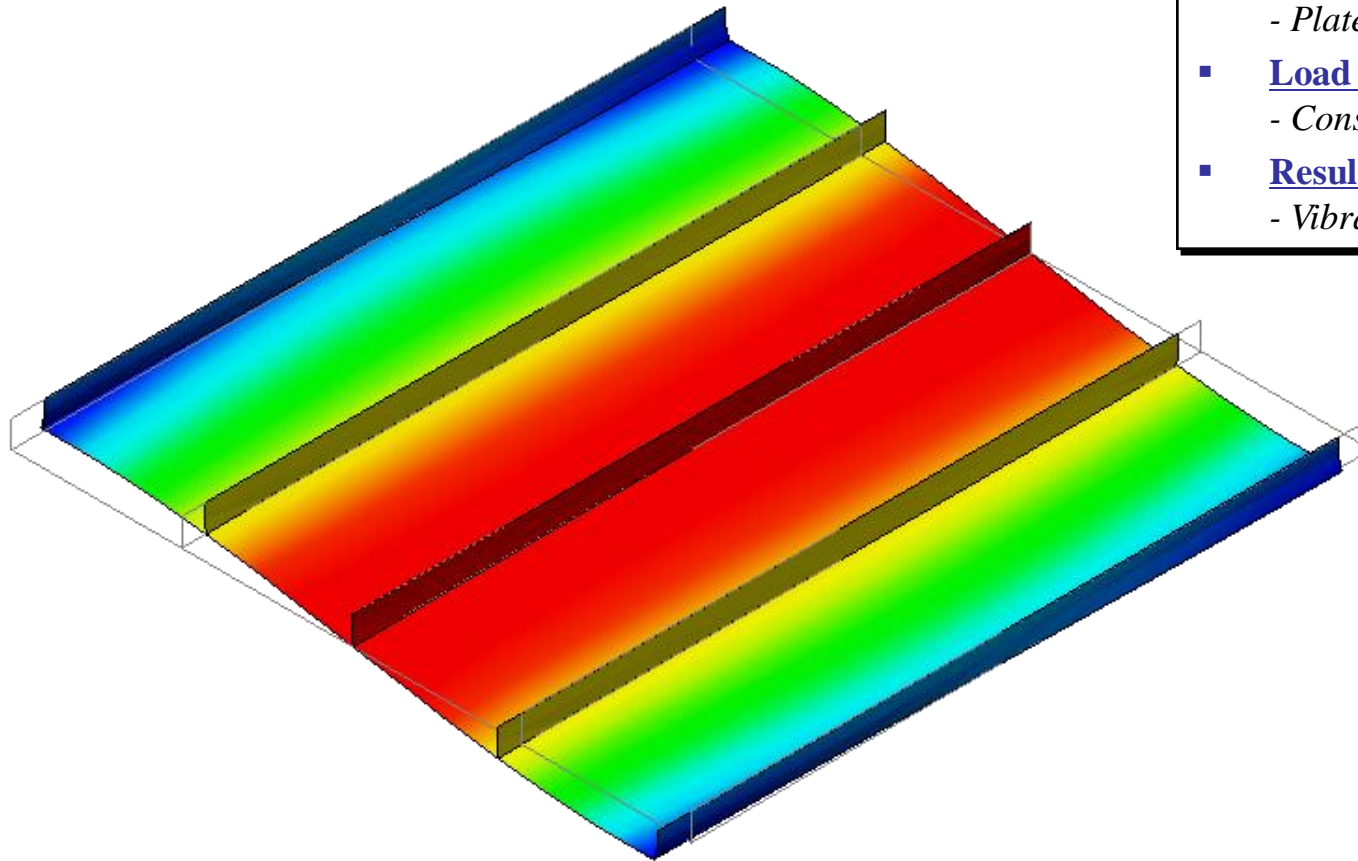


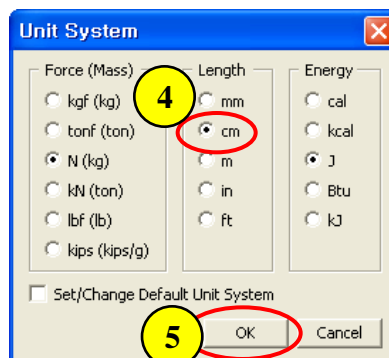
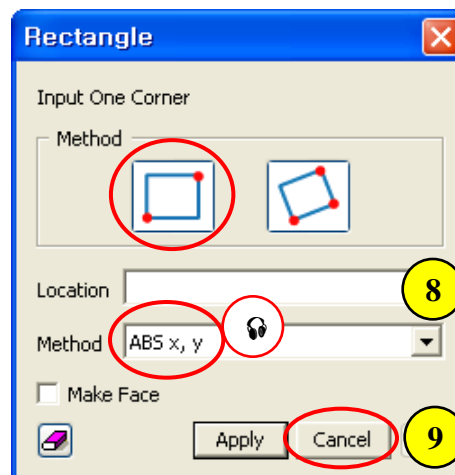
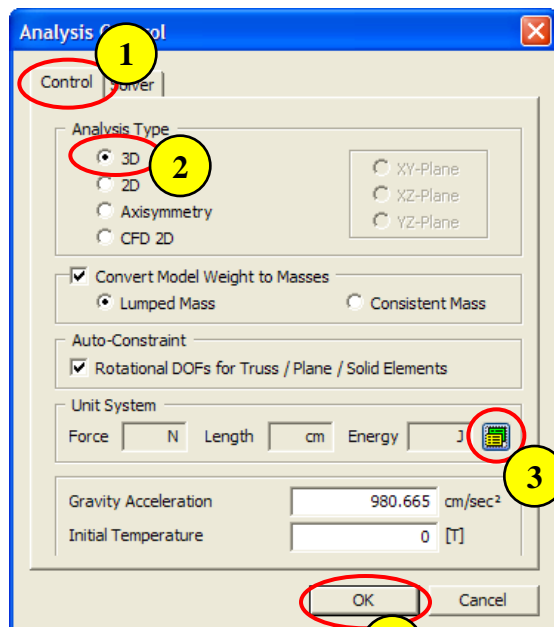
MA-1. Modal Analysis of Stiffened Plate



