

Overview

▪ 3-D Linear Static Analysis

▪ Model

- 1/12 (30°) Symmetric Model
- Unit : N, cm
- Isotropic Elastic Material
- Plate Elements

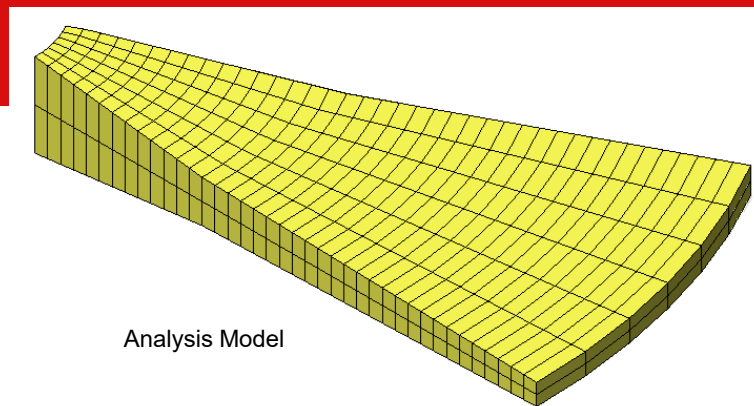
▪ Load & Boundary Condition

- Variable Pressure
- Constraint in Nodal Csys

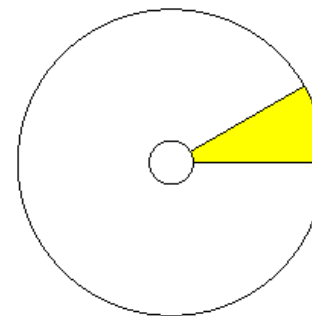
▪ Result Evaluation

- Deformation
- von Mises Stress
- Result Extraction

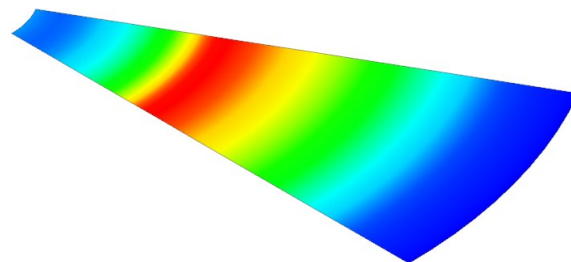
Tapered Plate



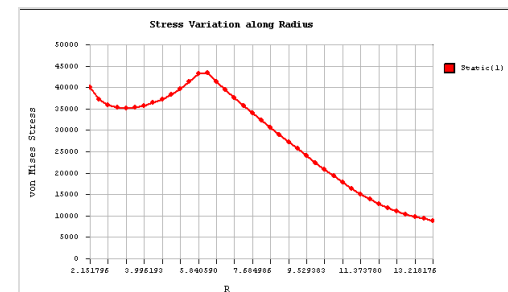
Analysis Model



1/12 Symmetric Part



von Mises Stress



Stress Variation Graph

Procedure

- 1 Model Type : [3D]
- 2 Unit System : [N, cm]
- 3 Click [OK] Button
- 4 Click [Isometric1 View]

Analysis Setting

Project Title Engineer

Desc.

Model Type

1 ☒ 3D

☐ 2D

☐ Axisymmetric

Gravity Direction

☒ Y

☐ Z

Unit System

2

Initial Parameters Water Parameters

Gravity Acceleration(g) 5 cm/sec²


Initial Temperature [T]

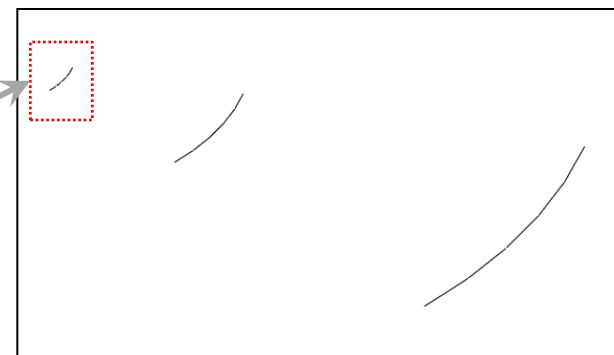
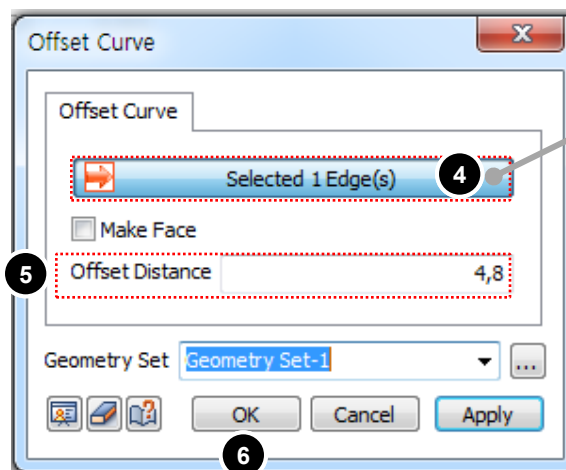
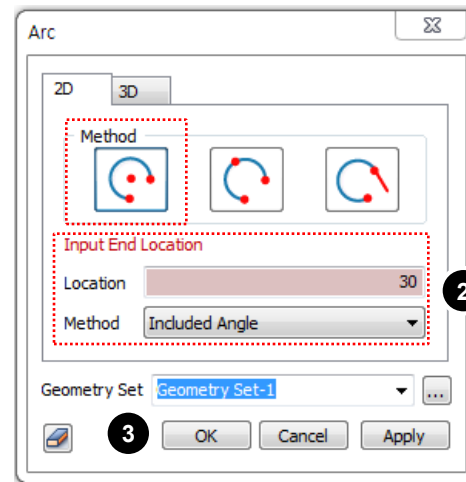
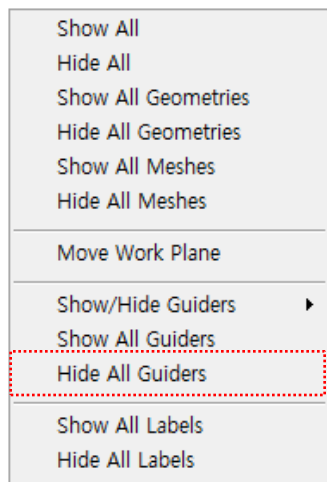
Plane Strain Thickness cm


3



Procedure

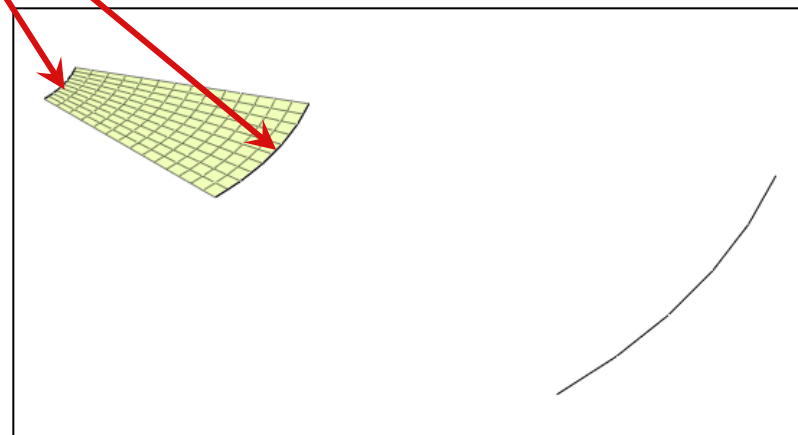
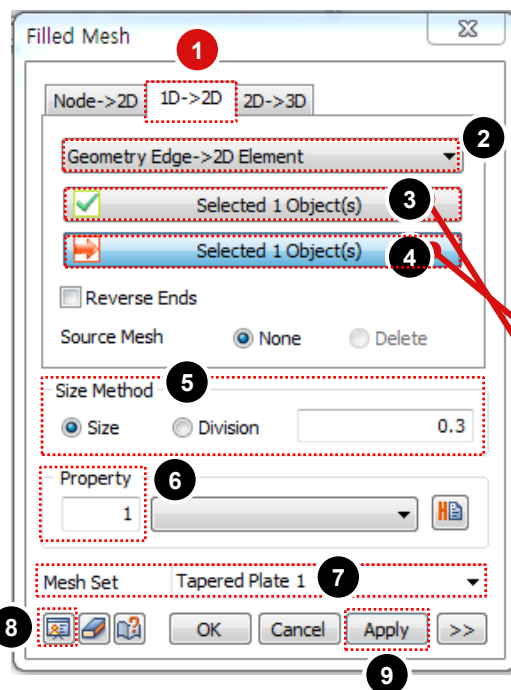
- 1 Click Right Button in Work Window and Select > **[Hide All Guiders]**
- 2 Center “(0)” - Start “(2)” 
- Included Angle “(30)”
- 3 Click **[OK]** Button
- 4 Select **[Arc]**
- 5 Offset Distance : “4, 8”
- 6 Click **[OK]** Button
- 7 Click **[Zoom All]**



