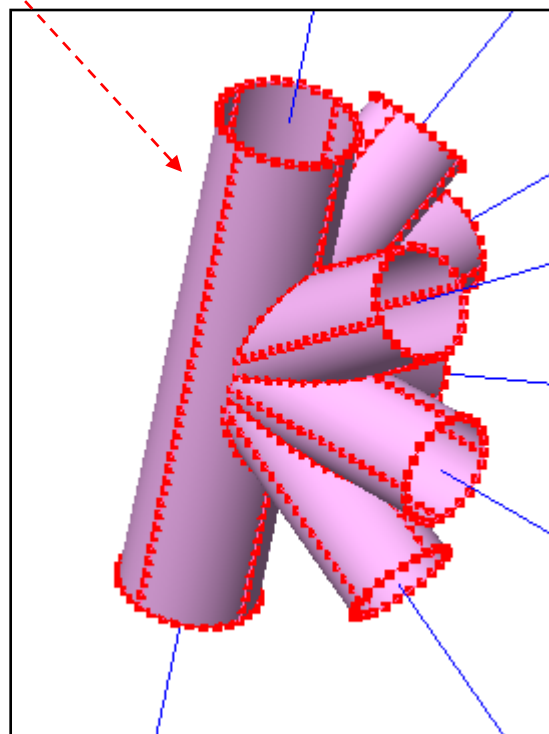
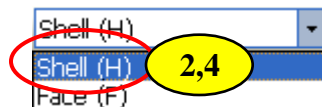
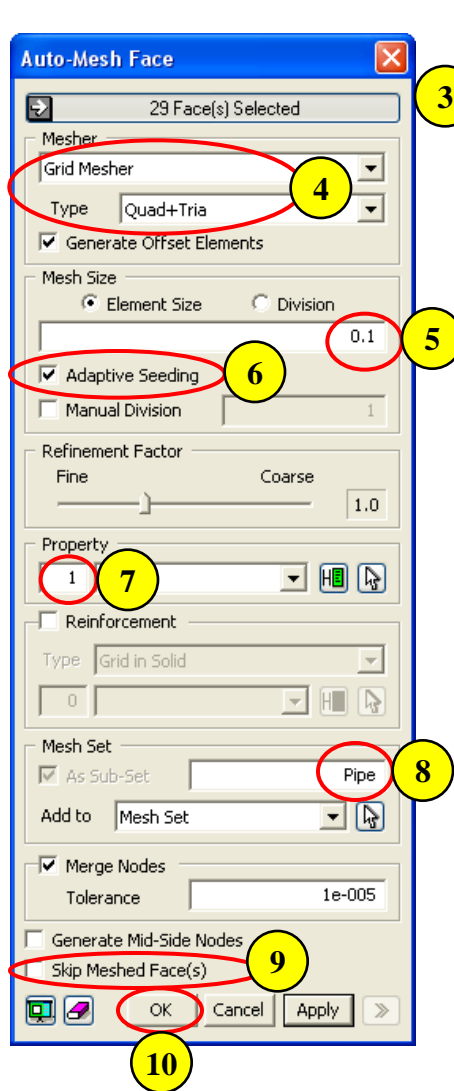


Step 11.



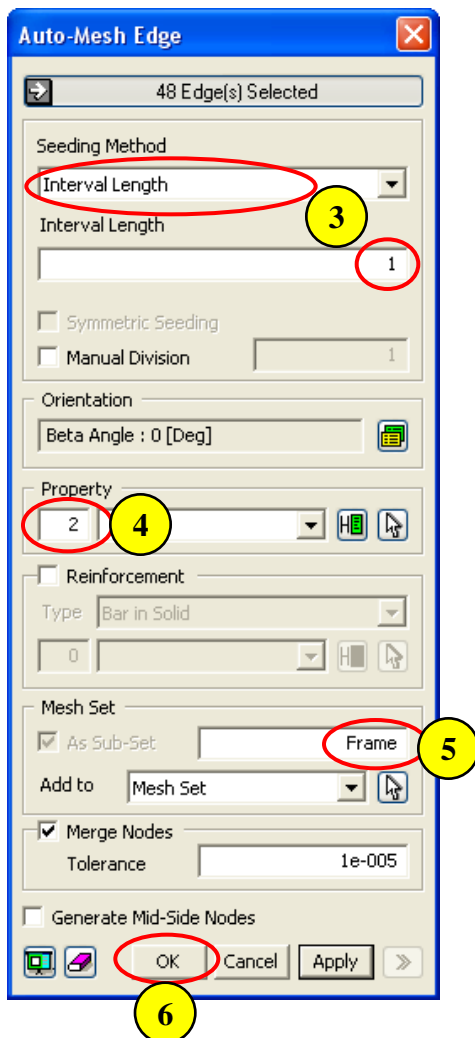
1. Mesh > Mesh Preference ...
2. Shape Display after Meshing : Hide
3. Click [OK] Button

Step 12.