Overview

- 3-D Eigenvalue Analysis
- Model
 - Unit : N, cm
 - Isotropic Elastic Material
 - Plate Element
- Load & Boundary Condition
 - Constraint
- Result Evaluation
 - Vibration Frequency / Period

Step 1.



1. Analysis > Analysis Control – “Control” tab

2. Analysis Type : 3D

3. Click  Button (Unit System)

4. Length : cm

5. Click [OK] Button

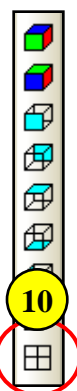
6. Click [OK] Button

7. Geometry > Curve > Create on WP > Rectangle (Wire)...

8. Location : (0), <50, 50>

9. Click [Cancel] Button

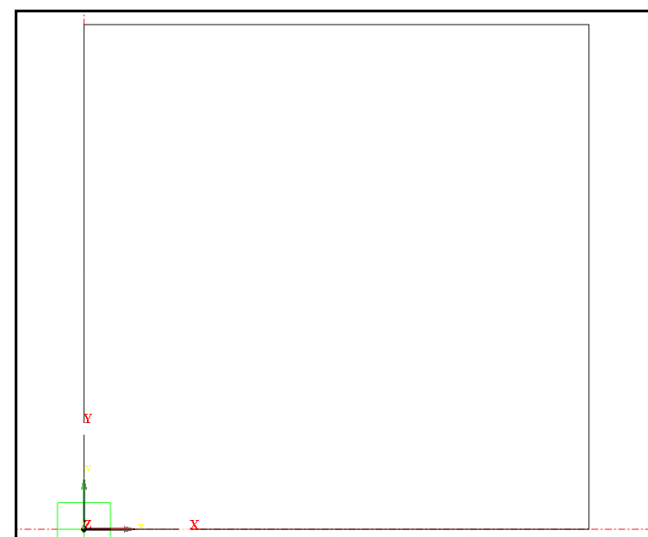
10. Click “Normal View”



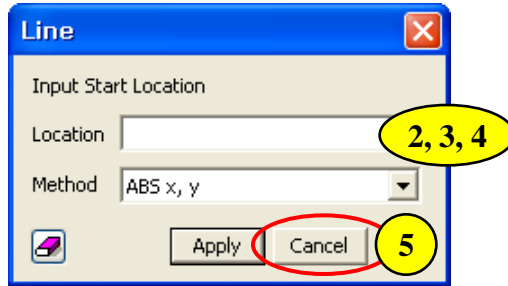
⦿ () : “ABS x, y”, <> : “REL dx, dy”
(0) same as (0, 0)

⦿ “Esc” as shortcut for “Cancel”.

⦿ Analysis Control Dialog is automatically activated at startup



Step 2.



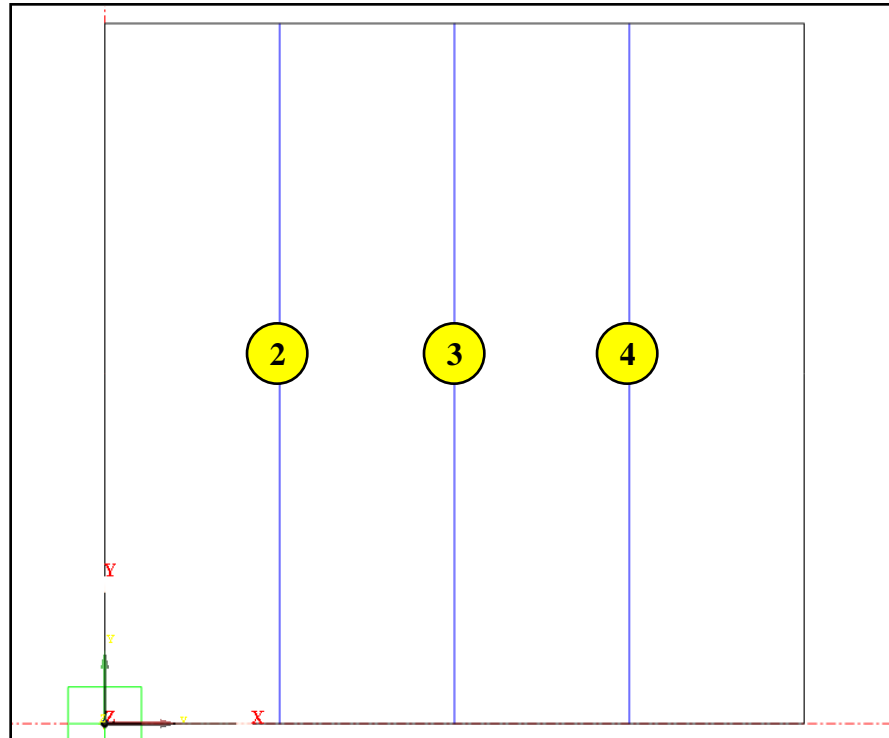
1. Geometry > Curve > Create on WP > Line...

