**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/m^3

================= 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