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

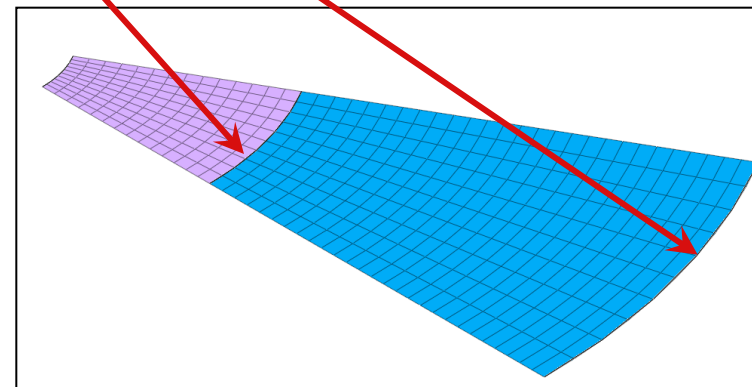
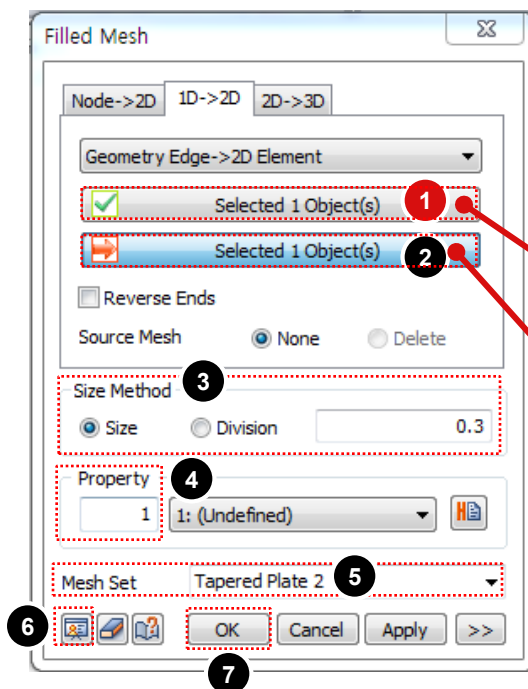
Procedure

- 1 Select **[1D→2D]** tab
- 2 Select **[Geometry Edge →2D Element]**
- 3 Select **[Bottom Edge]**
- 4 Select **[Top Edge]**
- 5 Size Method - Size : **"0.3"**
- 6 Property : **"1"**
- 7 Mesh Set : Tapered Plate **"1"**
- 8 Click **[Preview]** Button
- 9 Click **[Apply]** Button



Procedure

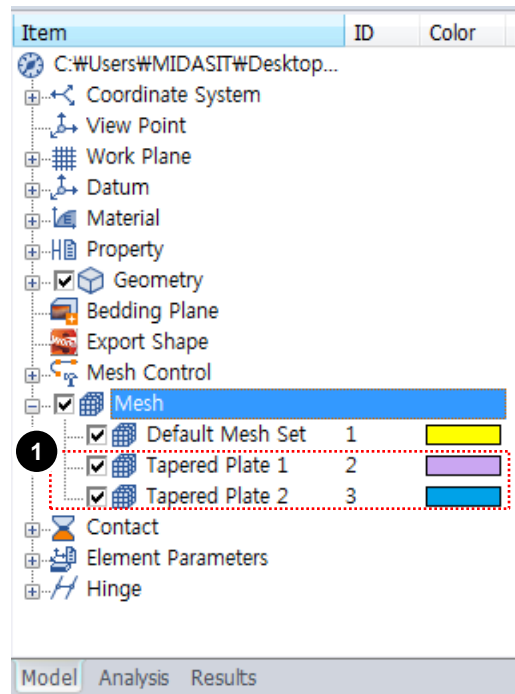
- 1 Select **[Bottom Edge]**
- 2 Select **[Top Edge]**
- 3 Mesh Size - Element Size : **"0.3"**
- 4 Property : **"1"**
- 5 Mesh Set : **[Tapered Plate 2]**
- 6 Click **[Preview]** Button
- 7 Click **[OK]** Button



Procedure**1** Tapered Plate 1 & 2 >

Click Right Mouse > Display

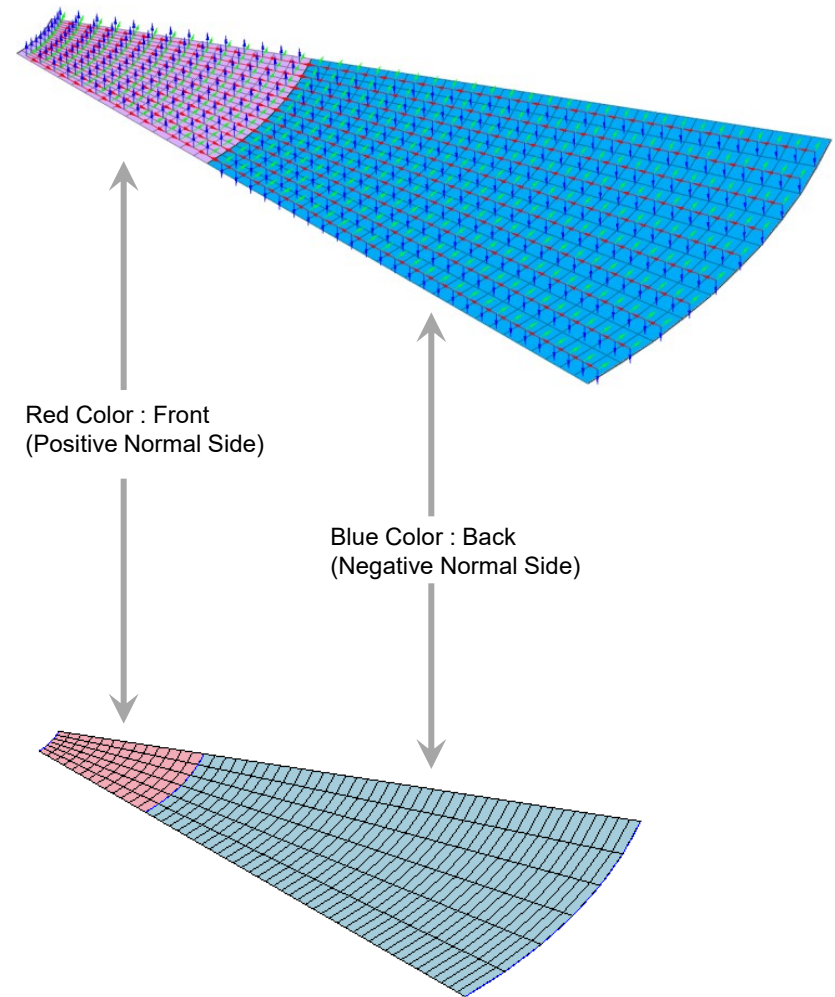
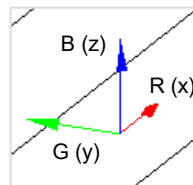
> Element CSys



Pre-Works Tree :