2. Location : (12.5), <0, 50>

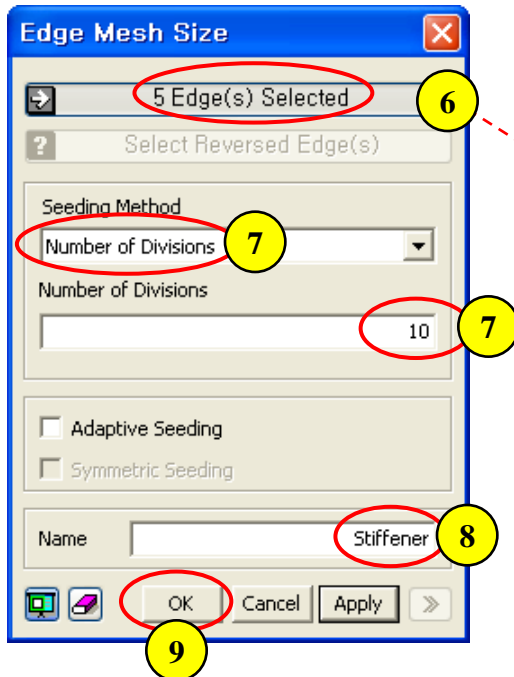
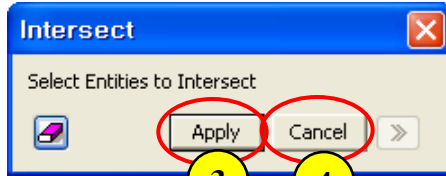
3. Location : (25), <0, 50>


4. Location : (37.5), <0, 50>

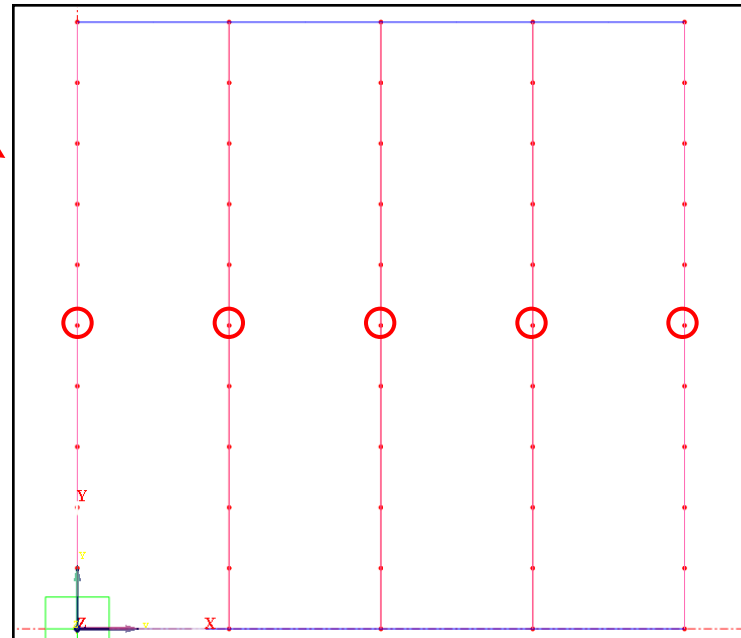
5. Click [Cancel] Button



Step 3.



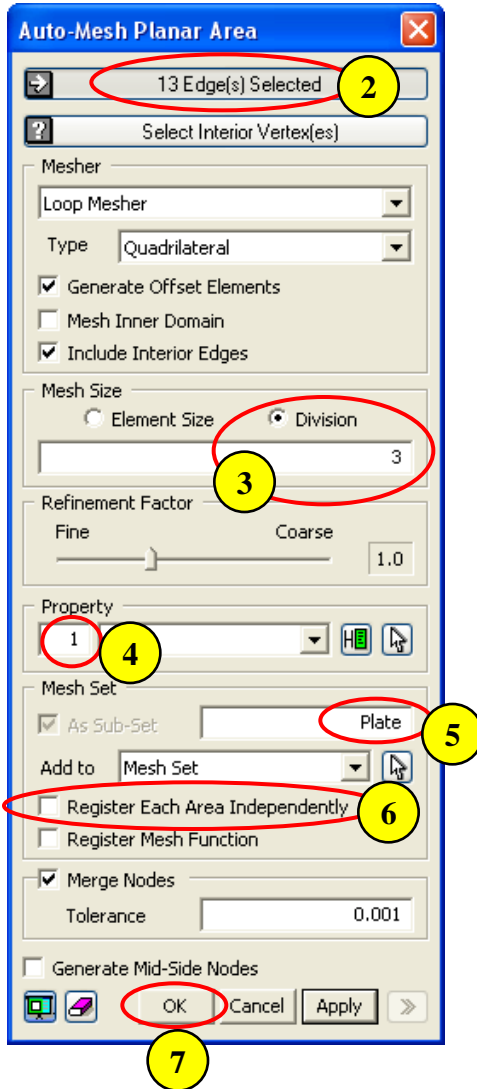
1. Geometry > Curve > Intersect ...
2. Select  "Displayed" [Ⓐ]
3. Click [Apply] Button [Ⓐ]
4. Click [Cancel] Button
5. Mesh > Size Control > Along Edge ...
6. Select 5 Edges marked by "O" (See Figure)
7. Seeding Method - Number of Divisions :10
8. Name : Stiffener
9. Click [OK] Button



