# STATIC ANALYSIS OF A HANGING PLATE

**Objective :**To find the nodal displacement, stress in each material and reaction force at the support for the plate shown below. Consider the self weight of the plate in addition to the load P = 444.82 N.(Material property: E = 206.842 GPa, v = 0.3,  $\rho = 7850 kg/m^3$ )





REFERENCE: Tirupathi R. Chandraupatla, Ashok D. Belegundu, Finite elements in engineering, Printice/Hall of India, 1997, New Delhi.

## PROCEDURE

## 1. Create keypoints

Command : POI	NT,ADD	
Menu : Geor	netry →Keypoint→	Create →Add
Parameters :	Point Data	0/0/0

Similarly create key points at (152.4/0/0), (114.3/-609.6/0), (38.1/-609.6/0) and (76.2/-304.4/0)

At the end of the operation/s your screen should look like this.



## 2. Create curve

Command :CURVE,LINE

Menu : Geometry  $\rightarrow$  Curve $\rightarrow$  Create  $\rightarrow$  Line

Parameters :		
	End points	P1/P2

Similarly create cure with points P3 and P4

At the end of the operation/s your screen should look like this.



## 3. Create surface

Command :SURFACE,LOFT

Menu	: Geon	netry→Surface →Cre	eate →On Geometry-	→ Loft
1 arameters	••	Section Curves	C1/C2	

At the end of the operation/s your screen should look like this.



#### 4. Generate mesh

#### Command :MESH,QUAD

Menu : Mesh→MeshGen→QUAD

-		
Parameters :	Surface	1 (Pick the surface from the screen)
	Element Size	Click on two points on the surface edge to give
	Method	Mapped
	Туре	4-Node
	Divisions	Adjust the number of divisions on each edge by
		clicking on the edge
	Bias	

## *Note* : Make sure that a node is created at the point P5

At the end of the operation/s your screen should look like this.



#### 5. Erase curve

Command : CURVE, ERASE

Menu : Geometry  $\rightarrow$  Curve  $\rightarrow$  Miscellaneous  $\rightarrow$  Erase

Parameters :

List of curves	(Type in the curve ID or pick the curve after
	clicking the arrow in the surface ID box)

Similarly erase the surface using the command (SURFACE, ERASE)

## 6. Apply boundary condition

Command : DISPBC,ADD

Menu : Load/BC →Structural→DispBC

Parameters:

[ranslation	Apply
₩ Ux 0	Cancel
₩ Uy 0	
I Uz 0	
Rotation	
I▼ Ry 0	

Nodes	(Select all nodes at $Y = 0$ )	
DispBC	0/0/0/0/0/0	

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LCS	
Label	

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At the end of the operation/s your screen should look like this.

# 7. Specifymaterial property

Command: MATERIAL, ISOTROPIC

Menu : Property  $\rightarrow$  Material  $\rightarrow$ Structural $\rightarrow$ Isotropic

Parameters :

Elements	(Select all the elements)
Young's Modulus	206843
Nu	0.3
Density	7.85E-09
Alpha	
Label	

#### 8. Specify thickness

Command: THICKNESS, ADD

Menu : Property  $\rightarrow$  Physical  $\rightarrow$ Thickness

Parameters :

Elements	(Select all the elements)
Thickness	<u>25.4</u>
Label	

#### 9. Specify load

Command:POINTLOAD,ADD

Menu : Load/BC→Structural→Point Load

Parameters :

Nodes	(Pick the node at point P5)
Magnitude	-444.822
Component	Fy
LCS	0
Label	

At the end of the above operation your screen should look like this.



## 10. Specify self weight

In order to specify the body force an acceleration of '1g' is applied to the model.

Command :GRAVITY,ADD

Menu : Load/BC →Structural→Gravity

Parameter :

Elements	(Select all the elements)
Acceleration	-9810
Direction	Y Axis
LCS ID	0
Label	

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At the end of above operation your screen should look like this.

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### 11. Set analysis type

Command : ANTYPE,ADD

Menu : Analysis →Analysis Type

Parameter :

Analysis Types	Static
1 1101 9 010 1 9 0 0	~

## 12. Submit the job in to FEAST

Click Run Solver button



After the solution gets completed, "Finished successfully" message appears in the message box.

#### **13. Perform Post Processing**

## i) Displacement

Command:POST,DEFLECTION

#### Menu : Post →Deflection

Parameters:

At the end of above operation your screen should look like this.



ii) Reaction force.

Command: POST, TABLEVIEW

Menu : Post  $\rightarrow$  View Table

F

Parameters:	Item	Reaction force
	Nodes	ALL
	LCS	
	Components	

At the end of above operation your screen should look like this.

Node	FX	FY	FZ	MX	MY	MZ
1	-13.2986	33.2453	0	0	0	-38.7016
2	-11.5864	59.2363	0	0	0	-53.7409
3	-7.95306	56.3376	0	0	0	-33.8837
4	-5.02414	56.54	0	0	0	-21,201
5	-2.4352	56.7673	0	0	0	-10.2629
6	-7.99677E-14	56.8589	0	0	0	-5.22819E-13
7	2.4352	56.7673	0	0	0	10.262
8	5.02414	56.54	0	0	0	21,201
g	7.95306	56.3376	0	0	0	33.883
10	11.5864	59.2363	0	0	0	53.7409
11	13.2986	33,2453	0	0	0	38.701
TOTAL	-8.34888E-14	581.112	0	0	0	-5.11591E-1

## iii) Stress contour

Command : POST, CONTOUR

Menu : Post →Contour

### **Parameters:**

Stress
Top
vonMises
Band
9
<u>2</u>

At the end of above operation your screen should look like this,

