

Overview

▪ 3-D Linear Static Analysis

▪ Model

- Unit : N, cm
- Isotropic Elastic Material
- Solid Elements

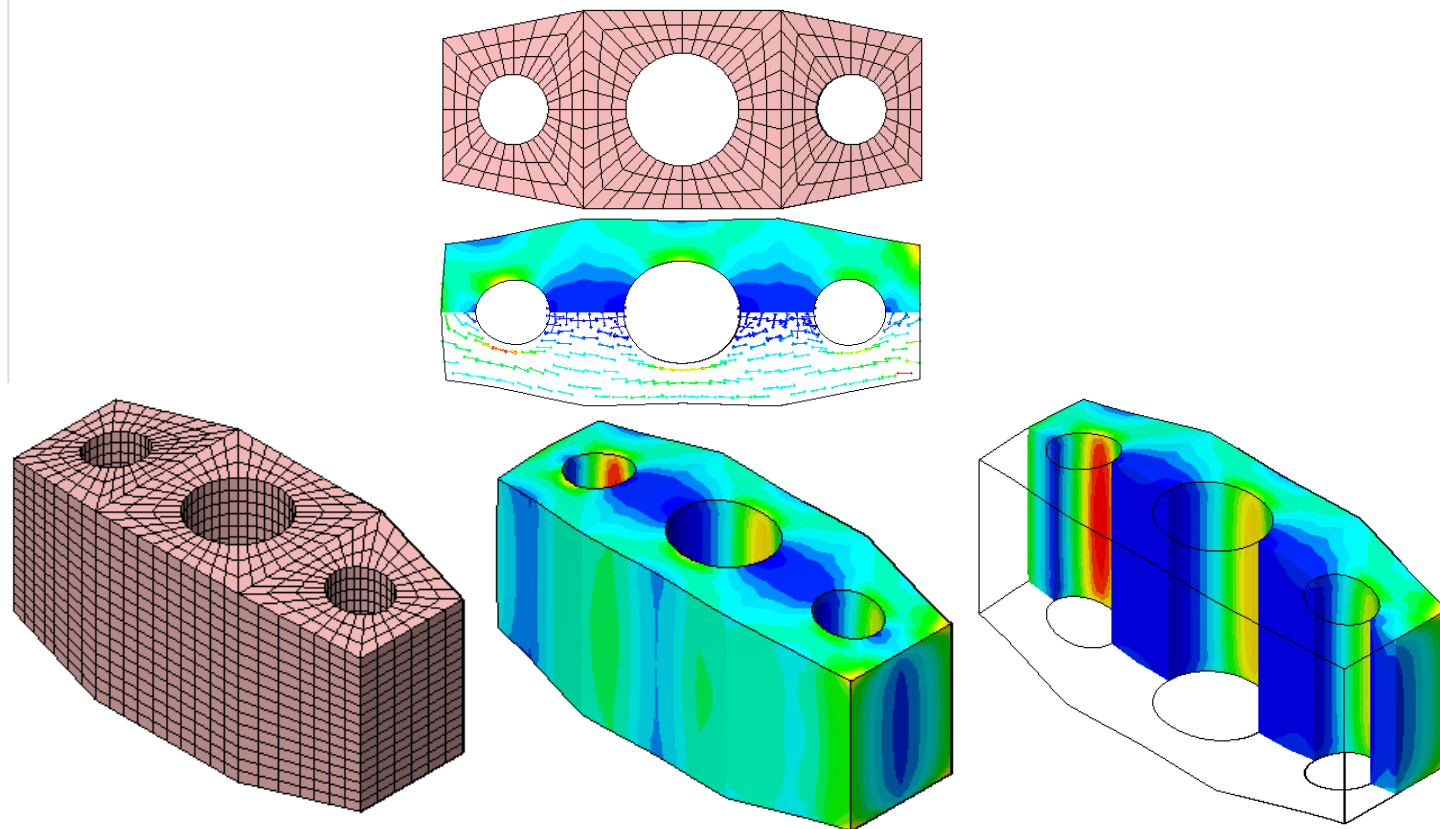
▪ Load & Boundary Condition

- Face Pressure
- Nodal Force

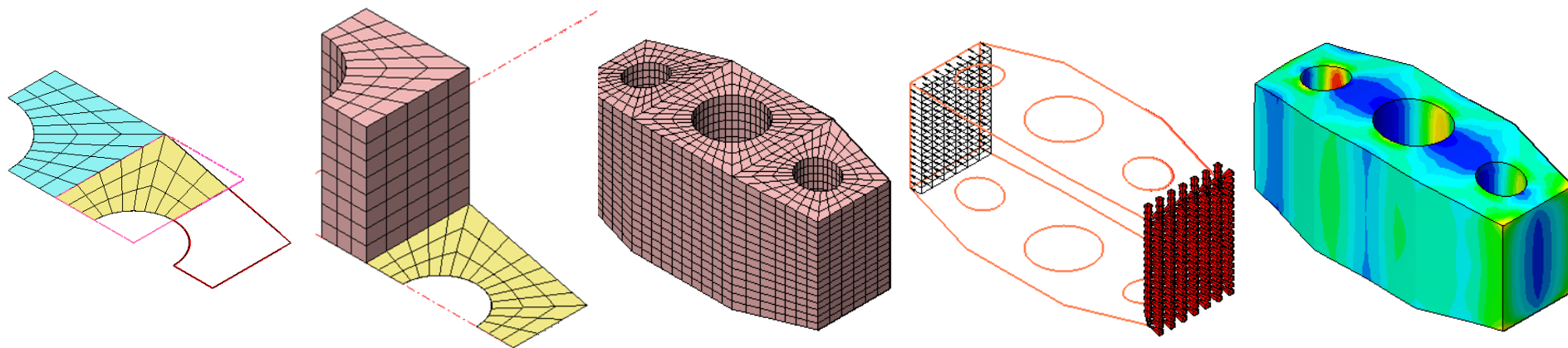
▪ Result Evaluation

- Deformation
- Principal Stress

Solid Block



Modeling & Analysis Point

2D Modeling**2D → 3D Modeling****Constraint & Load****Result**

About this Training...

This tutorial model is composed of 3D solid elements generated by Extrude, Project, and Mirror functions from 2D elements. The analysis is performed by defining the nodal load and the face pressure load of the element. Check the principal stress result of Solid with Clipping Plane, Probe Result, Vector Plot function.

Learning Target

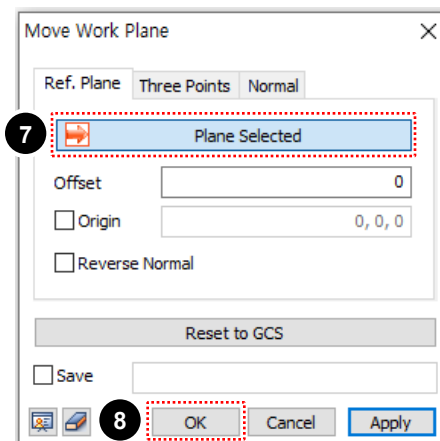
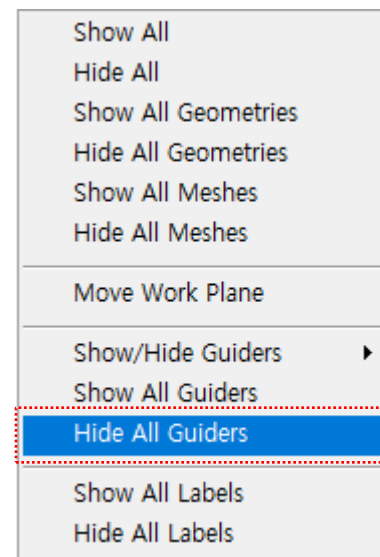
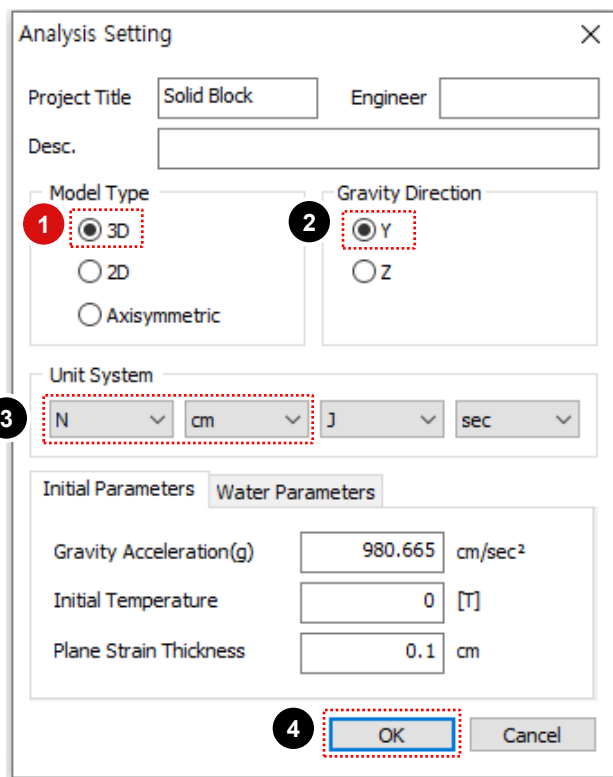
How to model 2D elements with K-Edge Area of Map Mesh