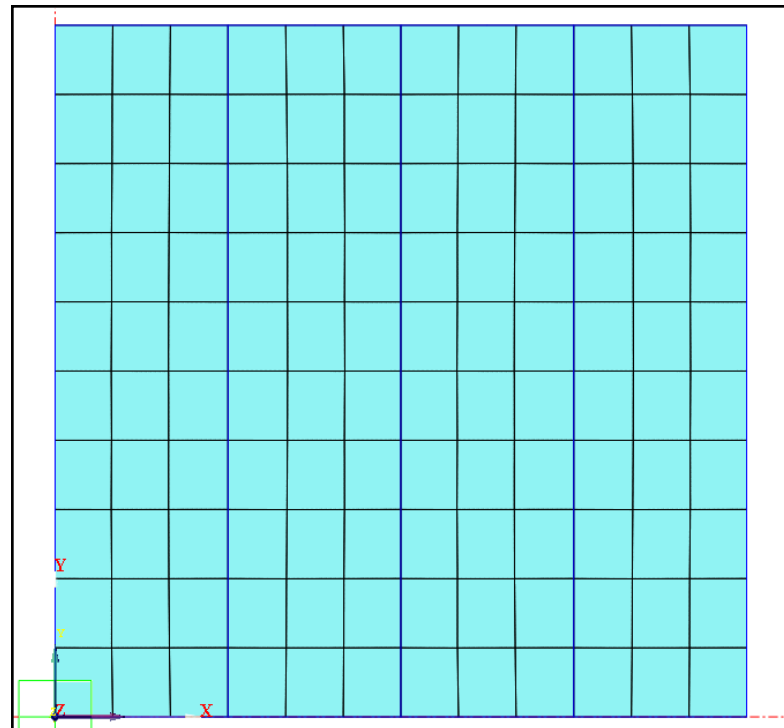
[Ⓐ] "Ctrl+A" as shortcut for "Select Displayed".

[Ⓐ] [Enter] as shortcut for [Apply].

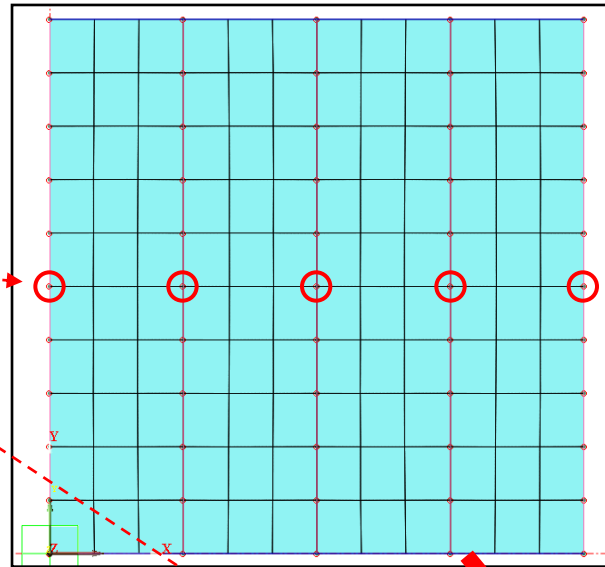
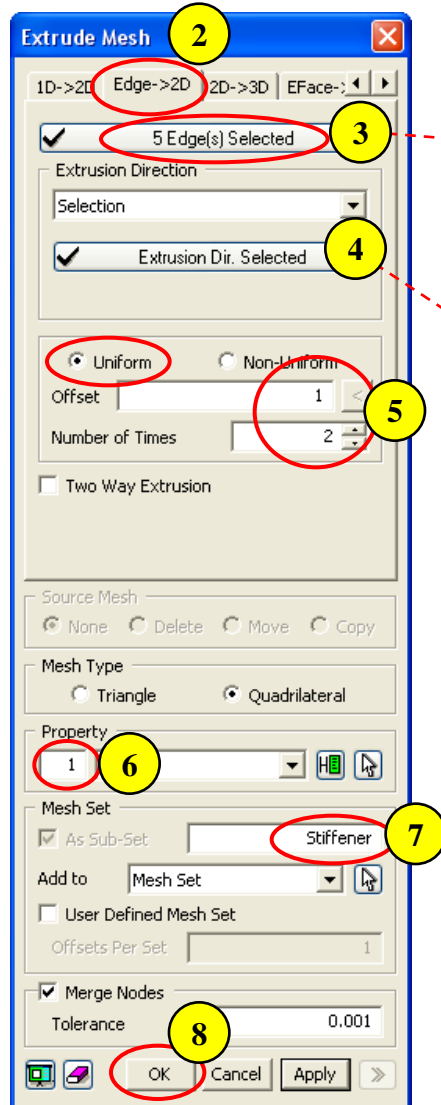
Step 4.