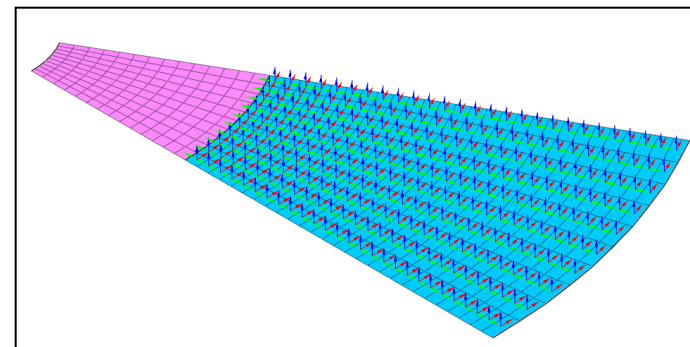
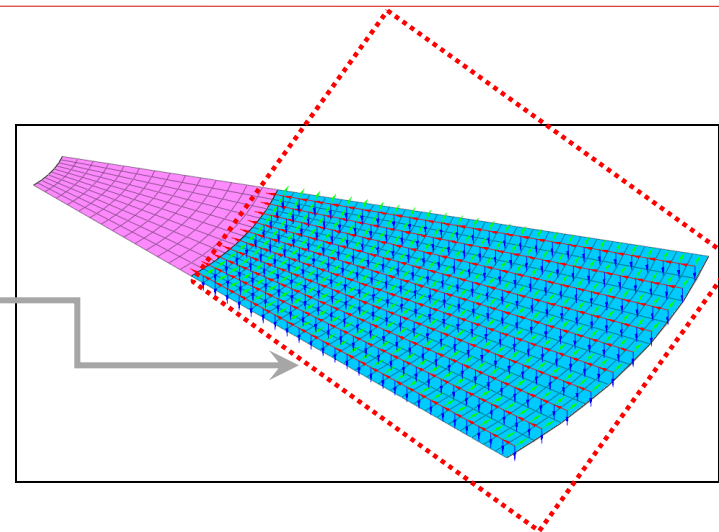
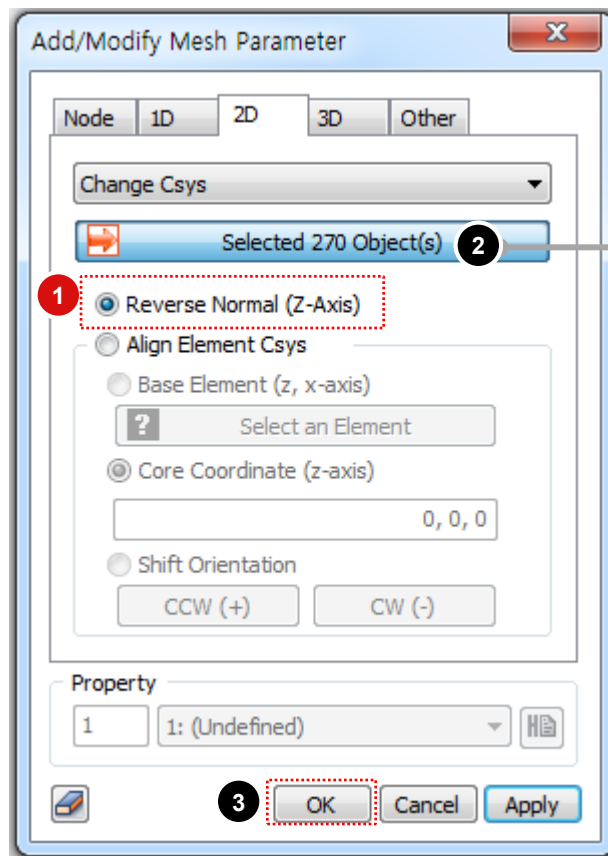
Mesh – Tapered Plate 1 & 2 (Context Menu: Display

> Element CSys



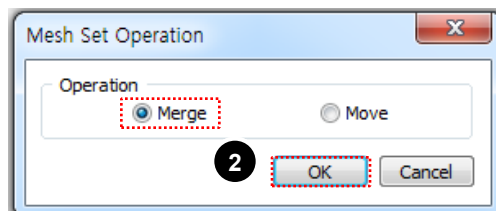
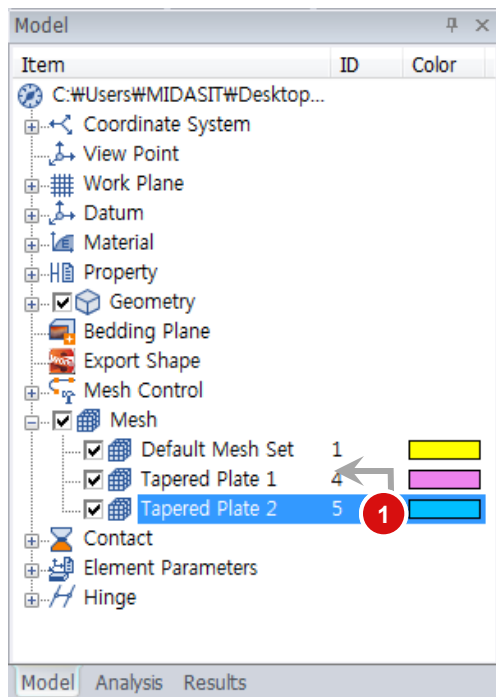
Procedure

- 1 Select **[Reverse Normal]** Option
- 2 Select **[Tapered Plate 2]** Mesh Set
- 3 Click **[OK]** Button



Procedure

- 1 Drag & Drop **[Tapered Plate 2]** to **[Tapered Plate 1]**
- 2 Click **Merge > OK** Button



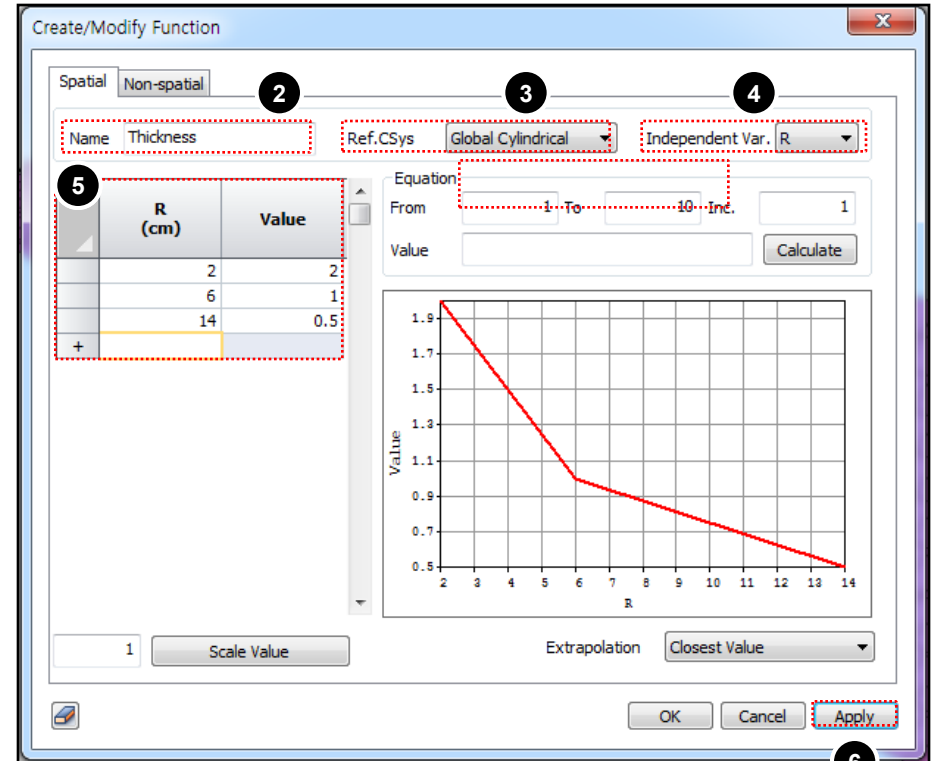
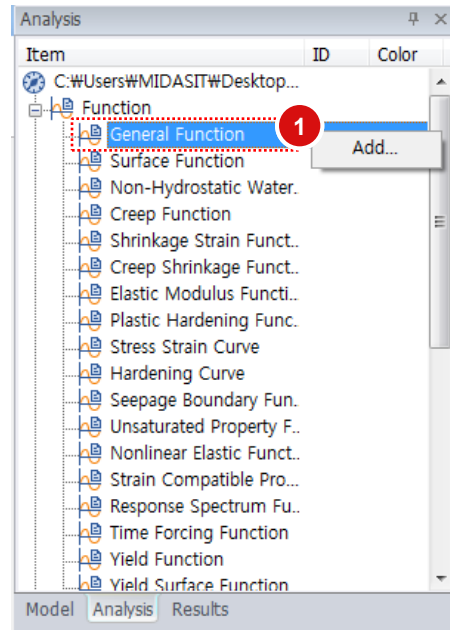
Tapered Plate 1

Tapered Plate 2

Tapered Plate 1
(Merged Mesh Set)

Procedure

- 1 Click Right Mouse > **Add**
- 2 Name : **"Thickness"**
- 3 Ref. CSys : **[Global Cylindrical]**
- 4 Independent Var. : **[R]**
- 5 Enter **"(2, 2), (6, 1), (14, 0.5)"**
- 6 Click **[Apply]** Button



Procedure

- 1 Name : **"Pressure"**
- 2 Ref. CSys : **[Global Cylindrical]**
- 3 Independent Var. : **[R]**
- 4 Equation > From : **"2"**, To : **"14"**,
Inc. : **"1"** Value : **"2*(r-2)*(r-2)"**
- 5 Click **[Calculate]** Button
- 6 Click **[OK]** Button

Create/Modify Function

Spatial ☒ Non-spatial

1

Name

2 Ref.CSys

3 Independent Var.

4

Equation

From To Inc.