How to define from 2D element to 3D Solid element with Extrude, Project, Mirror function


How to check the result with Clipping Plane, Probe Result, and Vector Plot

Procedure

- 1 Model Type : [3D]
- 2 Gravity Direction : [Y]
- 3 Unit System : [N, cm]
- 4 Click [OK] Button
- 5 Click Right Mouse Button in Work Window and Select [Hide All Guiders]
- 6 Move Work Plane
- 7 Select [XY-Plane]
- 8 Click [OK] Button

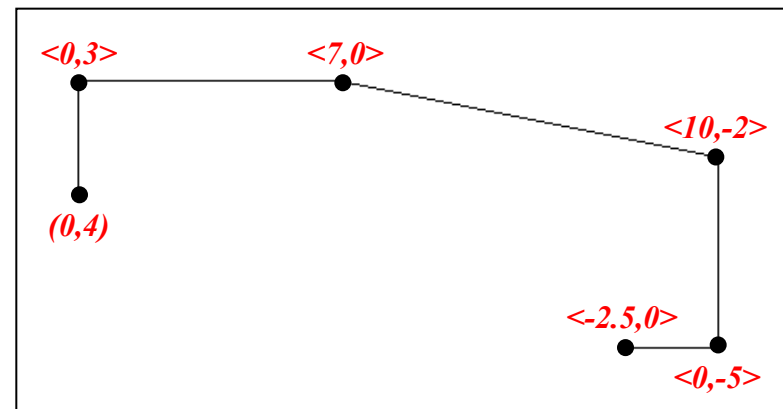
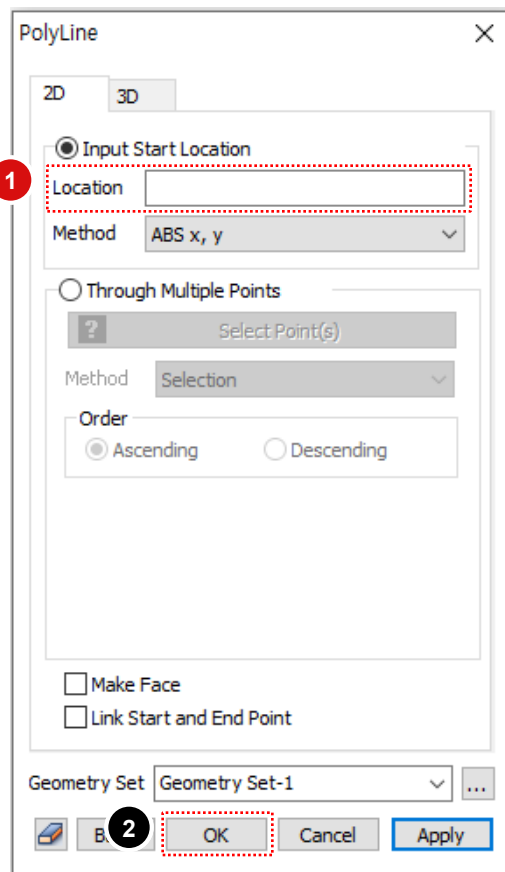



Procedure

1 Location : (0, 4) , <0, 3> , <7> ,
<10, -2> , <0, -5> , <-2.5> 

2 Click [OK] Button

3 Click [Normal] View



 (): “ABS x, y”, < >: “REL dx, dy”
<7> same as <7, 0>

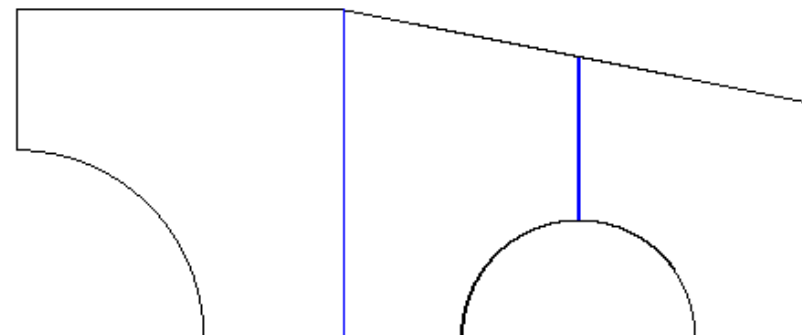
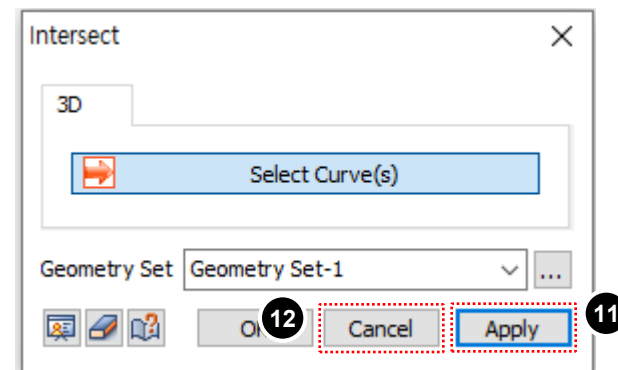
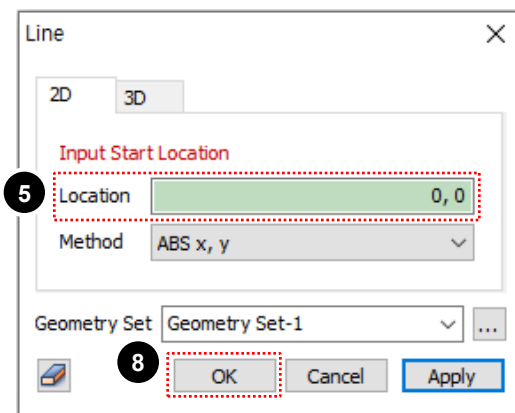
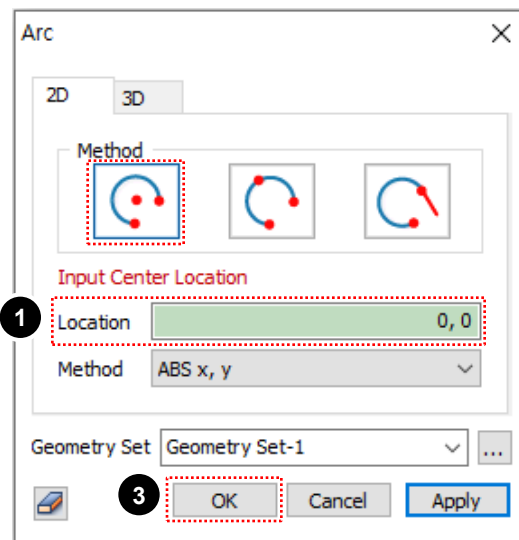


Procedure

- 1 Center (0), Start (4), End (0, 4)
- 2 Center (12), Start (14.5), End (9.5)
- 3 Click [OK] Button
- 4 Geometry > Point & Curve> **Line**
- 5 SL (4), EL : <5.5>
- 6 SL : (7, 7), EL : <0, -7>
- 7 SL : (12, 2.5), EL : <0, 3.5>
- 8 Click [OK] Button
- 9 Geometry > Point & Curve > **Intersect**
- 10 Select “Select All”
- 11 Click [Apply] Button
- 12 Click [Cancel] Button