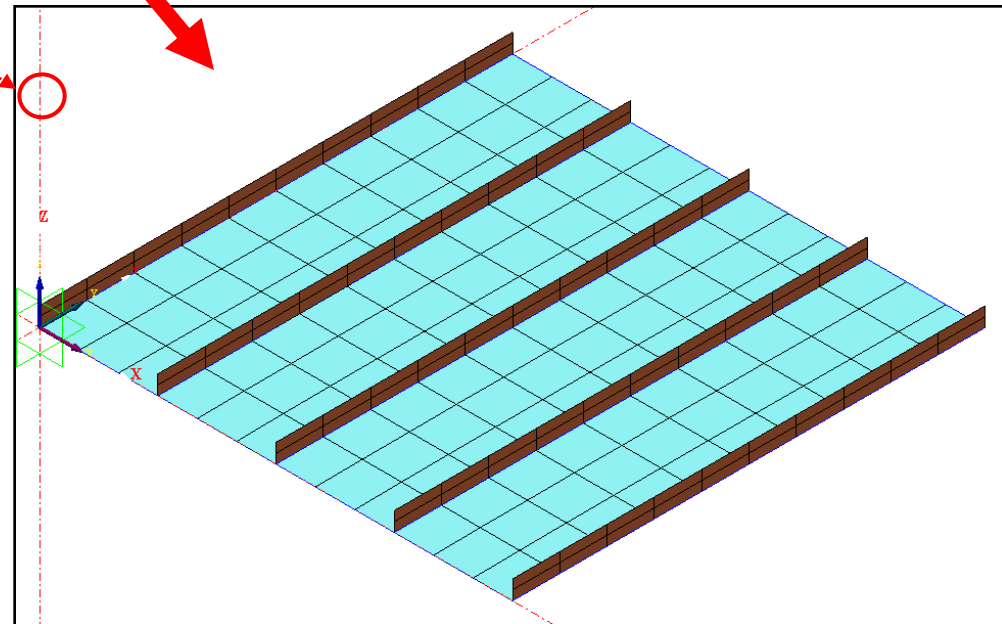
1. Mesh > Auto Mesh > Planar Area ...
2. Select  "Displayed"
3. Mesh Size : Division (3)
4. Property (1)
5. Mesh Set : Plate
6. Check off "Register Each Area Independently"
7. Click [OK] Button



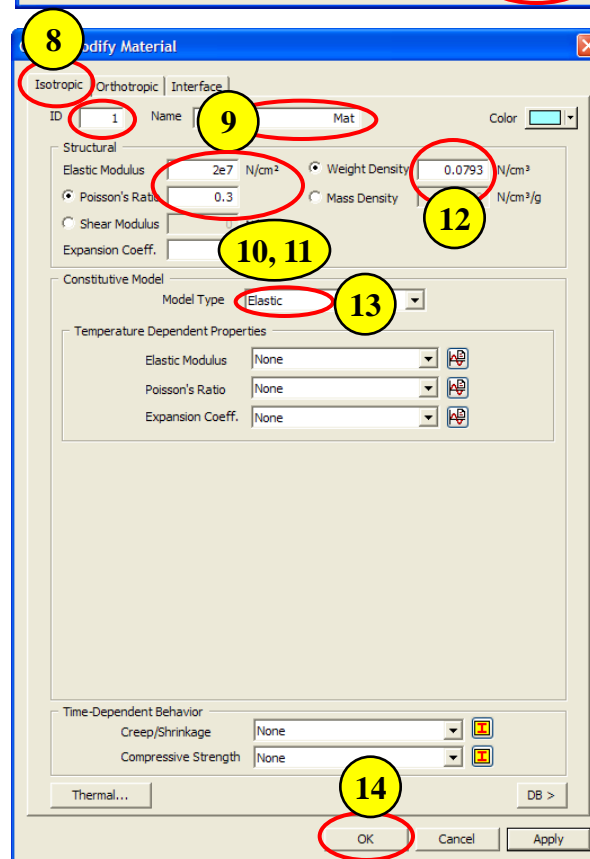
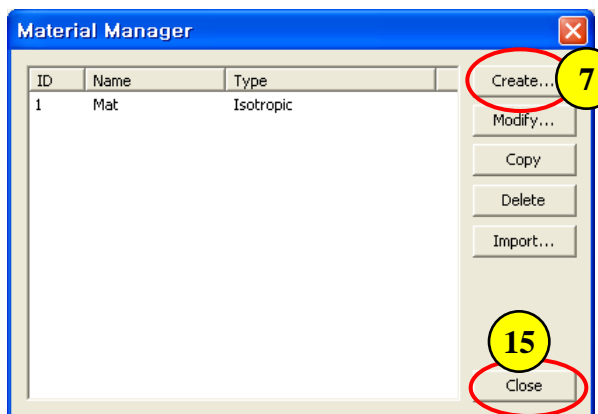
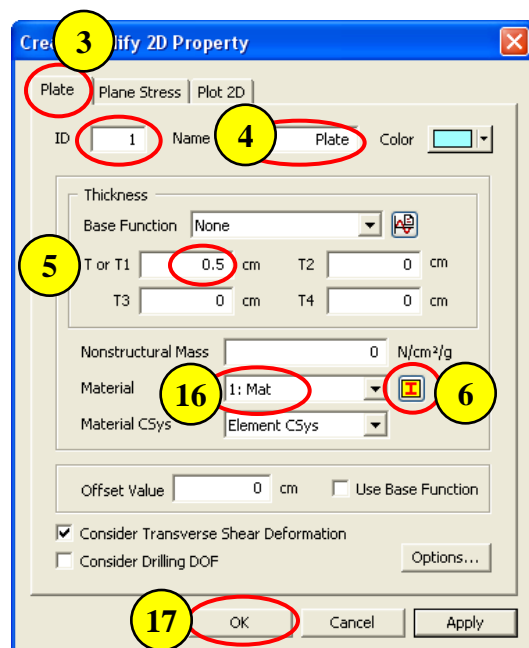
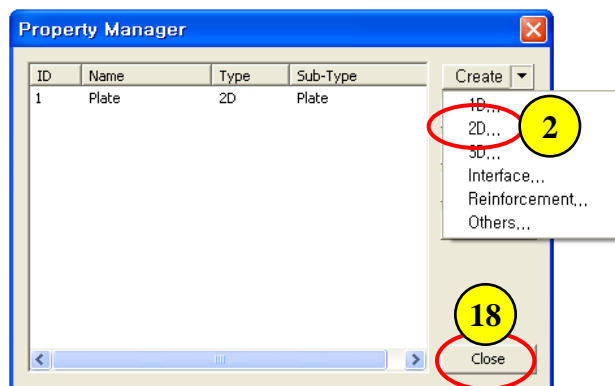
Step 5.