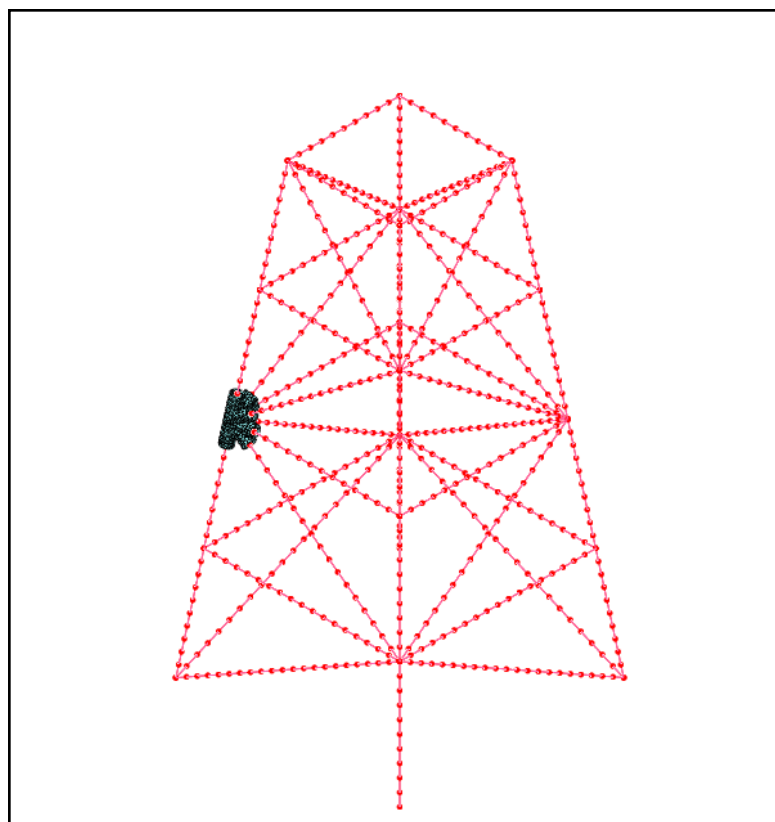


1. Mesh > Auto Mesh > Face ...
2. Change Selection Filter to "Shell"
3. Select Shell
4. Mesher - Grid Mesher : Quad+Tria
5. Mesh Size - Element Size : 0.1
6. Check on "Adaptive Seeding"
7. Property (1)
8. Mesh Set : Pipe
9. Check off "Skip Meshed Face(s)"
10. Click [OK] Button

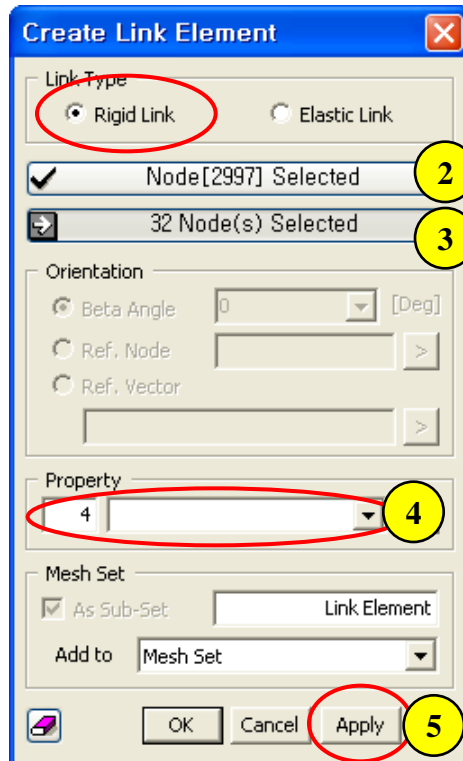
Step 13.



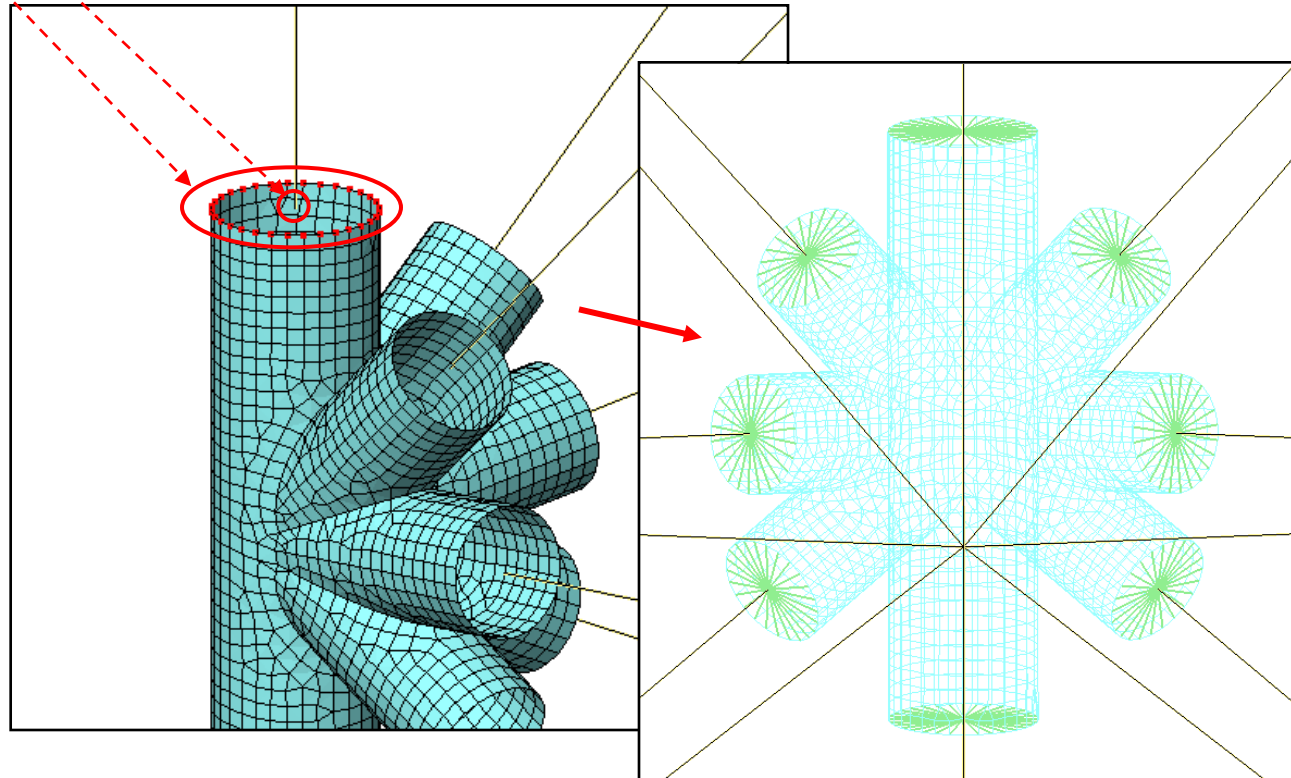
1. Mesh > Auto Mesh > Edge ...
2. Select  "Displayed"
3. Seeding Method - Interval Length : 1
4. Property (2)
5. Mesh Set : Frame
6. Click [OK] Button