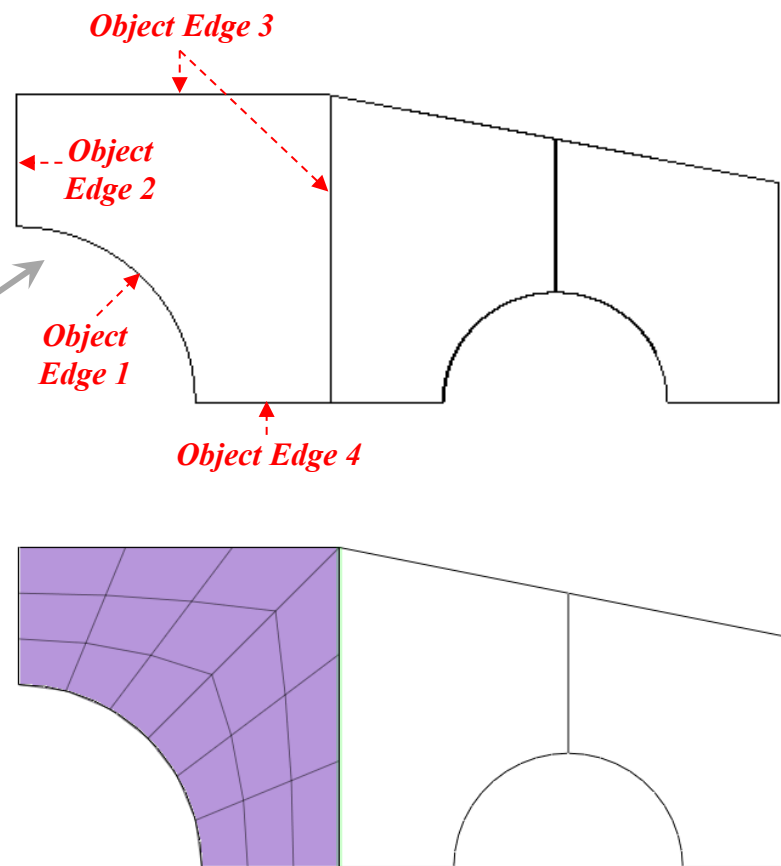
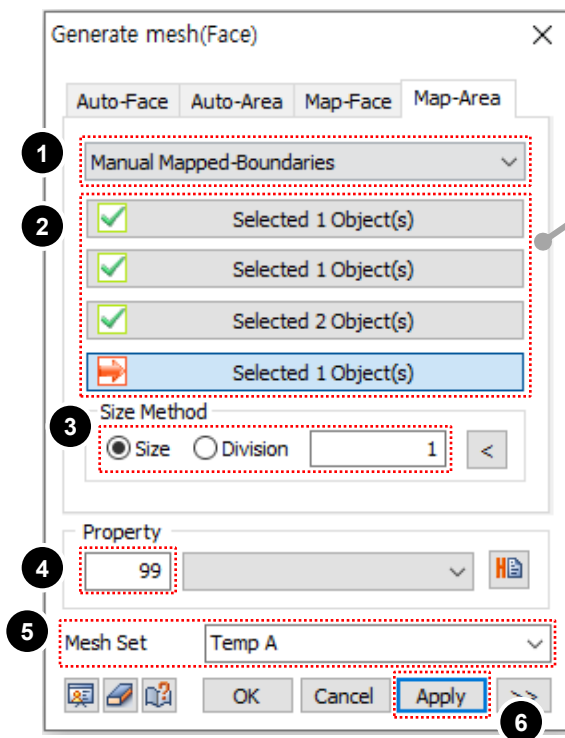
(): “ABS x, y”, < >: “REL dx, dy”
 (0) same as (0, 0), (4) same as (4, 0)

“Ctrl+A” as shortcut for “Select Displayed”.



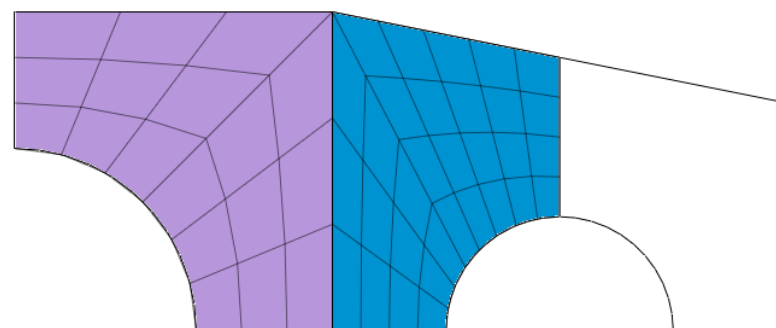
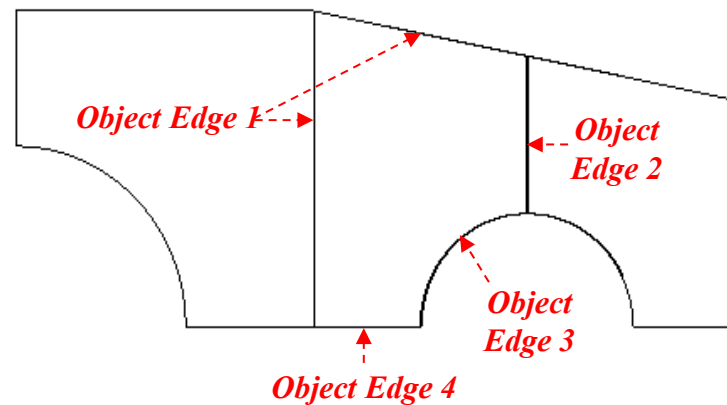
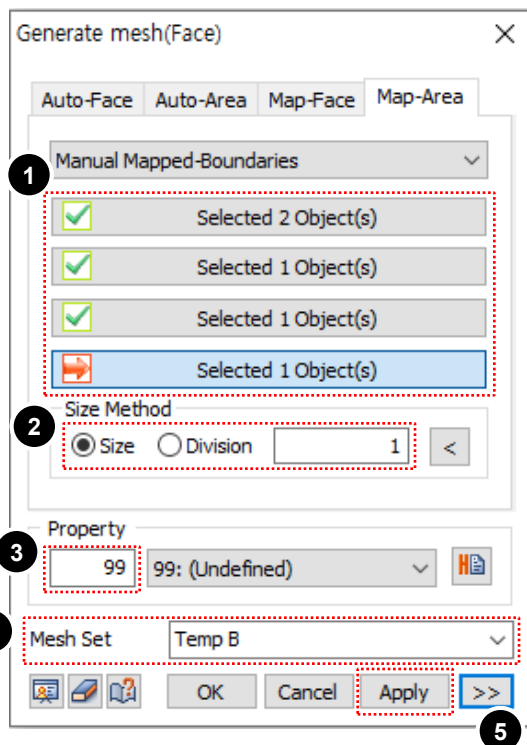
Procedure

- 1 Select **"Manual Mapped boundaries"**
- 2 Select Edge Groups 1~4 (See Figure)
- 3 Size Method : 1
- 4 Property : **"99"**
- 5 Mesh Set : **"Temp A"**
- 6 Click **[Apply]** Button



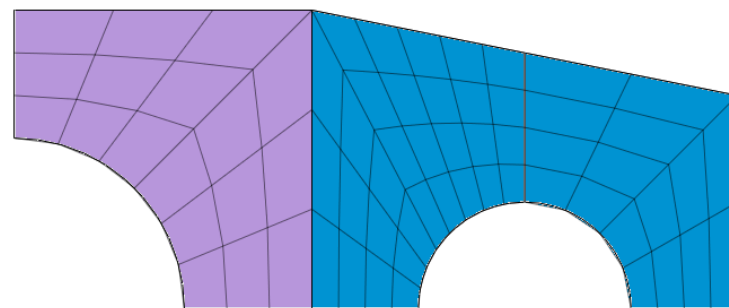
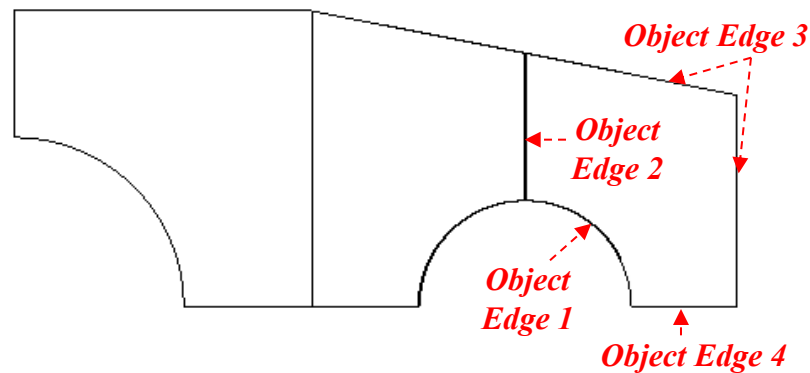
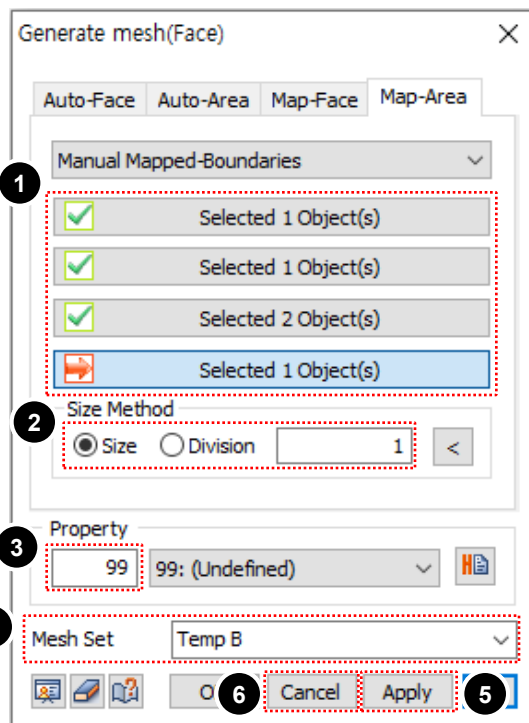
Procedure