Value 5

	R (cm)	Value
	2	0
	3	2
	4	8
	5	18
	6	32
	7	50
	8	72
	9	98
	10	128
	11	162
	12	200
	13	242
	14	288
+		

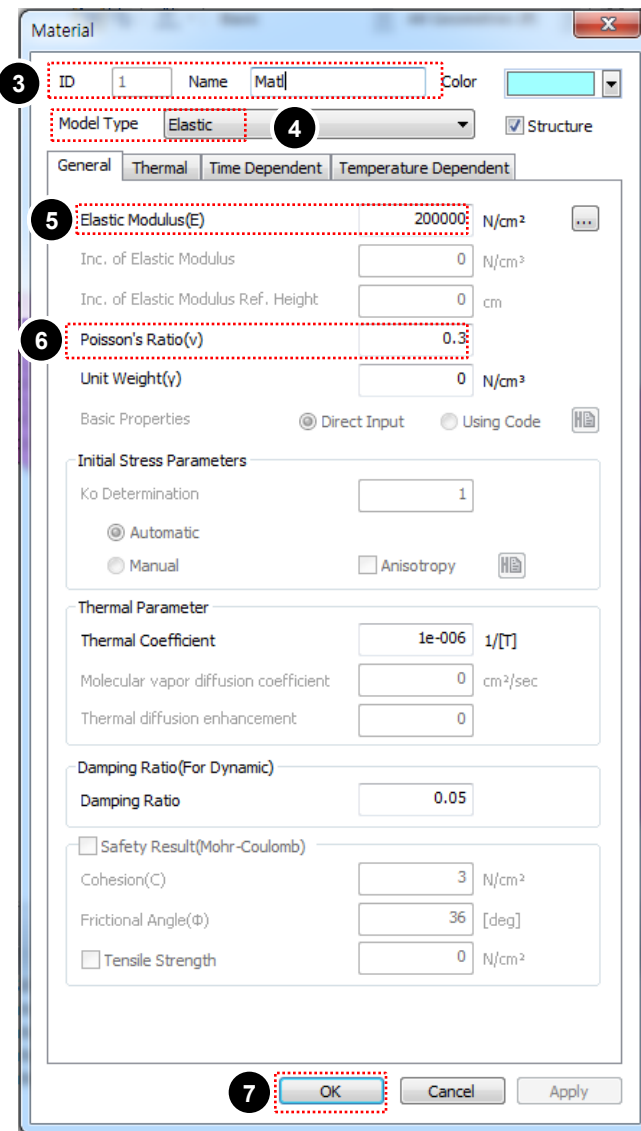
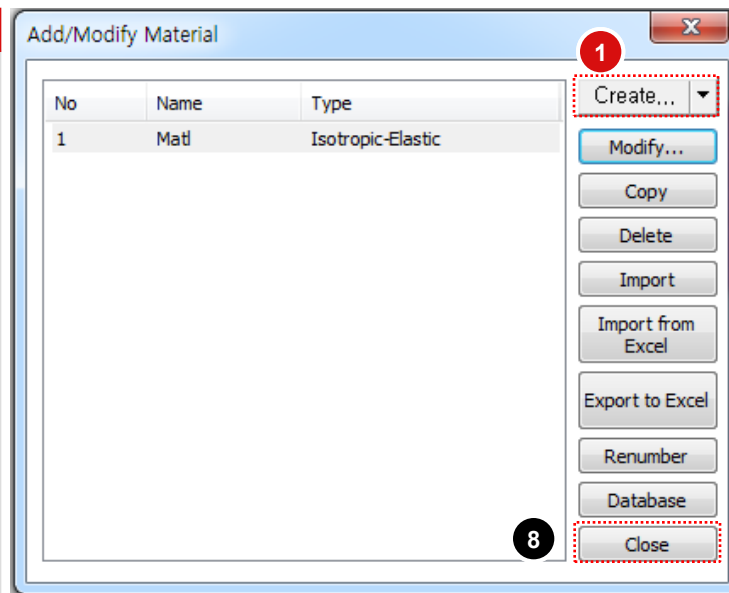
1

Extrapolation

6

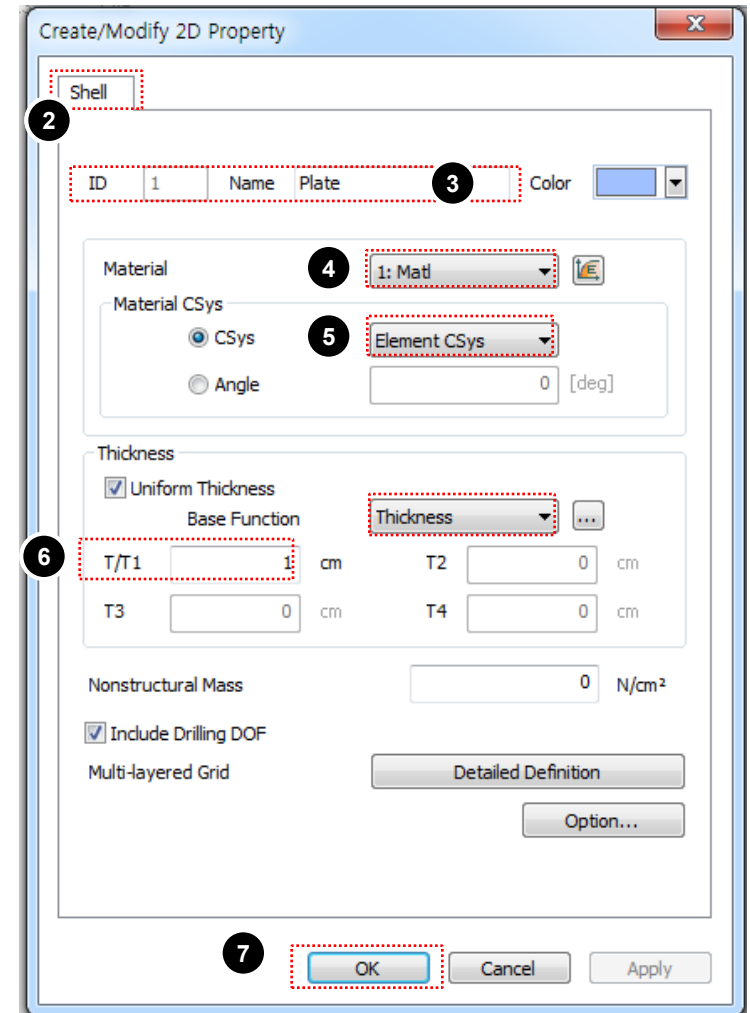
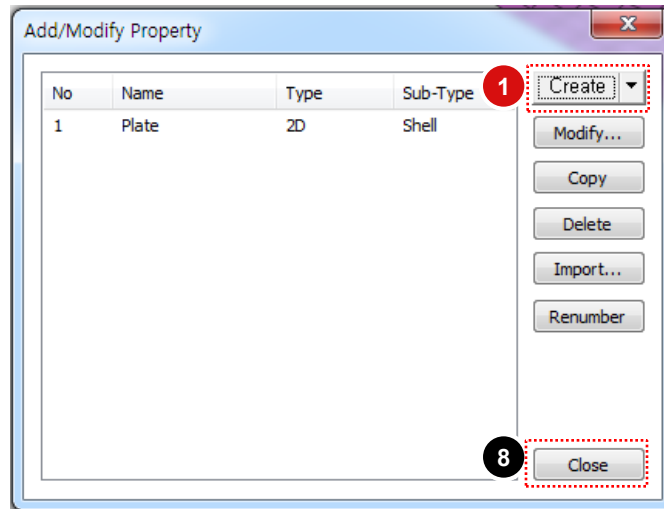
Procedure