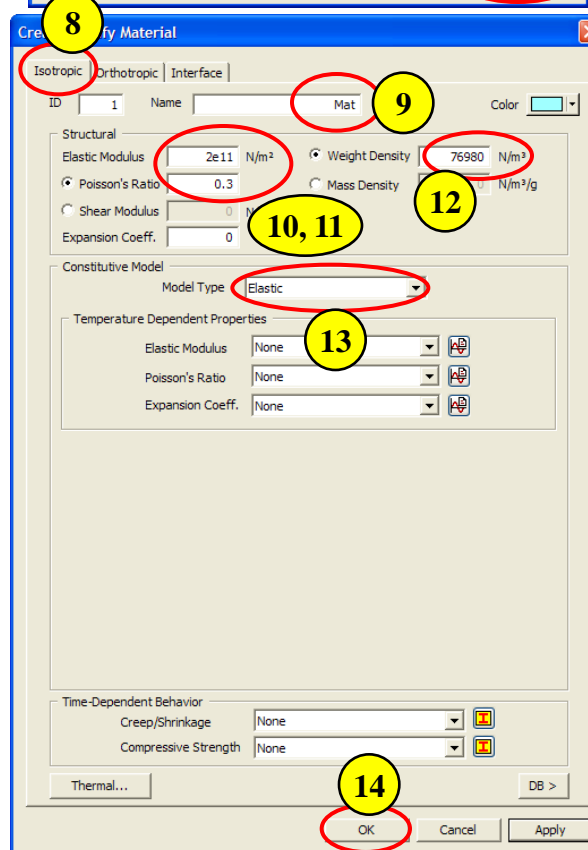
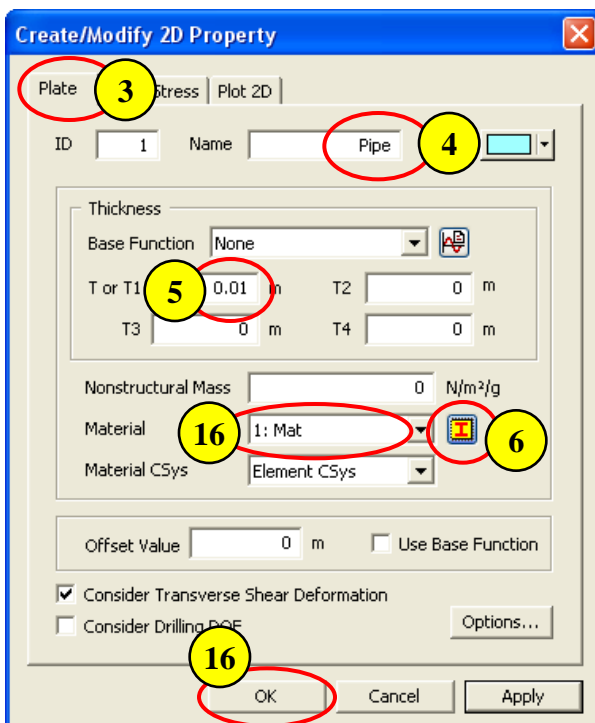
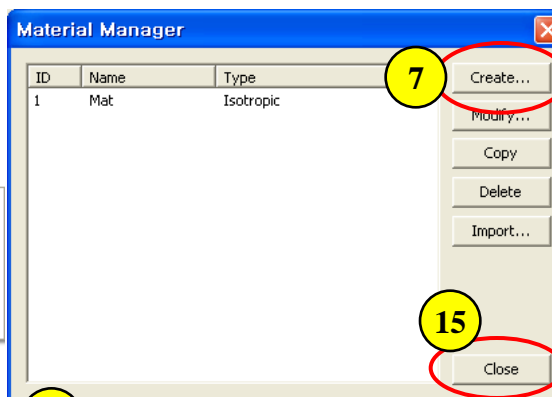
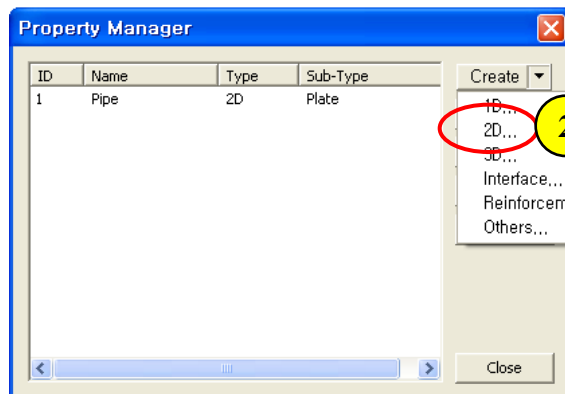
Step 14.



1. Mesh > Element > Create Link ...
2. Select Master Node (See Figure)
3. Select Slave Node (See Figure)
4. Property (4)
5. Click [Apply] Button
6. Repeat for Others

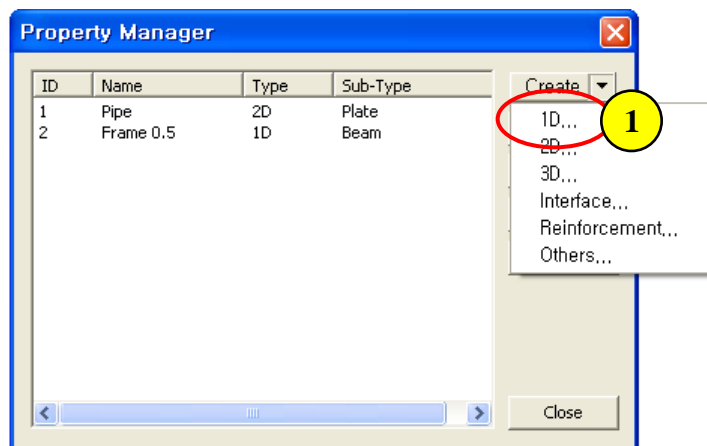


Step 15.



1. Analysis > Property ...
2. Create 2D ...
3. Select "Plate" tab
4. ID : 1 , Name : Pipe
5. Thickness : 0.01 m
6. Click  Button (Material)
7. Click [Create] Button
8. Select "Isotropic" tab
9. ID : 1 , Name : Mat
10. Elastic Modulus : 2e11 N/m²
11. Poisson's Ratio : 0.3
12. Weight Density : 76980 N/m³
13. Model Type : Elastic
14. Click [OK] Button
15. Click [Close] Button
16. Select "1: Mat" for Material
17. Click [OK] Button
18. Click [Close] Button

Step 16.