1. Mesh > Protrude Mesh > Extrude ...
2. Select "Edge->2D" Tab
3. Select 5 Edges marked by "O" (See Figure)
4. Extrusion Direction : Z-axis
5. Offset (1) , Number of Times (2)
6. Property (1)
7. Mesh Set Name : Stiffener
8. Click [OK] Button

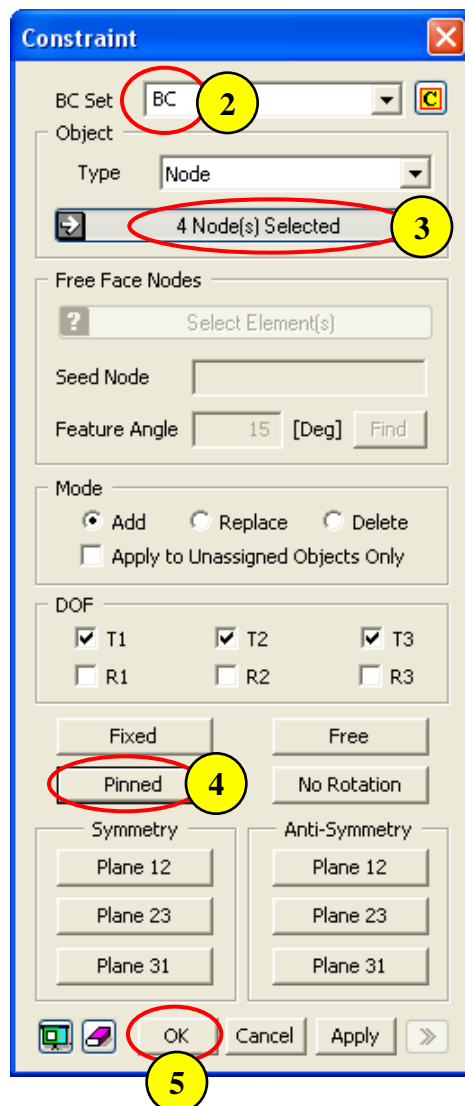


Step 6.