- 1 Click **[Create]** Button
- 2 Select **[Isotropic]** tab
- 3 ID : "1" , Name : "Matl"
- 4 Model Type : **[Elastic]**
- 5 Elastic Modulus : "2e5" N/cm²
- 6 Poisson's Ratio : "0.3"
- 7 Click **[OK]** Button
- 8 Click **[Close]** Button



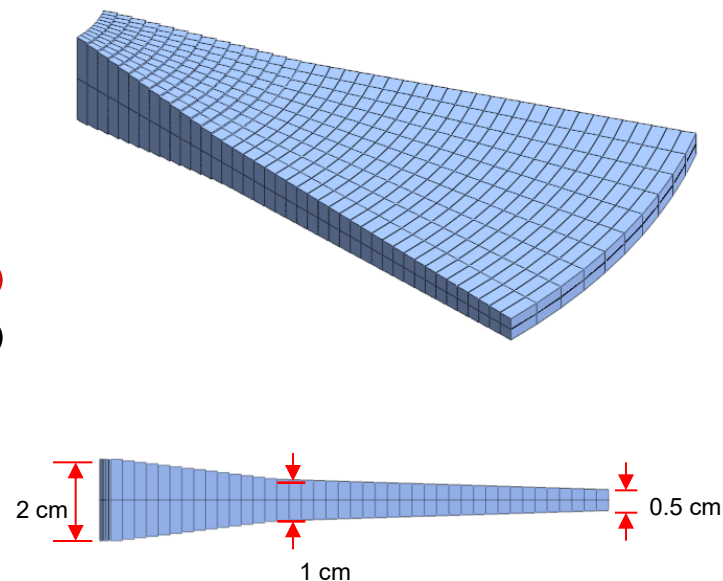
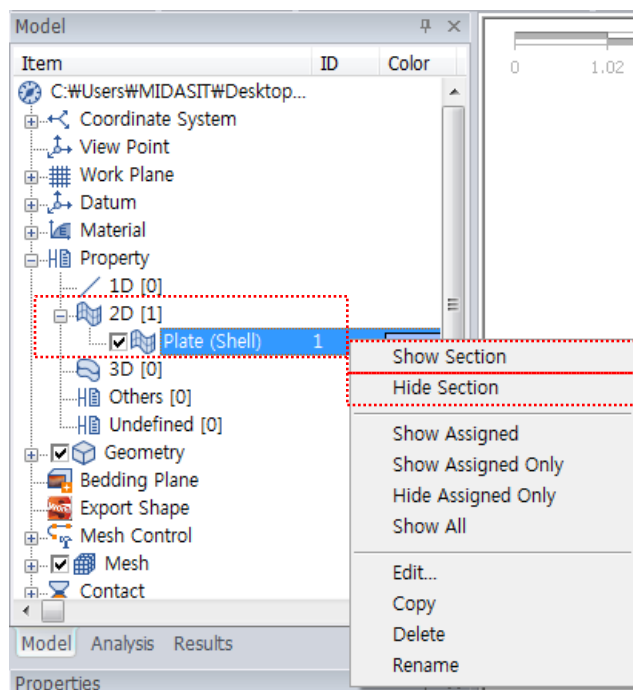
Procedure

- 1 Create [2D]
- 2 Select [Shell] tab
- 3 ID : "1" , Name : "Plate"
- 4 Material : "1: Matl"
- 5 Material CSys : [Element CSys]
- 6 Bar Function : **Thickness** , T or T1 : "1"
- 7 Click [OK] Button
- 8 Click [Close] Button




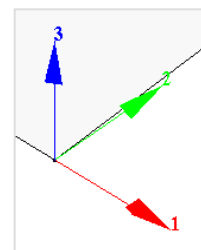
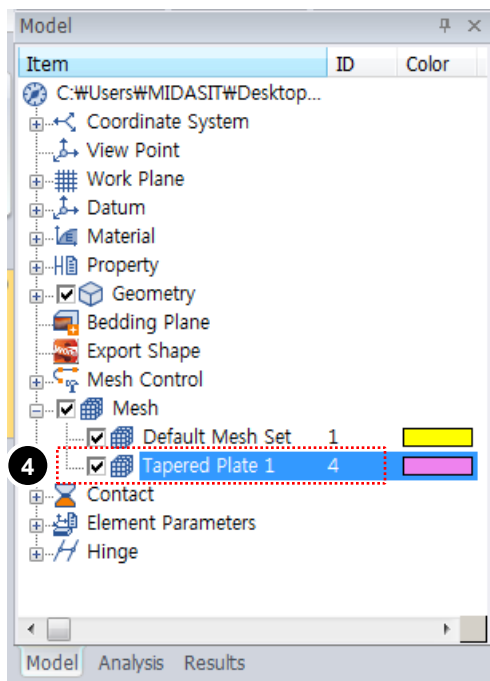
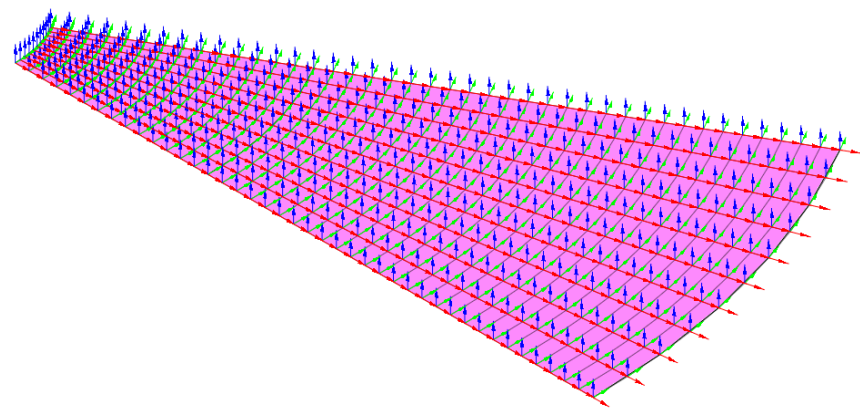
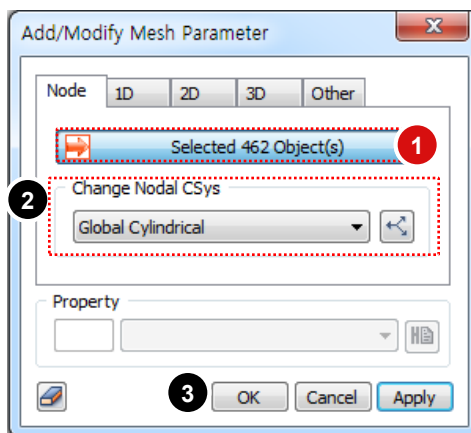
Procedure

- 1 Click Right Mouse Button and Select **[Show Section]**
- 2 Select **[Hide Section]**



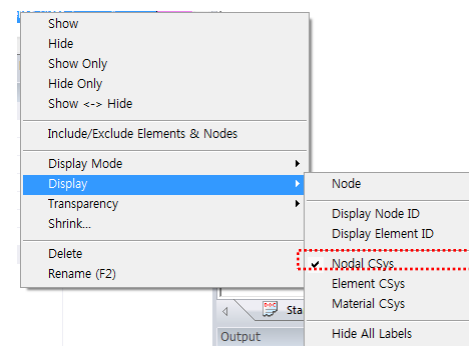
Procedure

- 1 Select All Displayed 
- 2 Csys : **[Global Cylindrical]**
- 3 Click **[OK]** Button
- 4 Model Tree: Mesh > Tapered Plate 1
- 5 Click Right Mouse Button and Select **[Display > Nodal Csys]**
- 6 Repeat <5> to Hide Nodal CSys