1. Create 1D ...

2. Select "Beam" Tab

3. ID : 2 , Name : Frame 0.5

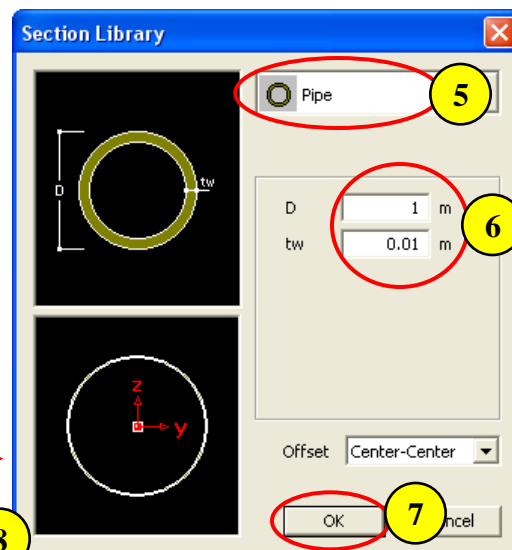
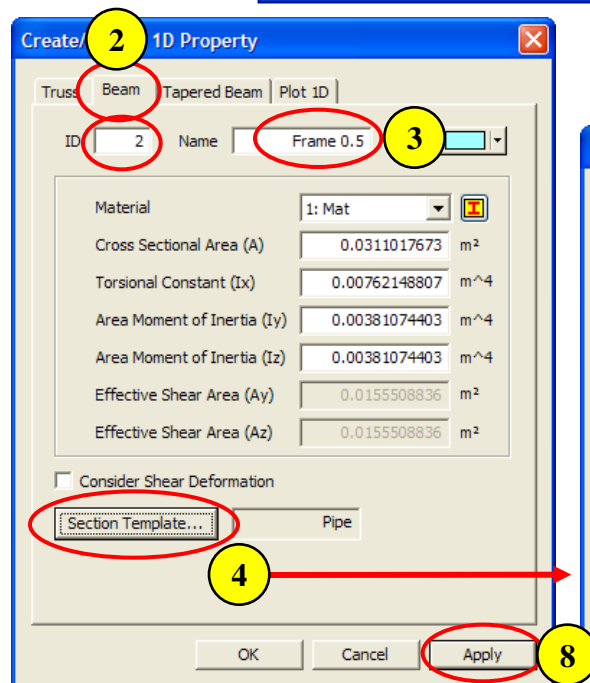
4. Click [Section Template...] Button

5. Select "Pipe"

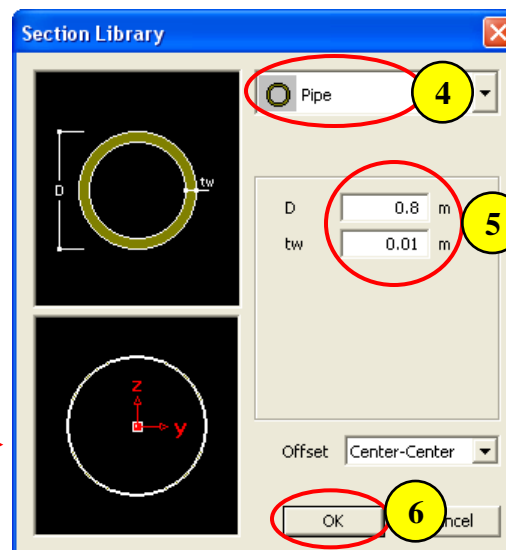
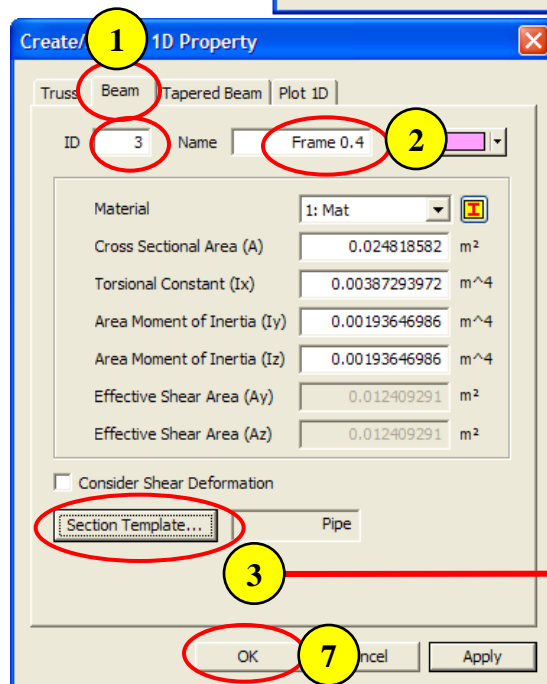
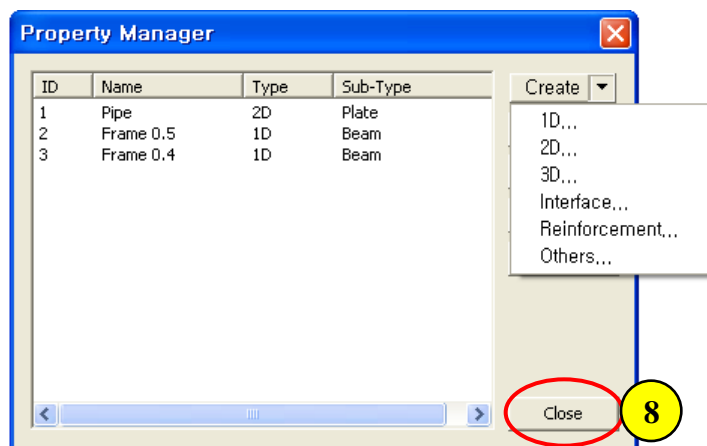
6. $D : 1m$, $tw : 0.01m$