- 1 Select Edge Groups 1~4 (See Figure)
- 2 Size Method : 1
- 3 Property : "99"
- 4 Mesh Set : "Temp B"
- 5 Click [Apply] Button



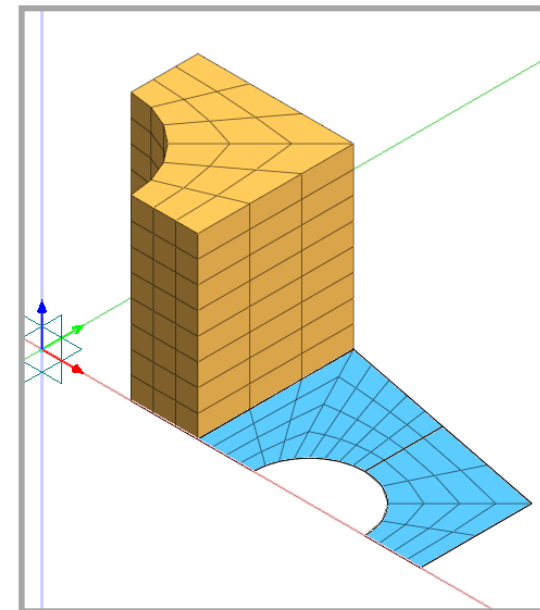
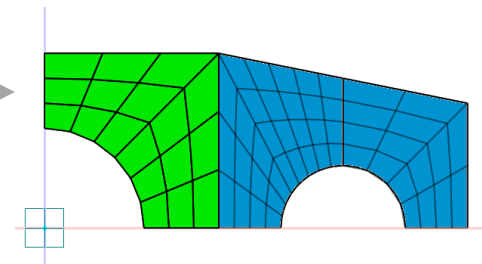
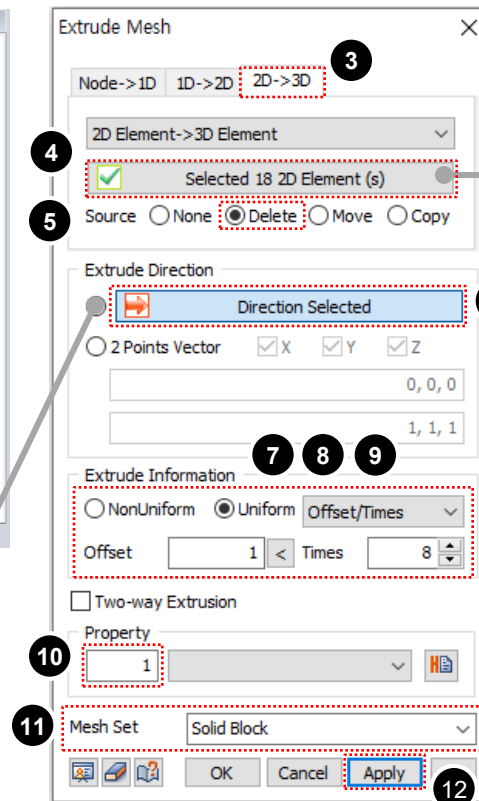
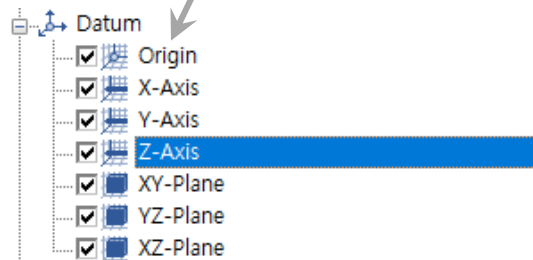
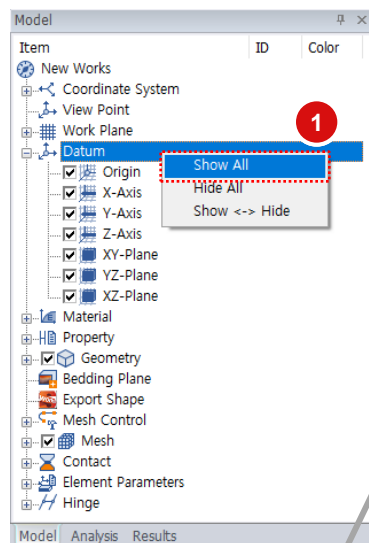
Procedure

- 1 Select Edge Groups 1~4 (See Figure)
- 2 Size Method : **Size : 1**
- 3 Property : **"99"**
- 4 Mesh Set : Select **"Temp B"**
- 5 Click **[Apply]** Button
- 6 Click **[Cancel]** Button



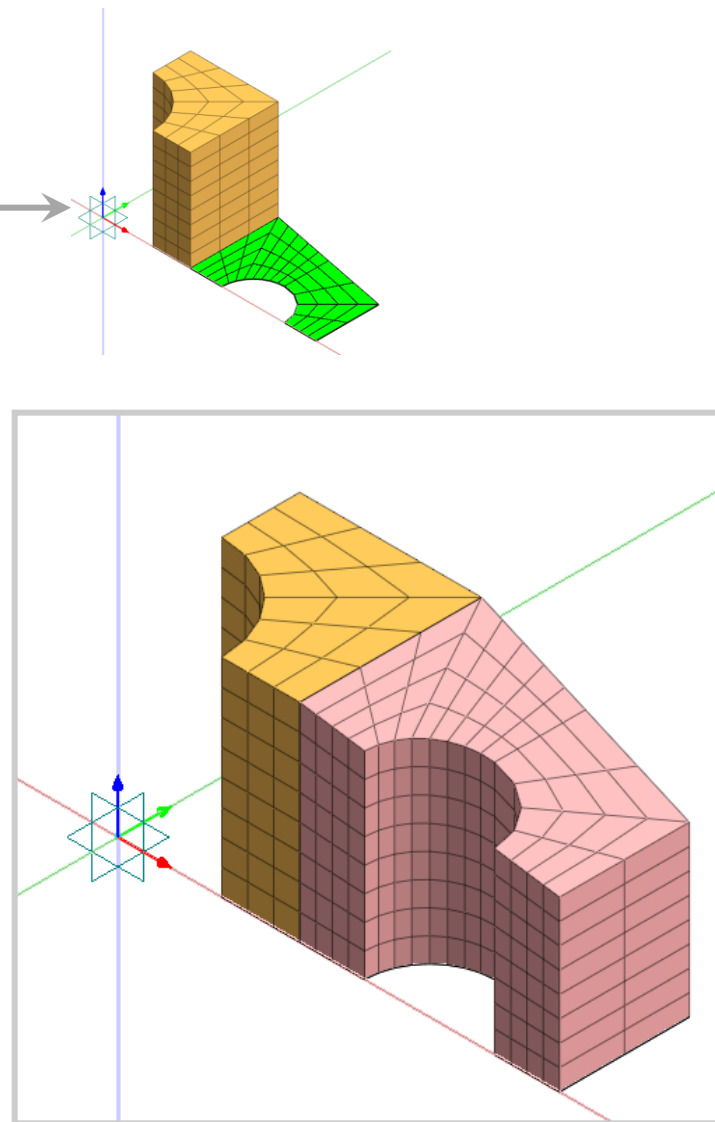
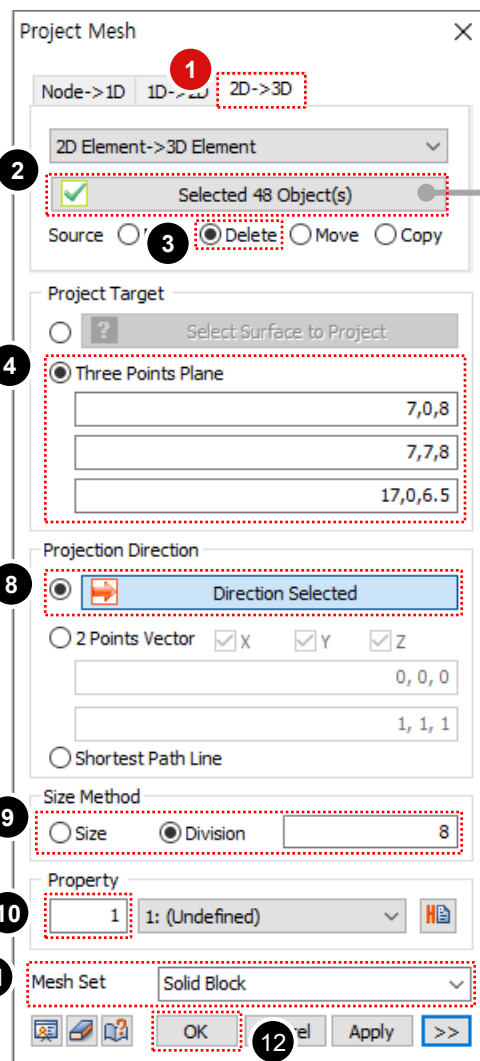
Procedure