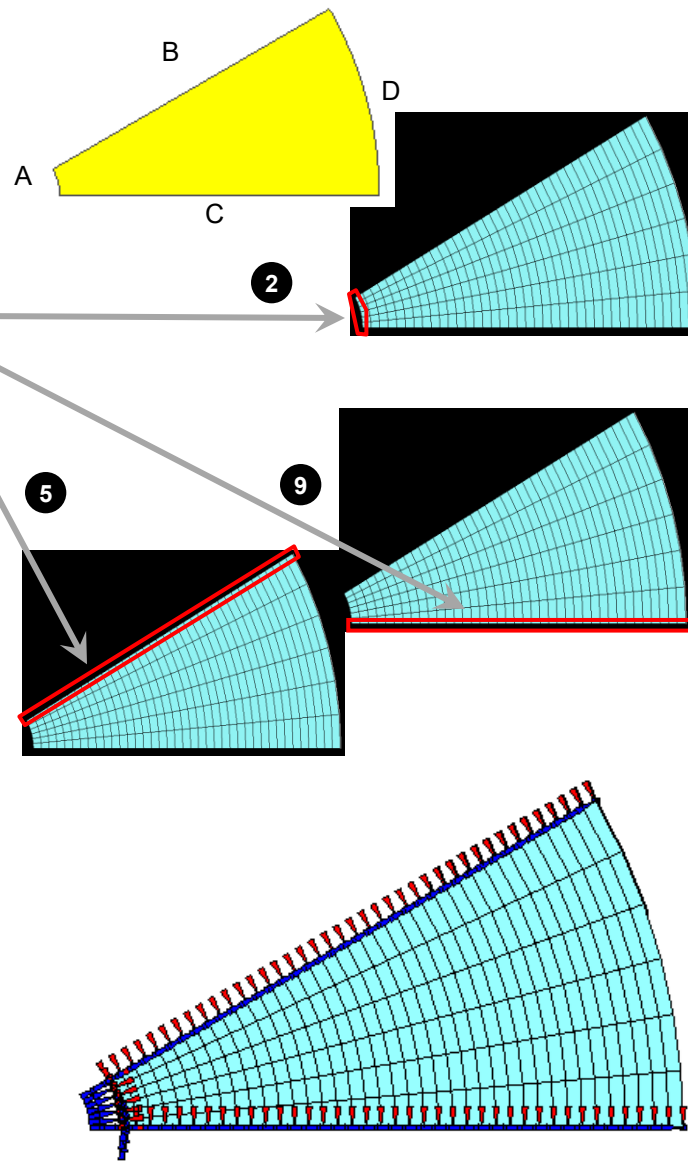
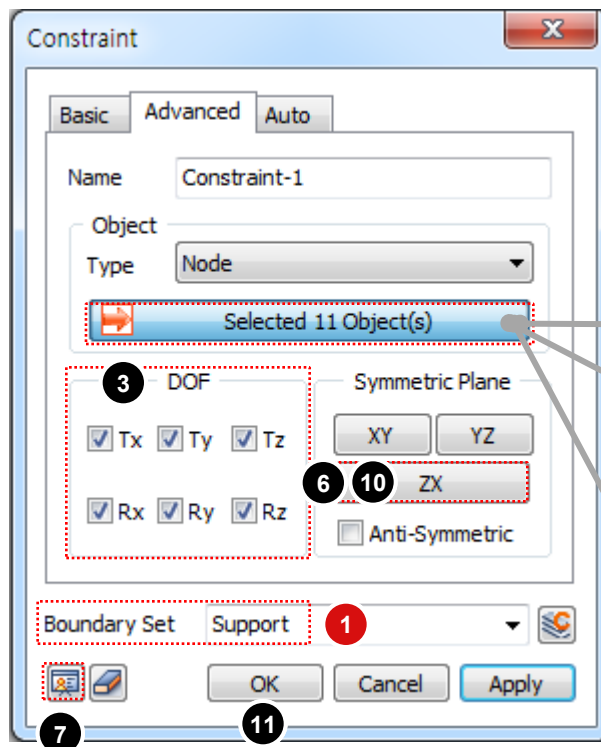
	<i>Color</i>	<i>Rect. CSys</i>	<i>Cyln. CSys</i>
1	<i>R</i>	<i>X</i>	<i>R</i>
2	<i>G</i>	<i>Y</i>	<i>θ</i>
3	<i>B</i>	<i>Z</i>	<i>T</i>

 "Ctrl+A" as shortcut for "Select Displayed"



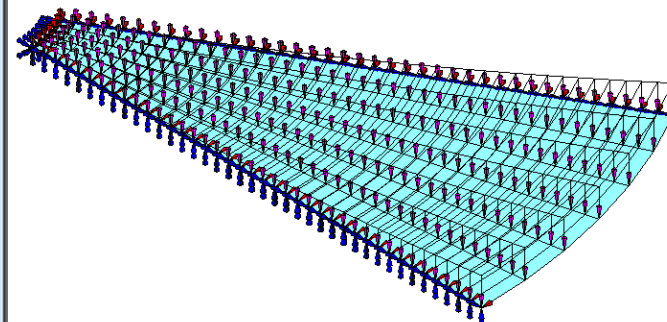
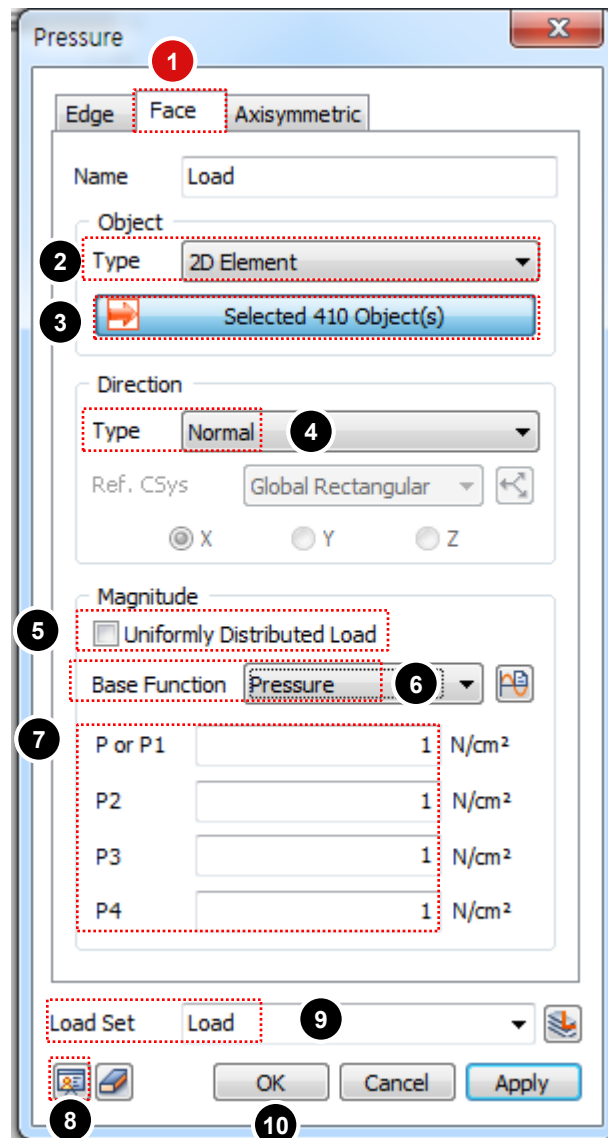
Procedure

- 1 Boundary Set : **[Support]**
- 2 Select **[11 Nodes]** (Side A)
- 3 DOF : Check **ALL** 
- 4 Click **[Apply]** Button
- 5 Select **[42 Nodes]** (Side B)
- 6 Click Symmetry – **[Plane ZX]** Button
- 7 Click **[Preview]** Button
- 8 Click **[Apply]** Button
- 9 Select **[42 Nodes]** (Side C)
- 10 Click Symmetry– **[Plane ZX]** Button
- 11 Click **[OK]** Button