7. Click [OK] Button

8. Click [Apply] Button

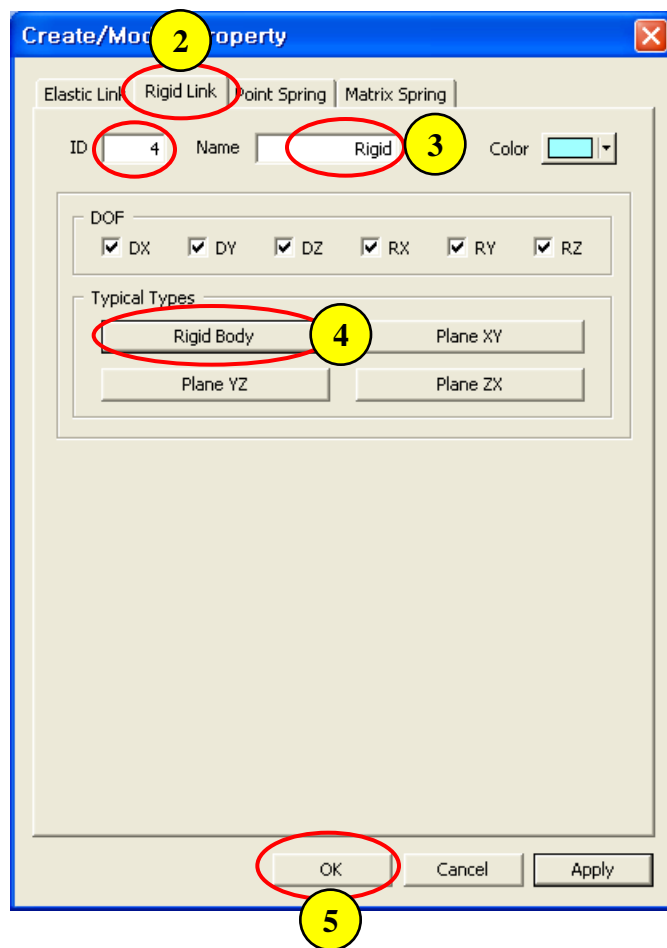


Step 17.

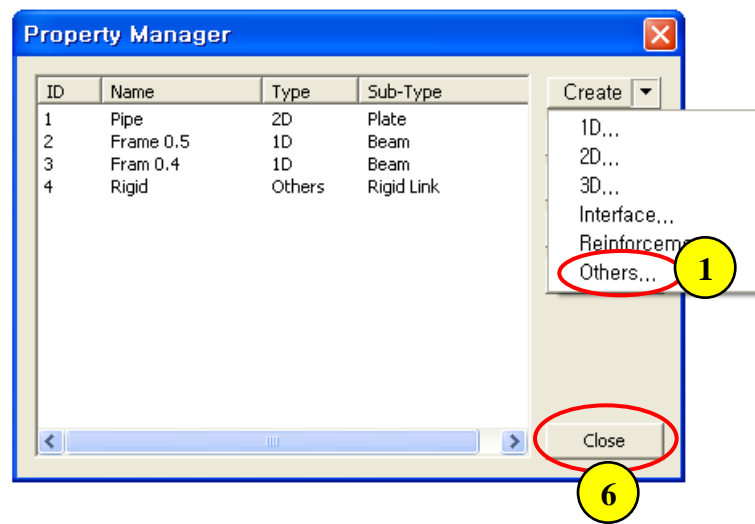


1. Select "Beam" Tab
2. ID : 3 , Name : Frame 0.4
3. Click [Section Template...] Button
4. Select "Pipe"
5. D : 0.4m , tw : 0.01m
6. Click [OK] Button
7. Click [OK] Button
8. Click [Close] Button

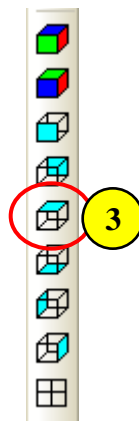
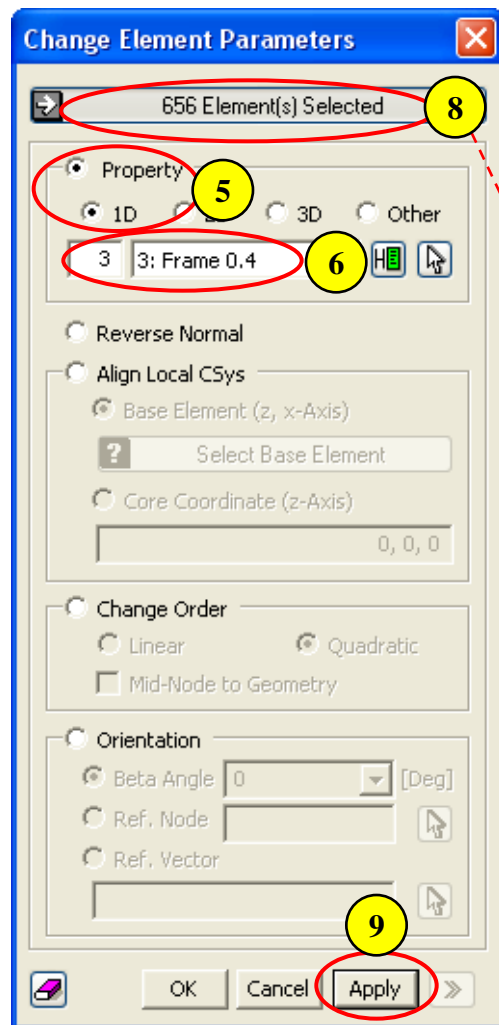
Step 18.




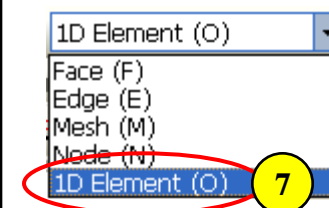
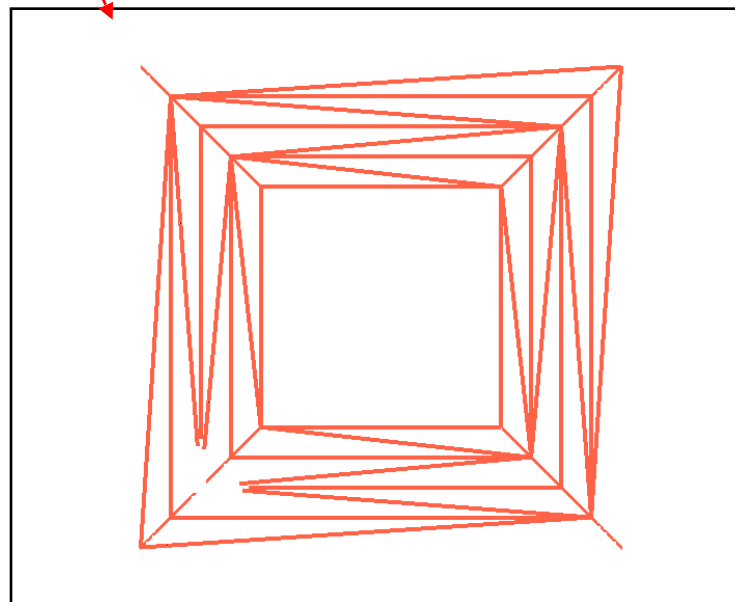
1. Create Others ...
2. Select "Rigid Link" Tab
3. ID : 4 , Name : Rigid
4. Click [Rigid Body] Button
5. Click [OK] Button
6. Click [Close] Button