- 1 Click Right Mouse Button and Select **"Show All"**
- 2 Mesh > Protrude > **Extrude**
- 3 Select **[2D->3D]** tab
- 4 Select **"Temp A"** Mesh Set
- 5 Source : **[Delete]**
- 6 Extrusion Direction : **"Z-Axis"**
- 7 Select **"Uniform"** Option
- 8 Select **"Offset/Times"**
- 9 Offset : **"1"** , Times : **"8"**
- 10 Property : **"1"**
- 11 Mesh Set : **[Solid Block]**
- 12 Click **[OK]** Button



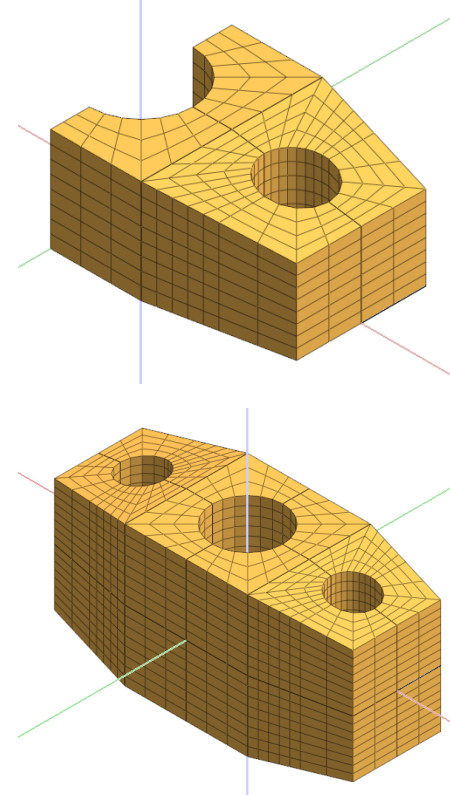
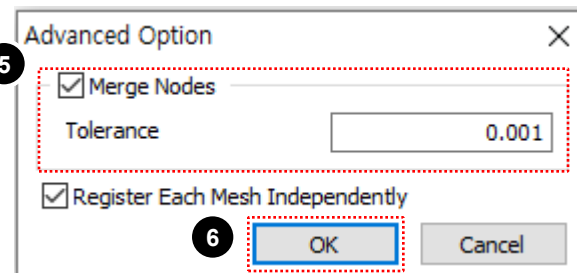
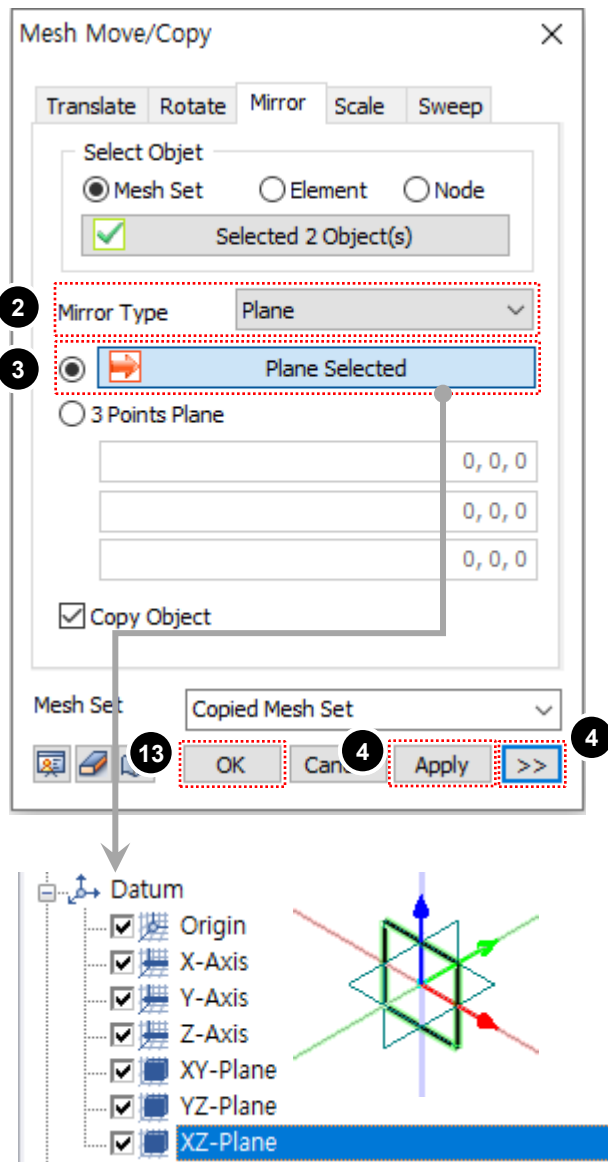
Procedure

- 1 Select **[2D->3D]** tab
- 2 Select **"Temp B"** Mesh Set
- 3 Source : **[Delete]**
- 4 Project Target : **"Three Point Plane"**
- 5 Point 1 : **(7, 0, 8)**
- 6 Point 1 : **(7, 7, 8)**
- 7 Point 1 : **(17, 0, 6.5)**
- 8 Projection Direction : **"Z-Axis"**
- 9 Size Method : **Division : 8**
- 10 Property : **"1"**
- 11 Mesh Set : Select **[Solid Block]**
- 12 Click **[OK]** Button




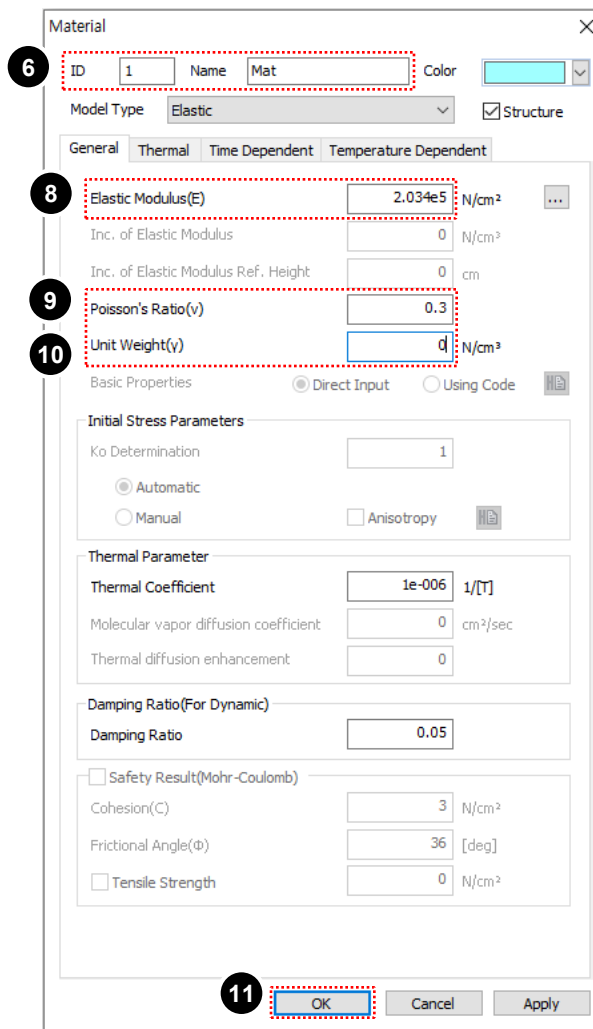
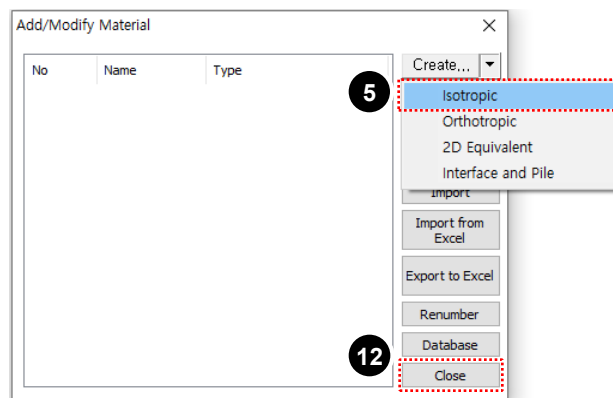
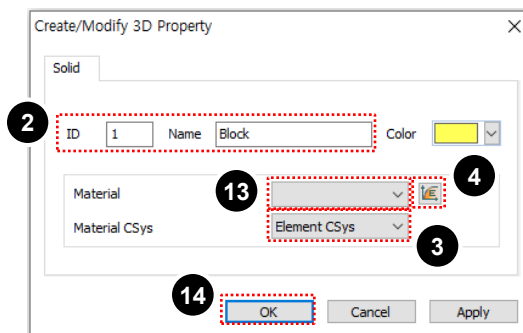
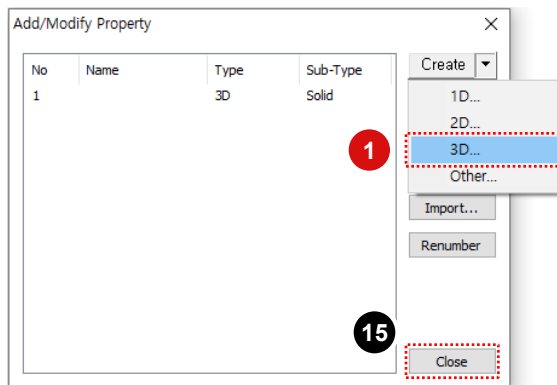
Procedure