Use  "Polygon" Selection

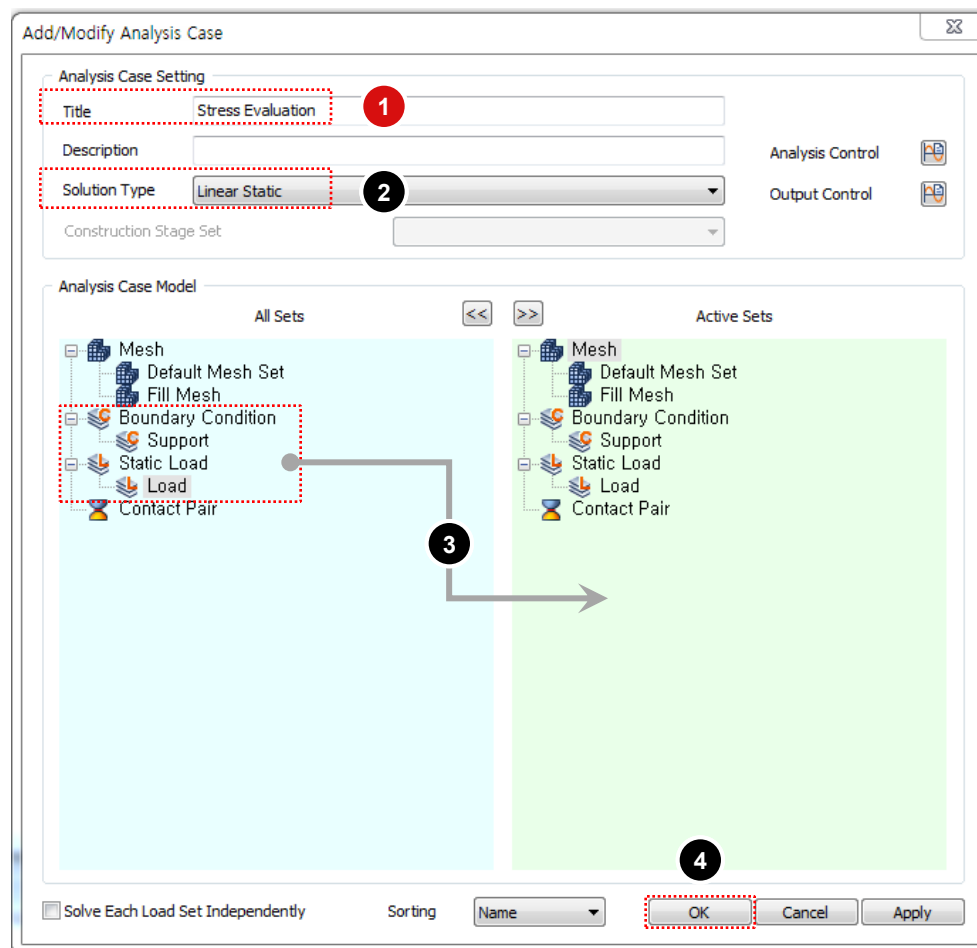
Procedure

- 1 Type : **[Face]**
- 2 Object Type : **[2D Element]**
- 3 Select All Displayed
- 4 Direction : **[Normal]**
- 5 Check off **[Uniformly ...]**
- 6 Base Function : **[Pressure]**
- 7 P1~P4 : **"1"**
- 8 Click **[Preview]** Button
- 9 Load Set : **[Load]**
- 10 Click **[OK]** Button



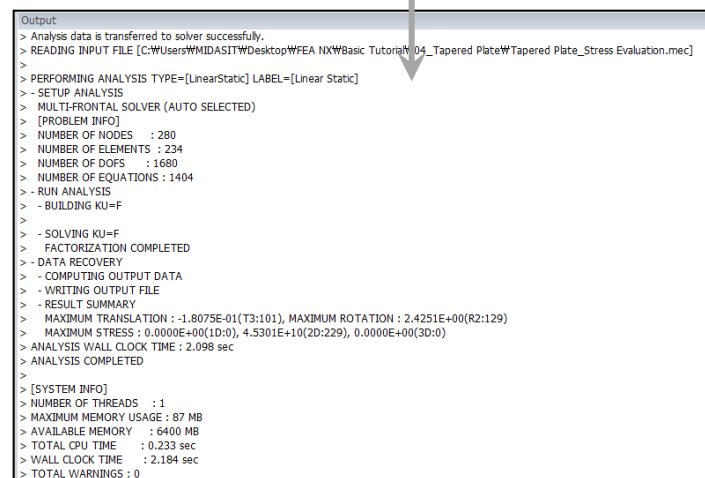
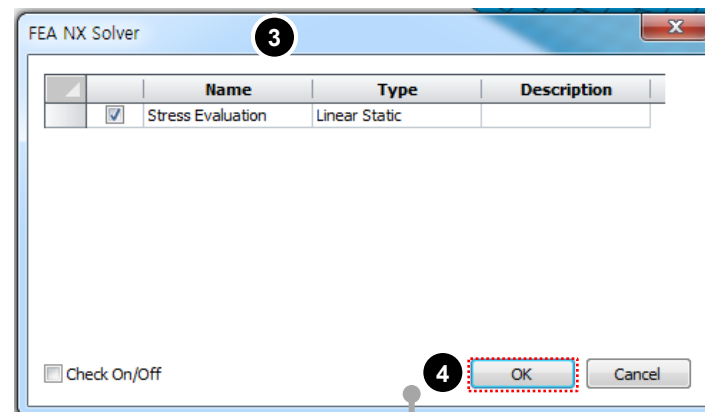
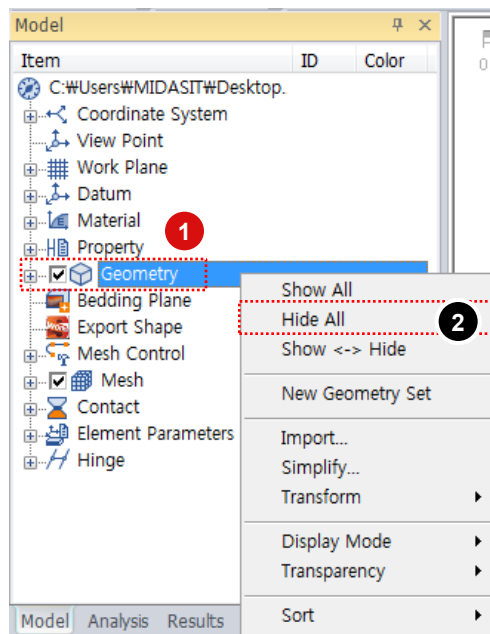
Procedure

- 1 Title : **"Stress Evaluation"**
- 2 Solution Type : **[Linear Static]**
- 3 Drag & Drop **[Support]** & **[Load]**
to **[Active Sets]** Window
- 4 Click **[OK]** Button



Procedure

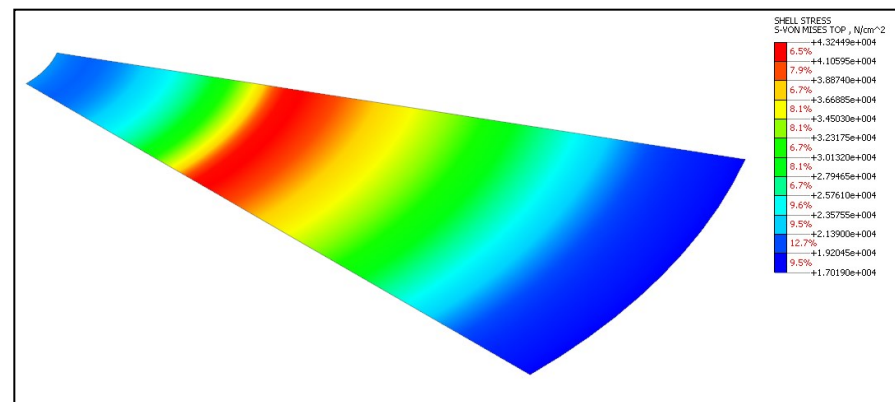
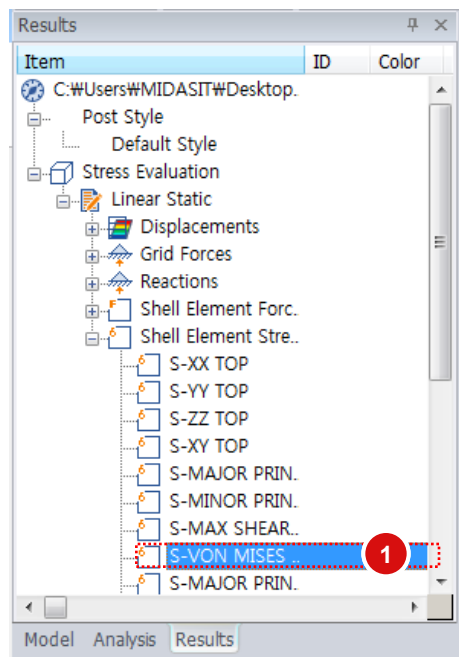
- 1 Model Tree : **[Geometry]**
- 2 Click Right Mouse Button and Select **[Hide All]**
- 3 Analysis > **[Perform ...]**
- 4 Click **[OK]** Button