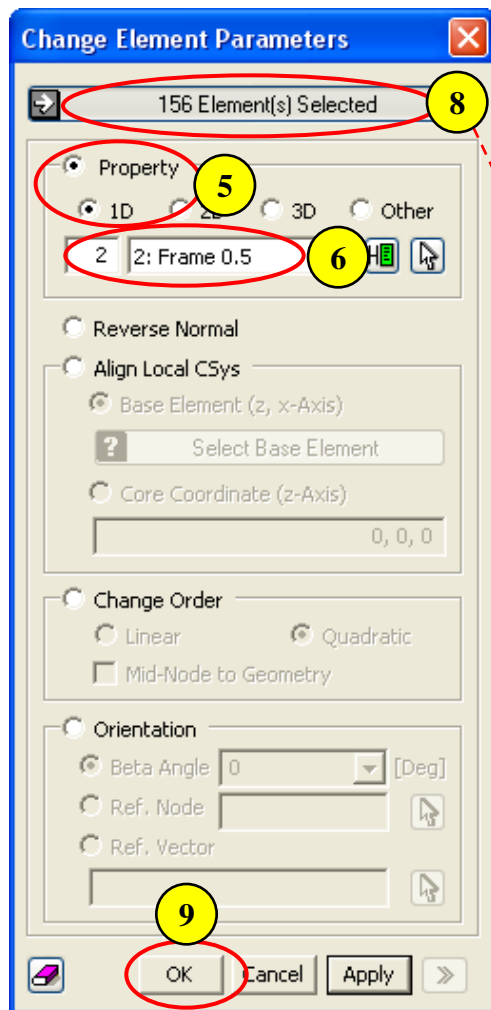
Step 19.



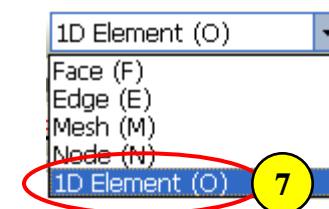
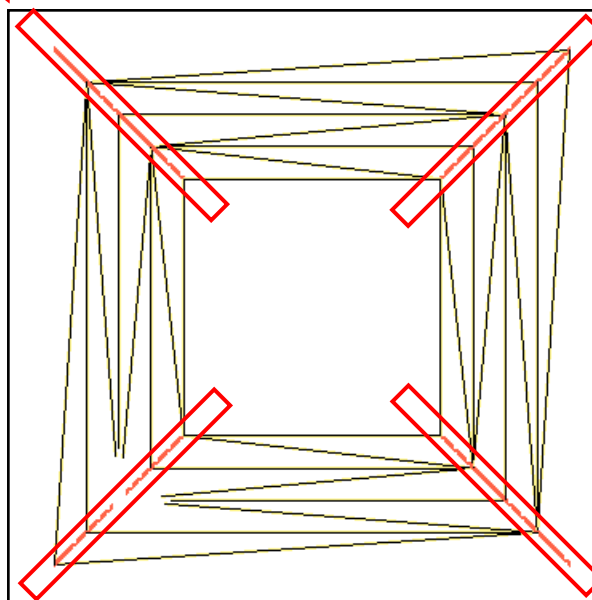
1. Pre-Works Tree : Mesh > Mesh Set > Frame
2. Click Right Mouse Button and Select "Show Only"
3. Click "Top View"
4. Mesh > Element > Change Parameter ...
5. Select "Property" – "1D"
6. Property "3: Frame 0.4"
7. Change Selection Filter to "1D Element (O)"
8. Select  "Displayed"(See Figure)
9. Click [Apply] Button




Step 20.

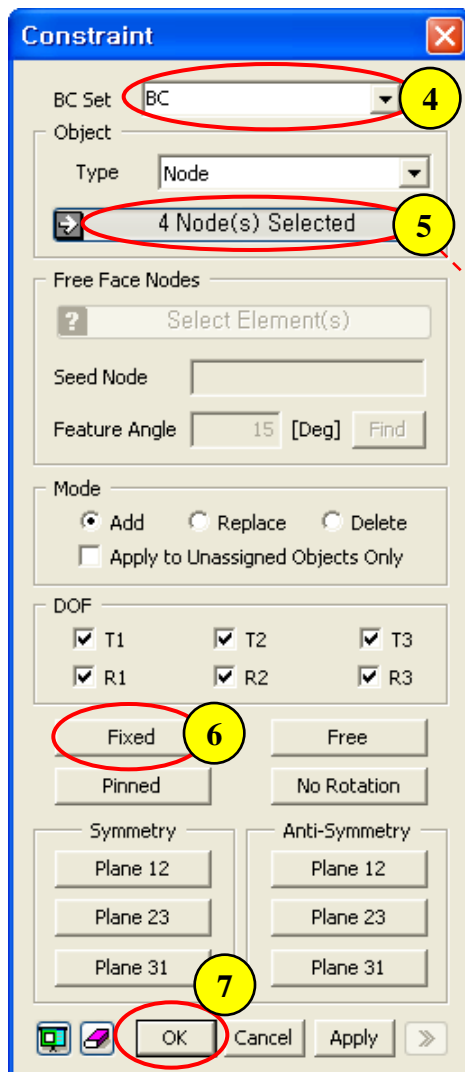


1. Pre-Works Tree : Mesh > Mesh Set > Frame
2. Click Right Mouse Button and Select "Show Only"
3. Click "Top View"
4. Mesh > Element > Change Parameter ...
5. Select "Property" – "1D"
6. Property "2: Frame 0.5"
7. Change Selection Filter to "1D Element (O)"
8. Select 156 Elements (See Figure) ⑥
9. Click [OK] Button