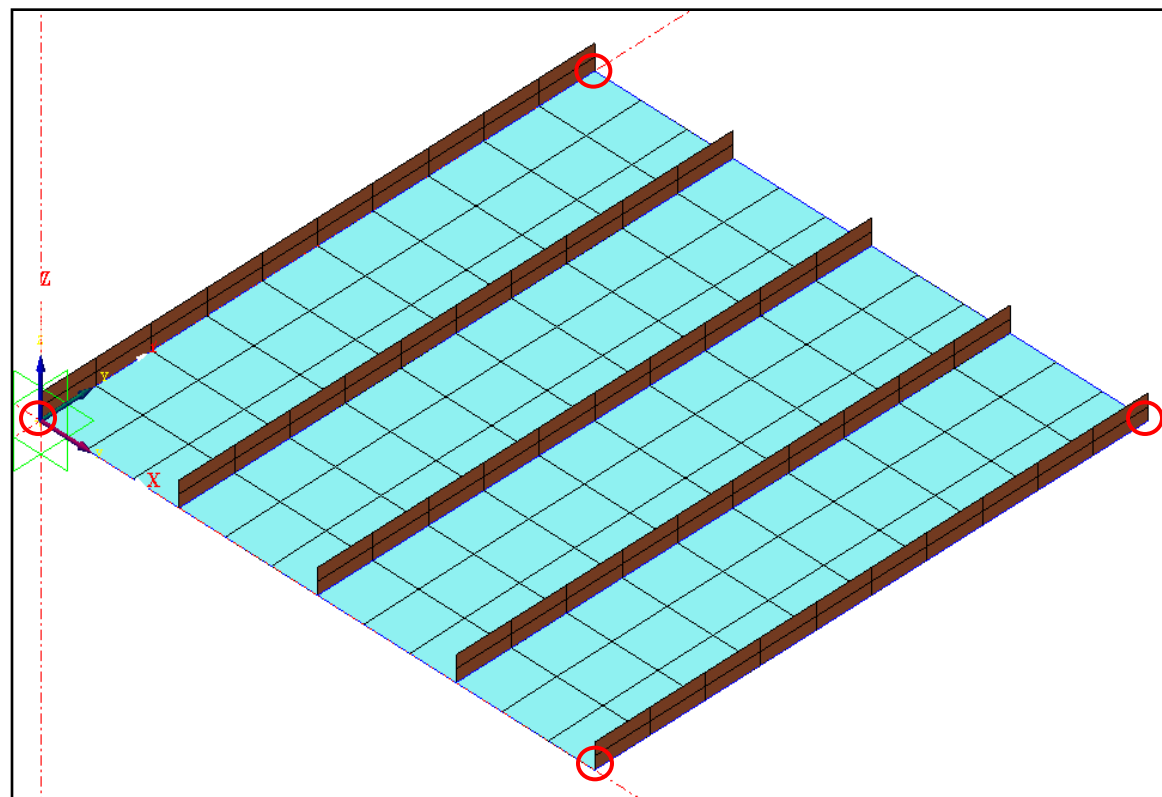


1. Analysis > Property ...
2. Create 2D ...
3. Select "Plate" tab
4. ID : 1 , Name : Plate
5. T or T1 : 0.5 cm
6. Click  Button (Material)
7. Click [Create] Button
8. Select "Isotropic" tab
9. ID : 1 , Name : Mat
10. Elastic Modulus : $2e7 \text{ N/cm}^2$
11. Poisson's Ratio : 0.3
12. Weight Density : 0.0793 N/cm^3
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

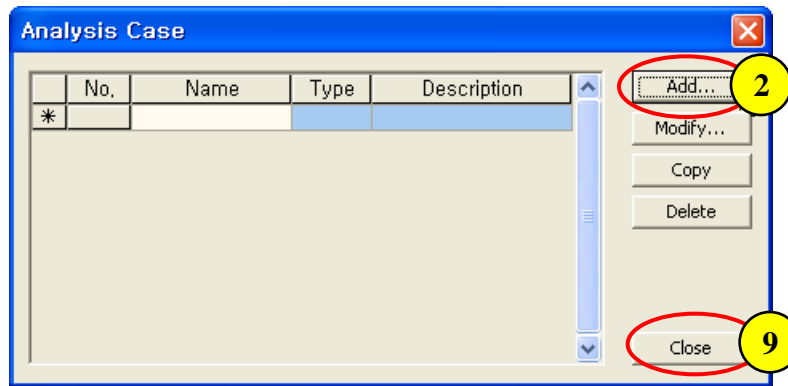
Step 7.



1. Analysis > BC > Constraint ...
2. BC Set : BC
3. Select 4 Nodes marked by "O" (See Figure)
4. Click [Pinned] Button
5. Click [OK] Button



Step 8.




1. Analysis > Analysis Case ...

2. Click [Add] Button

3. Name : Eigen

4. Analysis Type : Eigenvalue

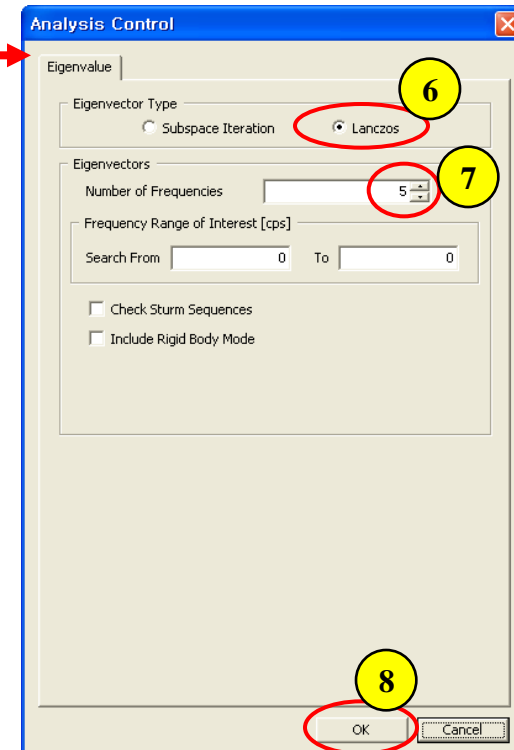
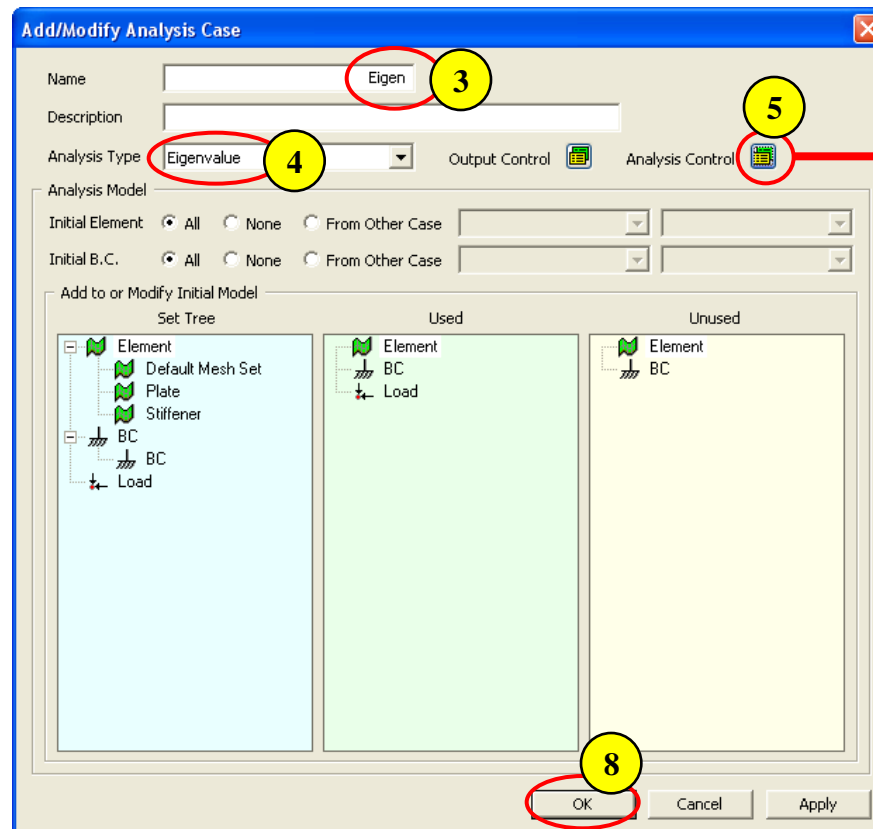
5. Click  Button (Analysis Control)