- 1 Select “Select All”
- 2 Mirror Type : “Plane”
- 3 Select : “XZ-Plane”
- 4 Click “>>” Button
- 5 Check “Merge Nodes”
- 6 Click [OK] Button
- 7 Click [Apply] Button
- 8 Select “Select All”
- 9 Select : “YZ-Plane”
- 10 Click [Apply] Button
- 11 Select “Select All”
- 12 Select : “XY-Plane”
- 13 Click [OK] Button



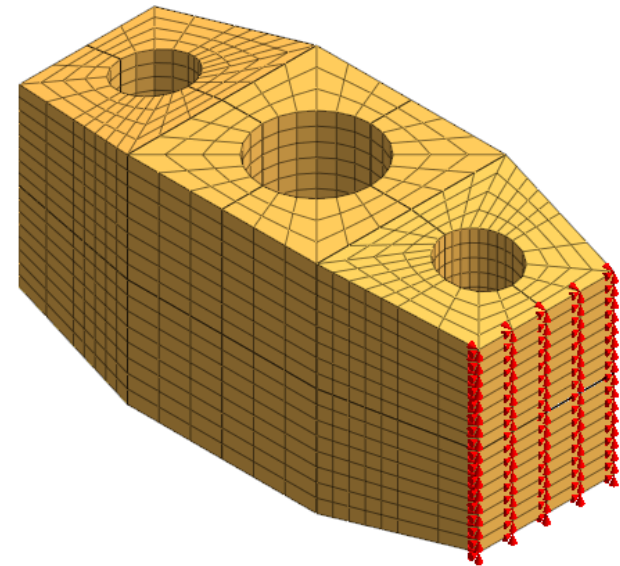
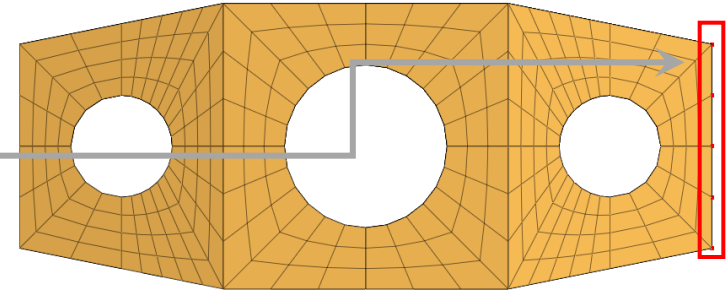
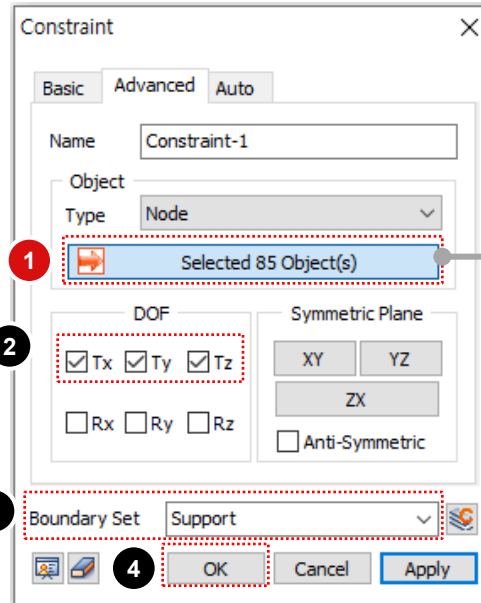
Procedure

- 1 Create [3D]
- 2 ID : "1", Name : "Block"
- 3 Select : "Element Csys"
- 4 Click  Button (Material)
- 5 Click [Create Isotropic] Button
- 6 ID : "1", Name : "Mat"
- 7 Model Type : "Elastic"
- 8 Elastic Modulus : $2.034e5 \text{ N/cm}^2$
- 9 Poisson's Ratio : "0.3"
- 10 Unit Weight : "0"
- 11 Click [OK] Button
- 12 Click [Close] Button
- 13 Select : "1: Mat" for Material
- 14 Click [OK] Button
- 15 Click [Close] Button



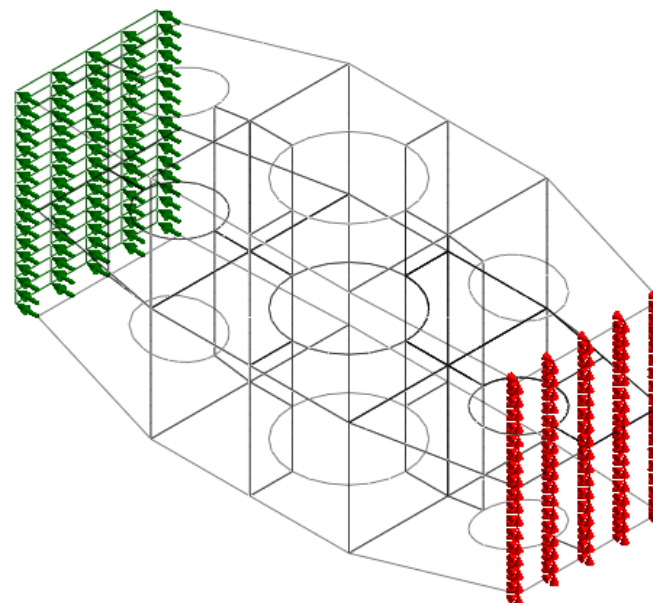
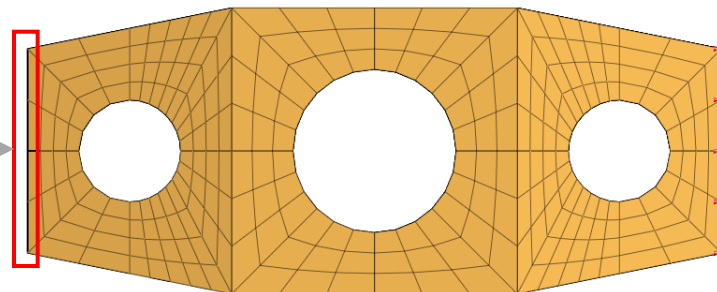
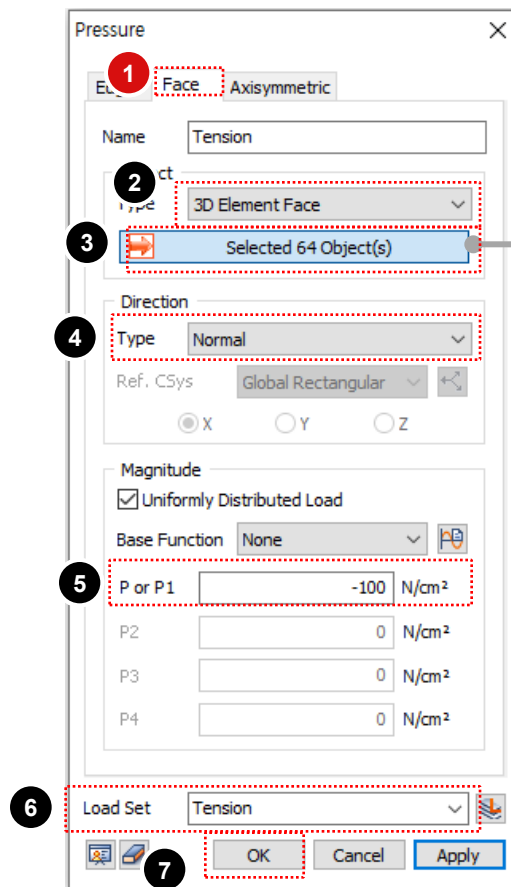
Procedure