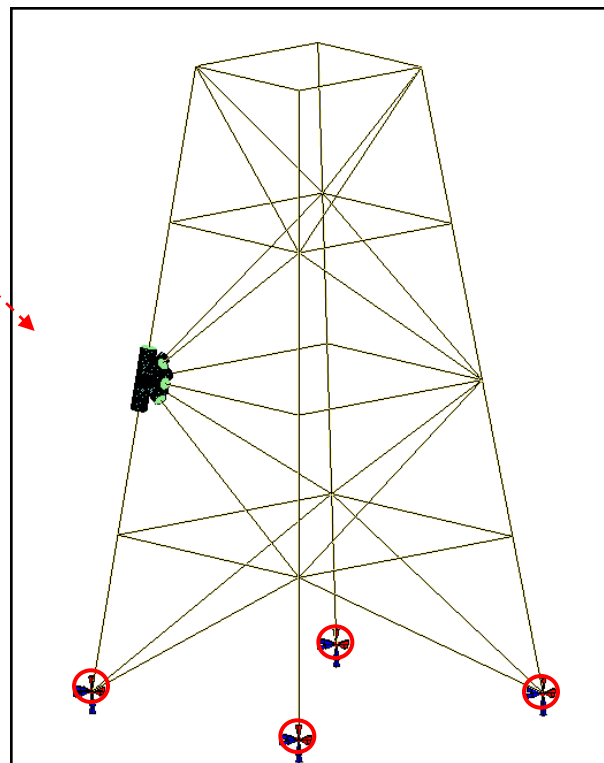


⑥ Use  "Polygon" Selection.

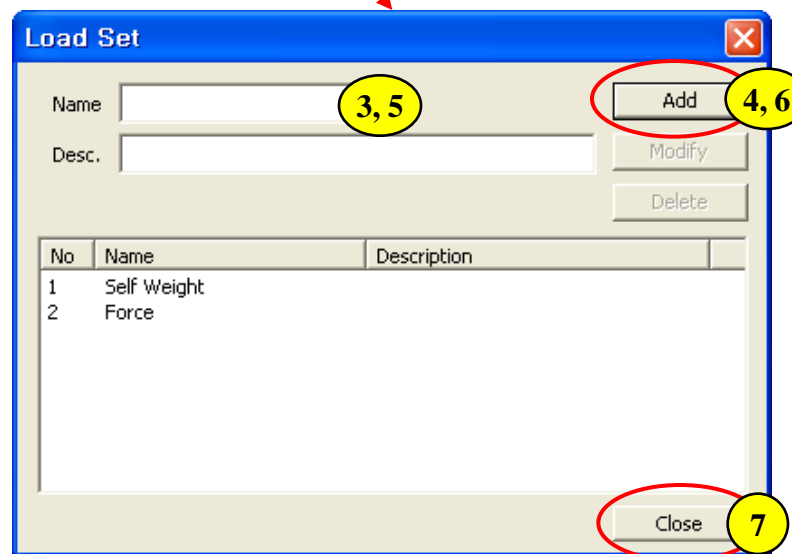
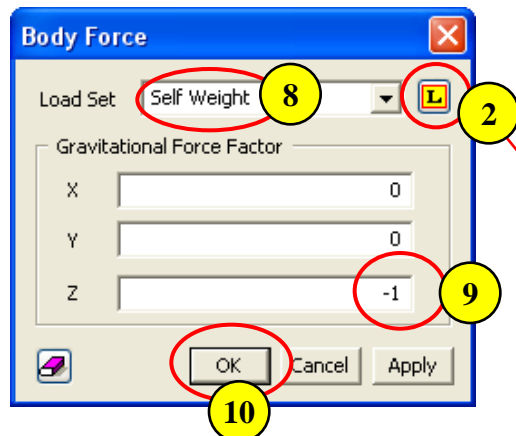
Step 21.



1. Pre-Works Tree : Mesh
2. Click Right Mouse Button and Select "Show All"
3. Analysis > BC > Constraint ...
4. BC Set : BC
5. Select 4 Bottom Corner nodes marked by "O" (See Figure)
6. Click [Fixed] Button
7. Click [OK] Button

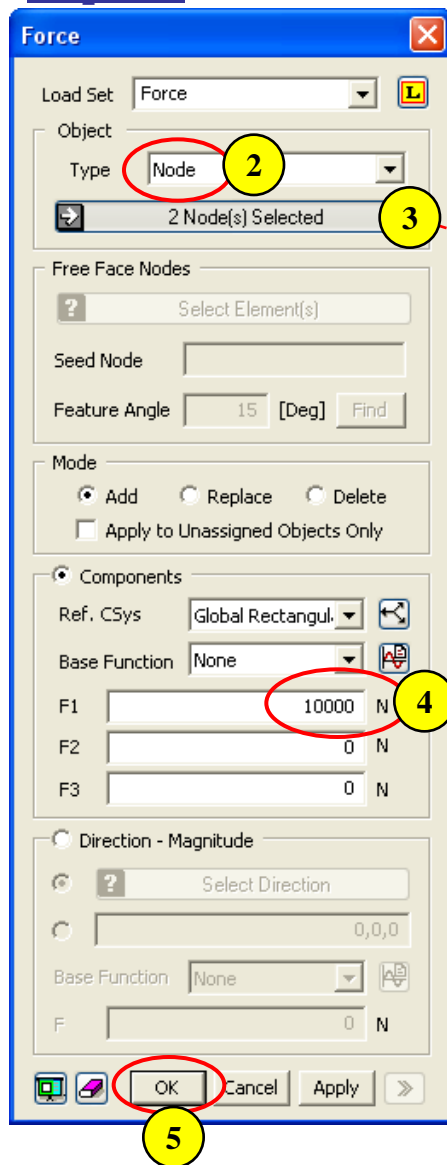


Step 22.