<Output Window> Analysis Procedure and Messages

Procedure

- 1 Double Click **[S-VON MISES, TOP]**

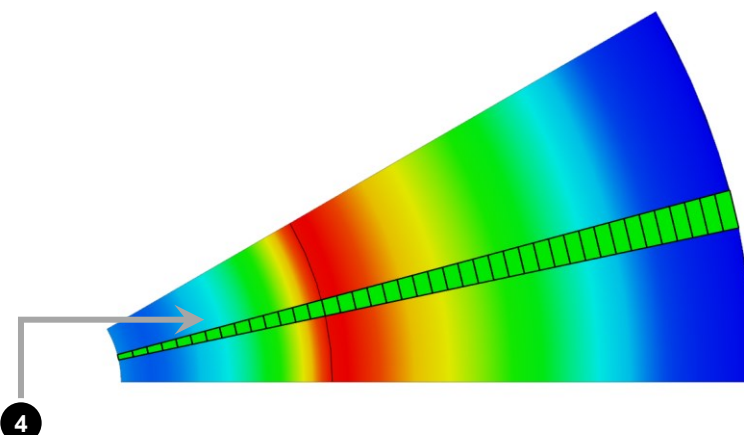
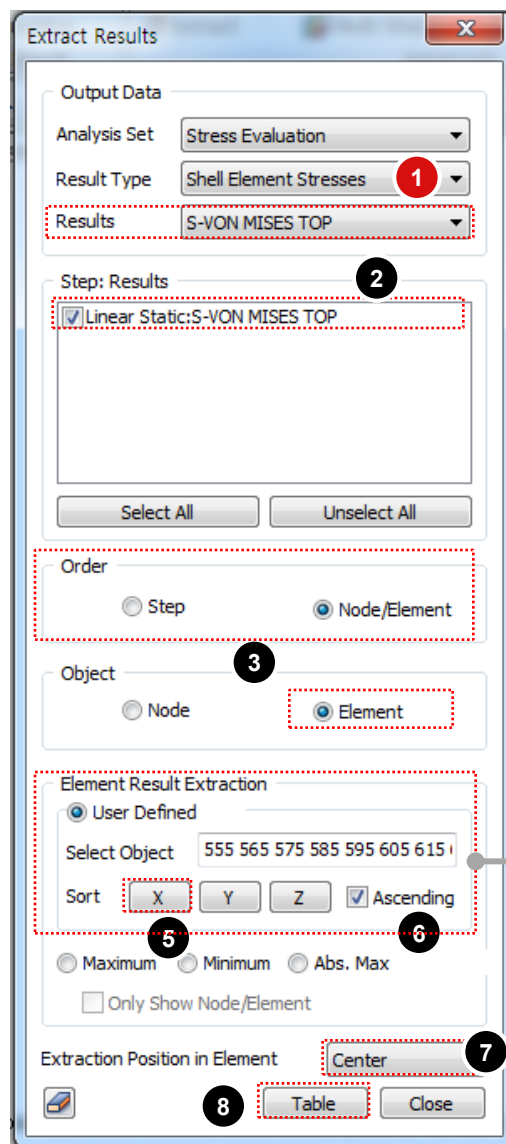


Procedure

- 1 Result Type :
[Shell Element Stresses]
- 2 Click **[S-VON MISES TOP]**
Linear Statics:S-VON MISES TOP]
at **[Step : Result]**
- 3 Order :
Element – **[Element]**
- 4 Select **[41 Elements]**
(Red Colored Elements in Figure) 
- 5 Click **[X Dir]** Button 
- 6 Check on **[Ascending]**
- 7 Extraction Position in Element :
[Center]
- 8 Click **[Table]** Button

 Use  “Polyline” Selection.

 “R Direction” in Cylindrical CSys



Click Two Column Headers > *R and Stress Evaluation(1)*

	No	Element	X (cm)	Y (cm)	Z (cm)	Linear Static S-VON MISES TOP Center (N/cm ²)
	1	555	1.346451e+001	3.232543e+000	0.000000e+000	1.721572e+004
	2	565	1.317650e+001	3.163397e+000	0.000000e+000	1.757974e+004
	3	575	1.288849e+001	3.094252e+000	0.000000e+000	1.787491e+004
	4	585	1.260048e+001	3.025107e+000	0.000000e+000	1.821750e+004
	5	595	1.231246e+001	2.955962e+000	0.000000e+000	1.869438e+004
	6	605	1.202445e+001	2.886816e+000	0.000000e+000	1.935103e+004
	7	615	1.173644e+001	2.817671e+000	0.000000e+000	2.019492e+004
	8	625	1.144843e+001	2.748526e+000	0.000000e+000	2.120641e+004
	9	635	1.116042e+001	2.679380e+000	0.000000e+000	2.235143e+004
	10	645	1.087241e+001	2.610235e+000	0.000000e+000	2.359172e+004
	11	655	1.058440e+001	2.541090e+000	0.000000e+000	2.489113e+004
	12	665	1.029639e+001	2.471944e+000	0.000000e+000	2.621901e+004
	13	675	1.000838e+001	2.402799e+000	0.000000e+000	2.755126e+004
	14	685	9.720367e+000	2.333654e+000	0.000000e+000	2.886988e+004
	15	695	9.432356e+000	2.264509e+000	0.000000e+000	3.016232e+004
	16	705	9.144345e+000	2.195363e+000	0.000000e+000	3.142079e+004
	17	715	8.856334e+000	2.126218e+000	0.000000e+000	3.264129e+004
	18	725	8.568324e+000	2.057073e+000	0.000000e+000	3.382293e+004
	19	735	8.280313e+000	1.987927e+000	0.000000e+000	3.496761e+004
	20	745	7.992302e+000	1.918782e+000	0.000000e+000	3.607972e+004
	21	755	7.704291e+000	1.849637e+000	0.000000e+000	3.716578e+004
	22	765	7.416280e+000	1.780491e+000	0.000000e+000	3.823467e+004
	23	775	7.128269e+000	1.711346e+000	0.000000e+000	3.929789e+004
	24	785	6.840258e+000	1.642201e+000	0.000000e+000	4.036988e+004
	25	795	6.552247e+000	1.573056e+000	0.000000e+000	4.146876e+004
	26	805	6.264237e+000	1.503910e+000	0.000000e+000	4.261757e+004
	27	815	5.976226e+000	1.434765e+000	0.000000e+000	4.384578e+004
	28	545	5.693358e+000	1.366854e+000	0.000000e+000	4.185294e+004
	29	535	5.415633e+000	1.300179e+000	0.000000e+000	3.744002e+004
	30	525	5.137908e+000	1.233503e+000	0.000000e+000	3.384485e+004
	31	515	4.860184e+000	1.166827e+000	0.000000e+000	3.087966e+004
	32	505	4.582459e+000	1.100151e+000	0.000000e+000	2.840984e+004
	33	495	4.304734e+000	1.033475e+000	0.000000e+000	2.633792e+004
	34	485	4.027009e+000	9.667994e-001	0.000000e+000	2.459354e+004
	35	475	3.749284e+000	9.001236e-001	0.000000e+000	2.312759e+004
	36	465	3.471560e+000	8.334478e-001	0.000000e+000	2.190953e+004
	37	455	3.193835e+000	7.667719e-001	0.000000e+000	2.092816e+004
	38	445	2.916110e+000	7.000961e-001	0.000000e+000	2.019692e+004
	39	435	2.638385e+000	6.334203e-001	0.000000e+000	1.976716e+004
	40	425	2.360661e+000	5.667445e-001	0.000000e+000	1.975697e+004
	41	415	2.082936e+000	5.000686e-001	0.000000e+000	2.041135e+004

MS-Excel Compatible table