- 1 Select 85 Nodes Marked by
“□” (Right Side, See Figure)
- 2 Click [Tx, Ty, Tz] Button
- 3 Boundary Set : [Support]
- 4 Click [OK] Button



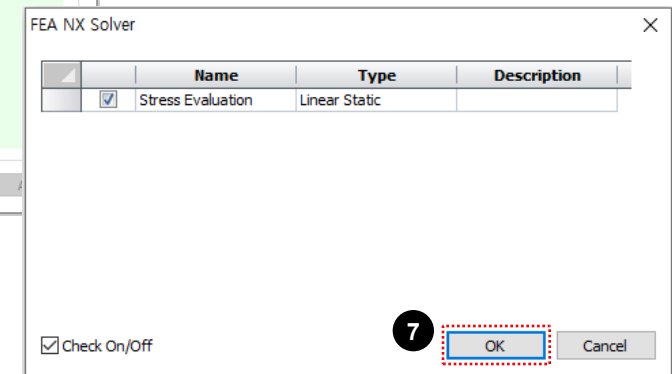
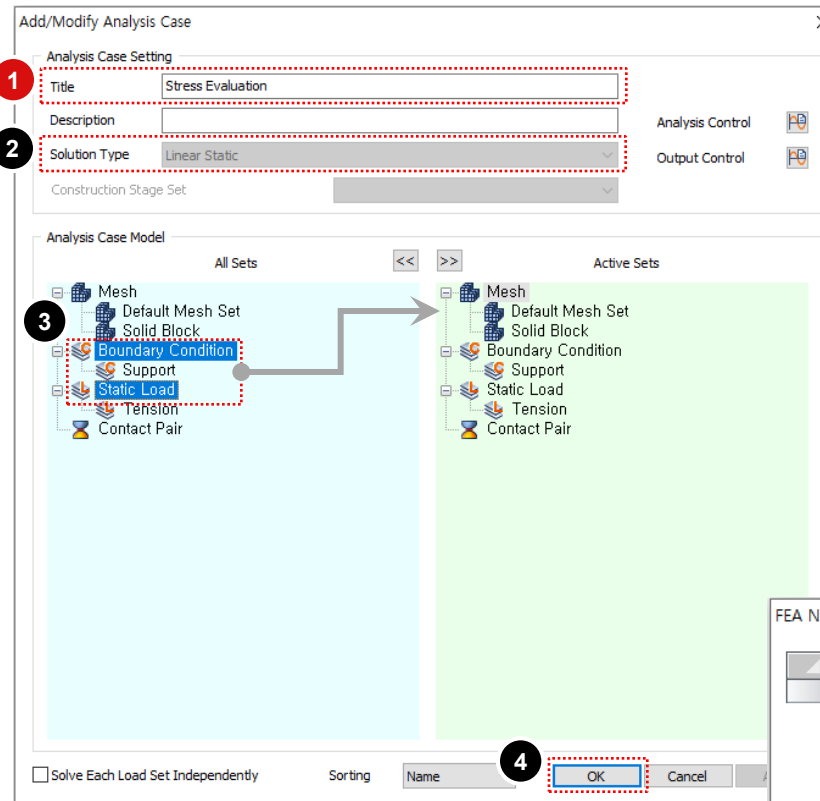
Procedure

- 1 Select **"Face"**
- 2 Object Type : **"3D Element Face"**
- 3 Select 64 Element Faces Marked by **"□"** (See Figure)
- 4 Direction : **"Normal"**
- 5 P or P1 : **"-100"**
- 6 Load Set : **"Tension"**
- 7 Click **[OK]** Button



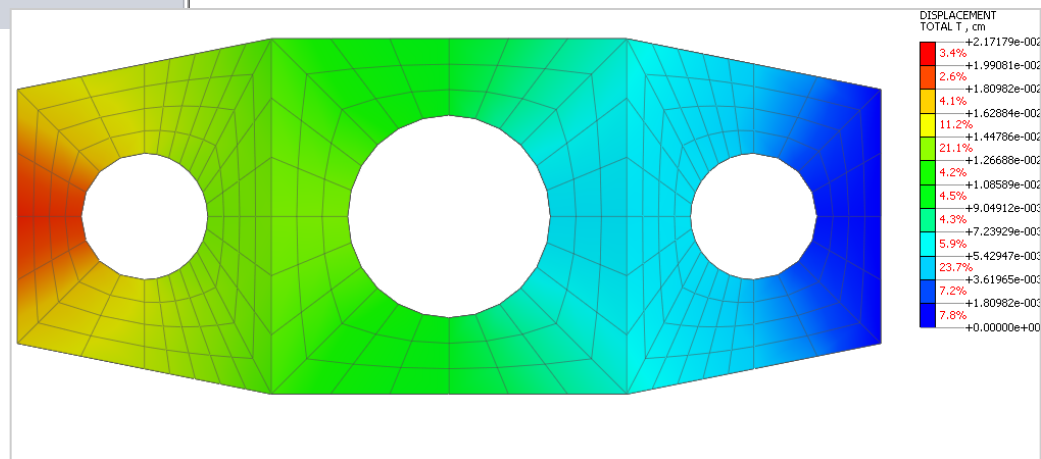
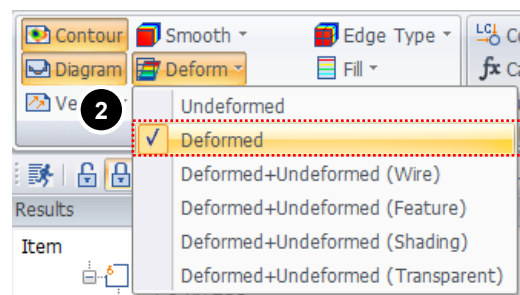
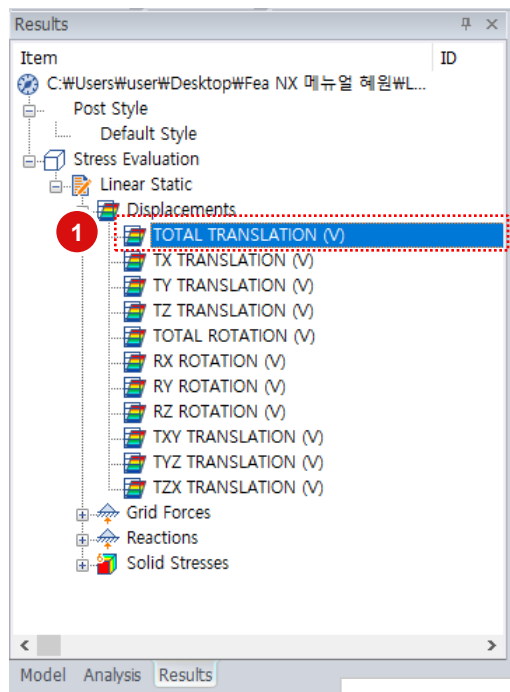
Procedure

- 1 Title : **"Stress Evaluation"**
- 2 Analysis Type : **[Linear Static]**
- 3 Drag & Drop **[Static Load]** and **[Boundary Condition]** to **[Active Sets]** Window
- 4 Click **[OK]** Buttons
- 5 File > **Save** : **"Solid Block"**
- 6 Analysis > **Perform**
- 7 Click **[OK]** Button