6. Eigenvector Type : Lanczos

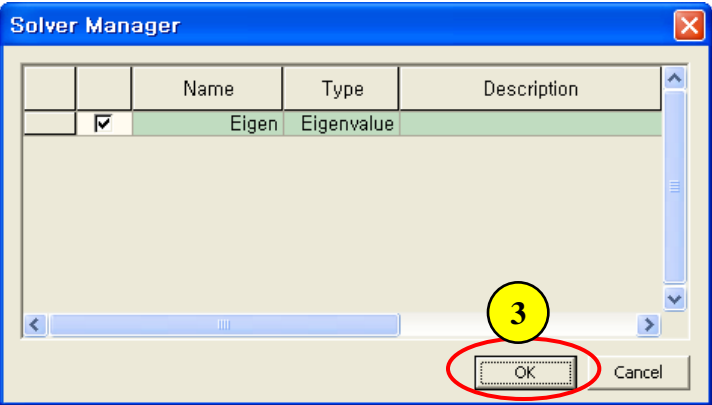
7. Number of Frequencies (5)

8. Click [OK] Button

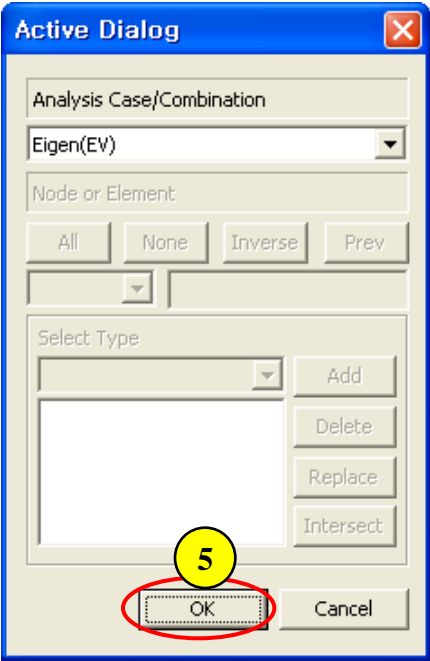
9. Click [Close] Button



Step 9.



- 1. File > Save... (StiffenedPlate.feb)
- 2. Analysis > Solve ...
- 3. Click "OK" Button
- 4. Post > Vibration Frequency / Period ...
- 5. Click "OK" Button



EIGENVALUE ANALYSIS												
Mode No	Frequency		Period		Tolerance							
	w (rad/sec)	f (cycle/sec)	T (sec)									
1	260.820465	41.510868		0.024090		0.000000						
2	475.069153	75.609604		0.013226		0.000000						
3	870.819336	138.595200		0.007215		0.000000						
4	1314.282471	209.174561		0.004781		0.000000						
5	1317.739868	209.724823		0.004768		0.000000						
MODAL PARTICIPATION MASSES(%) PRINTOUT												
Mode No	TRAN-X		TRAN-Y		TRAN-Z		ROTN-X		ROTN-Y		ROTN-Z	
	MASS(%)	SUM(%)	MASS(%)	SUM(%)	MASS(%)	SUM(%)	MASS(%)	SUM(%)	MASS(%)	SUM(%)	MASS(%)	SUM(%)
1	0.00	0.00	0.00	0.00	81.36	81.36	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.01	0.01	0.00	81.36	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.01	0.00	81.36	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.01	0.00	81.36	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.01	13.79	95.15	0.00	0.00	0.00	0.00	0.00	0.00
Mode No	TRAN-X		TRAN-Y		TRAN-Z		ROTN-X		ROTN-Y		ROTN-Z	
	MASS	SUM	MASS	SUM	MASS	SUM	MASS	SUM	MASS	SUM	MASS	SUM
1	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.02	0.11	0.00	0.00	0.00	0.00	0.00	0.00
MODAL PARTICIPATION FACTOR PRINTOUT												
Mode No	TRAN-X		TRAN-Y		TRAN-Z		ROTN-X		ROTN-Y		ROTN-Z	
	Value		Value		Value		Value		Value		Value	
		-0.00		0.00		-0.31		0.00		0.00		0.00
		0.00		0.00		0.00		0.00		0.00		0.00
		0.00		0.00		0.00		0.00		0.00		0.00
		-0.00		-0.00		-0.00		0.00		0.00		0.00
		-0.00		0.00		-0.13		0.00		0.00		0.00
MODAL DIRECTION FACTOR PRINTOUT												
Mode No	TRAN-X		TRAN-Y		TRAN-Z		ROTN-X		ROTN-Y		ROTN-Z	
	Value		Value		Value		Value		Value		Value	
1		0.10		0.00		99.90		0.00		0.00		0.00
2		0.11		0.10		99.79		0.00		0.00		0.00
3		0.16		0.03		99.81		0.00		0.00		0.00
4		0.42		0.09		99.49		0.00		0.00		0.00
5		0.25		0.14		99.61		0.00		0.00		0.00