

MECH530 – Assignment 2

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CHOSEN MATERIAL: graphite_epoxy_2

===== MATERIAL PROPERTIES =====

Modulus Parameters

E_x : 138000.000 MPa
E_y : 8960.000 MPa
E_s : 7100.000 MPa
nu_x : 0.300 none
nu_y : 0.019 none
m : 1.006 none

Strength Parameters

X_t : 1447.000 MPa
X_c : 1447.000 MPa
Y_t : 51.700 MPa
Y_c : 206.000 MPa
S_c : 93.000 MPa
h_o : 0.125 mm
rho : 1600.000 kg/m³

===== GEOMETRY PARAMETERS =====

Layer Number	Type	Thickness (mm)	Orientation (degrees)
1	ply	0.125	45
2	ply	0.125	-45
3	ply	0.125	20
4	ply	0.125	-20
5	ply	0.125	0
6	ply	0.125	90
-	core	150.000	N/A
7	ply	0.125	90
8	ply	0.125	0
9	ply	0.125	-20
10	ply	0.125	20
11	ply	0.125	-45
12	ply	0.125	45

===== ON-AXIS MATRICES =====

Matrix [S] (in MPa⁻¹):

7.246e-06	-2.174e-06	0.000e+00
-2.174e-06	1.116e-04	0.000e+00
0.000e+00	0.000e+00	1.408e-04

Matrix [Q] (in MPa):

138811.140	2703.800	0.000
2703.800	9012.665	0.000
0.000	0.000	7100.000

===== Assignment 2, Question 1 =====

===== OFF-AXIS MATRICES PER LAYER =====

Layer 1 - Orientation: 45 degrees

Transformed Matrix [S] (in MPa⁻¹):

6.384e-05	-6.585e-06	-5.218e-05
-6.585e-06	6.384e-05	-5.218e-05
-5.218e-05	-5.218e-05	1.232e-04

Transformed Matrix [Q] (in MPa):

45407.851	31207.851	32449.619
31207.851	45407.851	32449.619
32449.619	32449.619	35604.052

Layer 2 - Orientation: -45 degrees

Transformed Matrix [S] (in MPa⁻¹):

6.384e-05	-6.585e-06	5.218e-05
-6.585e-06	6.384e-05	5.218e-05
5.218e-05	5.218e-05	1.232e-04

Transformed Matrix [Q] (in MPa):

45407.851	31207.851	-32449.619
31207.851	45407.851	-32449.619
-32449.619	-32449.619	35604.052

Layer 3 - Orientation: 20 degrees

Transformed Matrix [S] (in MPa⁻¹):

2.128e-05	-3.996e-06	-3.788e-05
-3.996e-06	1.012e-04	-2.920e-05
-3.788e-05	-2.920e-05	1.336e-04

Transformed Matrix [Q] (in MPa):

111850.415	14480.987	34893.718
14480.987	12419.015	6822.707
34893.718	6822.707	18877.187

Layer 4 - Orientation: -20 degrees

Transformed Matrix [S] (in MPa⁻¹):

2.128e-05	-3.996e-06	3.788e-05
-3.996e-06	1.012e-04	2.920e-05
3.788e-05	2.920e-05	1.336e-04

Transformed Matrix [Q] (in MPa):

111850.415	14480.987	-34893.718
14480.987	12419.015	-6822.707
-34893.718	-6822.707	18877.187

Layer 5 - Orientation: 0 degrees

Transformed Matrix [S] (in MPa⁻¹):

7.246e-06	-2.174e-06	-0.000e+00
-2.174e-06	1.116e-04	0.000e+00
-0.000e+00	0.000e+00	1.408e-04

Transformed Matrix [Q] (in MPa):

138811.140	2703.800	0.000
2703.800	9012.665	0.000
0.000	0.000	7100.000

Layer 6 - Orientation: 90 degrees

Transformed Matrix [S] (in MPa⁻¹):

1.116e-04	-2.174e-06	-5.310e-21
-2.174e-06	7.246e-06	-7.471e-21
-5.310e-21	-7.471e-21	1.408e-04

Transformed Matrix [Q] (in MPa):

9012.665	2703.800	0.000
2703.800	138811.140	0.000
0.000	0.000	7100.000

===== Assignment 2, Question 2 =====

Layer 1 - Orientation: 35 degrees

Off-Axis Stress Vector (Given) (MPa):

9.990e+03
-3.100e+03
-4.400e+03

Off-Axis Strain Vector:

5.987e-01
-1.481e-01
-9.229e-01

On-Axis Stress Vector (MPa):

2.907e+03
3.983e+03
-7.868e+03

On-Axis Strain Vector:

1.241e-02
4.382e-01
-1.108e+00