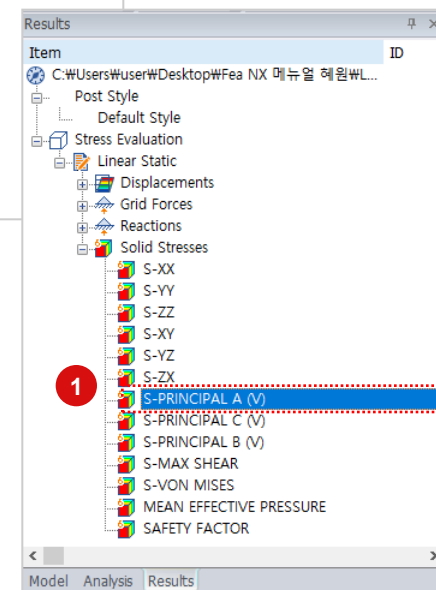
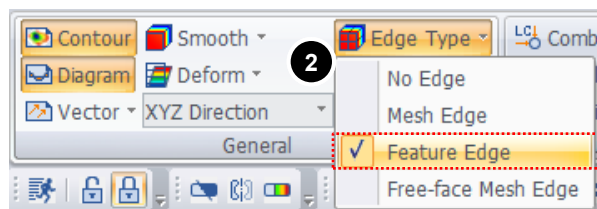
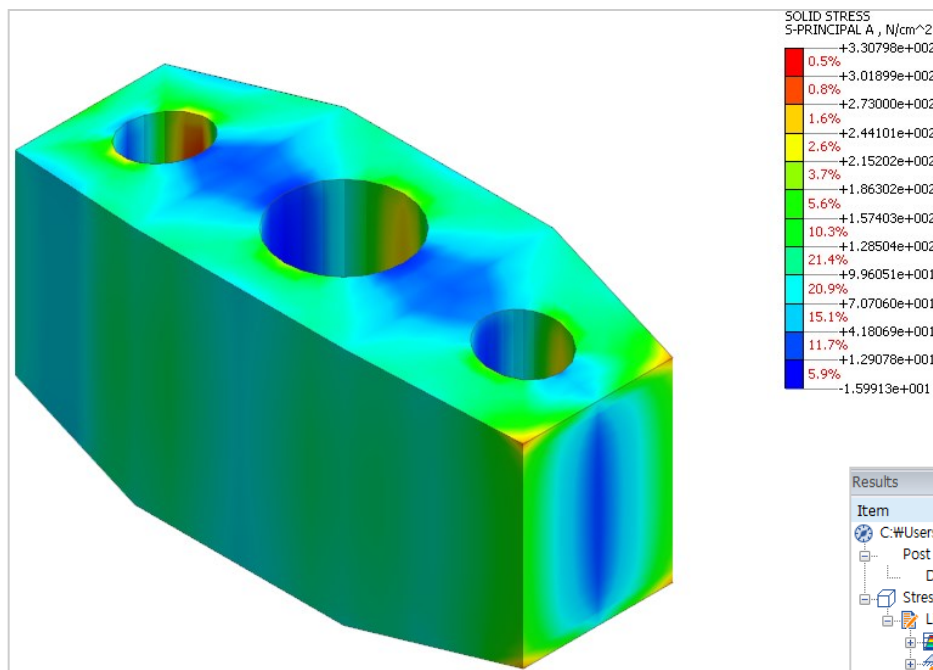
Procedure

- 1 Double Click **[TOTAL TRANSLATION(V)]**
- 2 Select **[Deformed]** for Mesh Shape at **[Result]** Tab



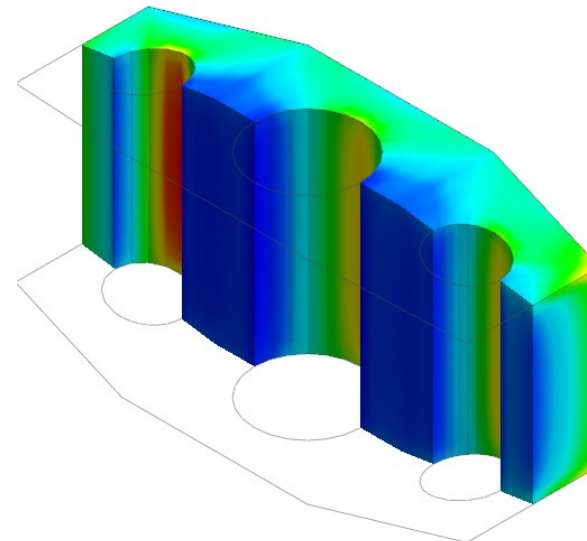
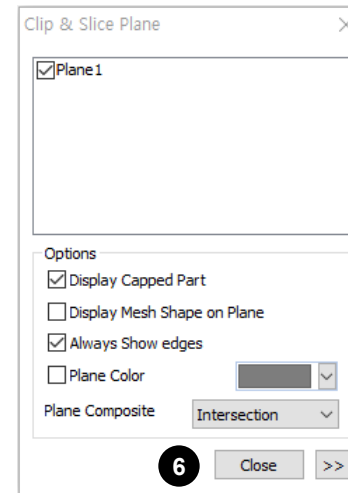
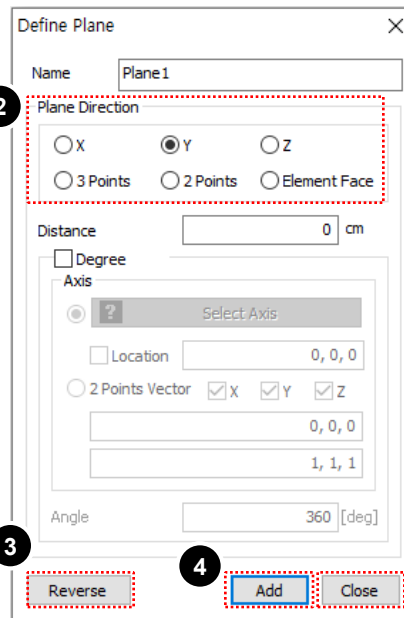
Procedure

- 1 Double Click **[S-PRINCIPAL A(V)]**
- 2 Select **[Feature Edge]** for Edge
Type at **[Result]** tab



Procedure

- 1 Select **[Clipping Plane]**
- 2 Select "Plane Direction - Y"
- 3 Click **[Reverse]** Button
- 4 Click **[Add]** Button
- 5 Click **[Close]** Button
- 6 Click **[Close]** Button

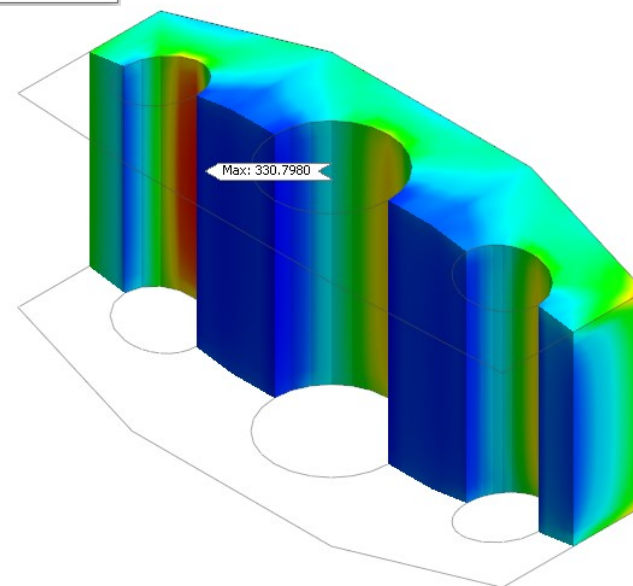
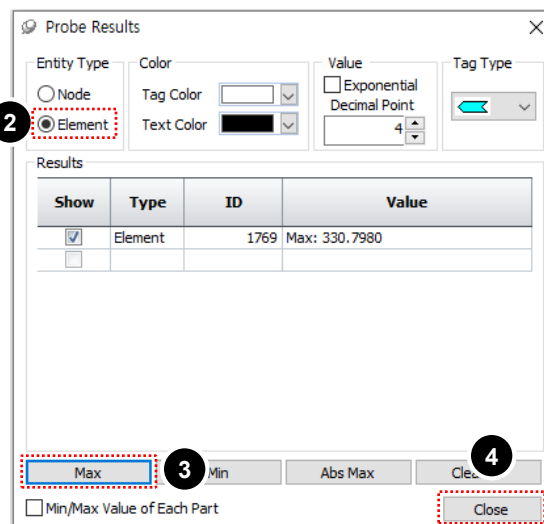


SOLID STRESS
S-PRINCIPAL A, N/cm²

0.5%	+3.30798e+002
0.8%	+3.01899e+002
1.6%	+2.73000e+002
2.6%	+2.44101e+002
3.7%	+2.15202e+002
5.6%	+1.86302e+002
10.3%	+1.57403e+002
21.4%	+1.28504e+002
20.9%	+9.96051e+001
15.1%	+7.07060e+001
11.7%	+4.18069e+001
5.9%	+1.29078e+001
	-1.59913e+001

Procedure

- 1 Result > Advanced > **Probe**
- 2 Entity Type : **[Element]**
- 3 Click **[Max]** Button
- 4 Click **[Close]** Button



SOLID STRESS
S-PRINCIPAL A, N/cm²

0.5%	+3.30798e+002
0.8%	+3.01899e+002
1.6%	+2.73000e+002
2.6%	+2.44101e+002
3.7%	+2.15202e+002
5.6%	+1.86302e+002
10.3%	+1.57403e+002
21.4%	+1.28504e+002
20.9%	+9.96051e+001
15.1%	+7.07060e+001
11.7%	+4.18069e+001
5.9%	+1.29078e+001
	-1.59913e+001