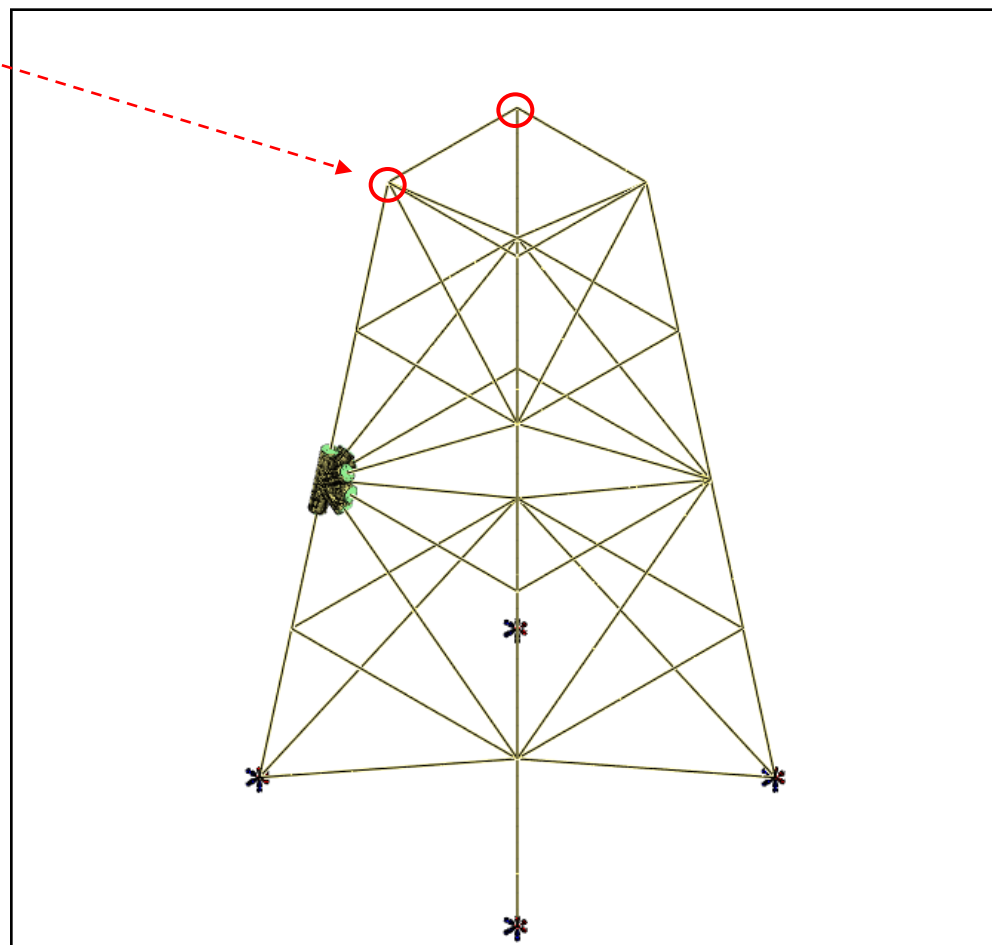


1. Analysis > Load > Body Force ...
2. Click Button
3. Name : Self Weight
4. Click [Add] Button
5. Name : Force
6. Click [Add] Button
7. Click [Close] Button
8. Select "Self Weight" for Load Set
9. Z: -1
10. Click [OK] Button

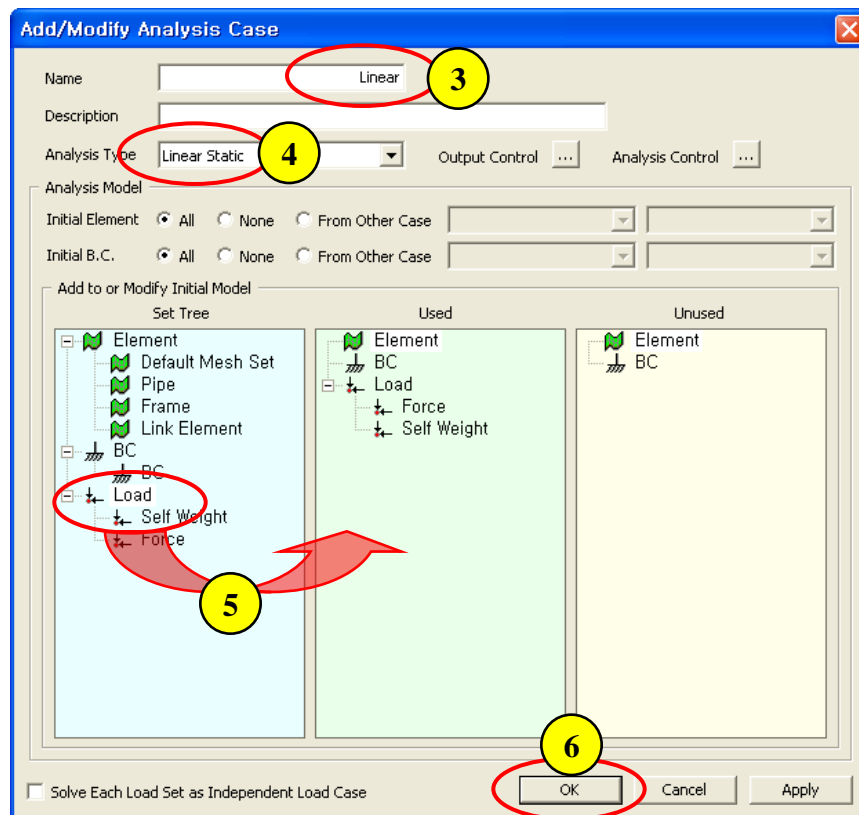
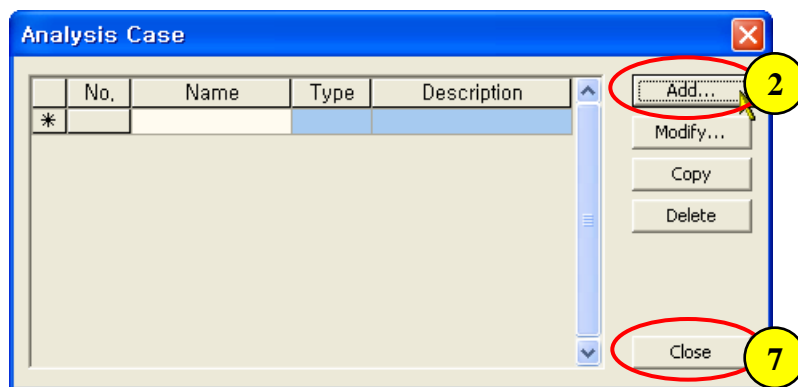
Step 23.



1. Analysis > Load > Force ...
2. Select "Force" for Load Set
3. Select 2 Nodes marked by "O" (See Figure)
4. F1 : 10000 N
5. Click [OK] Button



Step 24.



1. Analysis > Analysis Case ...

2. Click [Add] Button

3. Name : Linear

4. Analysis Type : Linear Static

5. Drag & Drop "Load" to "Used" Window

6. Click [OK] Button

7. Click [Close] Button

8. File > Save ... (Frame Tower.feb)

9. Analysis > Solve ...

10. Click [OK] Button

