McGill University

Mechanics of Composite Materials

MECH 530

Assignment 4

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```
4.340625e-08
```

Ply orientation list

```
Orientation [degrees] :
[0, 0, 25, -25, 0, 0, 0, 0, -25, 25, 0, 0]
```

Number of plies

```
12
```

Material properties

```
Graphite/Thermoplastic
'          ID :                     5  [-]'
'fiber/matrix :               AS4/PEEK  [-]'
'        name : Graphite/Thermoplastic  [-]'
'          ex :               134.0000  [GPA]'
'          ey :                 8.9000  [GPA]'
'          es :                 5.1000  [GPA]'
'         nux :                 0.2800  [-]'
'          xt :              2130.0000  [MPA]'
'          xc :              1100.0000  [MPA]'
'          yt :                80.0000  [MPA]'
'          yc :               200.0000  [MPA]'
'          sc :               160.0000  [MPA]'
'          h0 :                 0.1250  [mm]'
'         nuy :                 0.0186  [-]'
```

Thickness

```
Total thickness : 0.011500 [m]
Ply thickness   : 0.001500 [m]
```

On-axis Modulus and Compliance matrices -- [Q] and [S]

```
S_on [1/GPa] :
[[   0.0075   -0.0021    0.0000]
 [  -0.0021    0.1124    0.0000]
 [   0.0000    0.0000    0.1961]]
U's for S [1/GPa]
U1 :  0.0689
U2 : -0.0524
U3 : -0.0090
U4 : -0.0111
U5 :  0.1600

Q_on [GPa] :
[[ 134.7014    2.5050    0.0000]
 [   2.5050    8.9466    0.0000]
 [   0.0000    0.0000    5.1000]]
U's for Q [GPa]
U1 : 57.0443
U2 : 62.8774
U3 : 14.7797
U4 : 17.2848
U5 : 19.8797
```

In-plane Modulus and Compliance -- [A] and [a]

```
A [GN/m] :
[[   0.7526    0.1853    0.0000]
 [   0.1853    0.5864    0.0000]
 [   0.0000    0.0000    0.2151]]
a [m/GN] :
[[   1.4408   -0.4552   -0.0000]
```

```
 [  -0.4552    1.8491   -0.0000]
 [   0.0000    0.0000    4.6486]]
```

Flexural Modulus and Compliance -- [D] and [d]

```
D [kNm] :
[[   5.2718    0.3594    0.0130]
 [   0.3594    0.4622    0.0032]
 [   0.0130    0.0032    0.4720]]
d [1/MNm] :
[[ 200.3143 -155.6995   -4.4529]
 [-155.6995 2284.5488  -11.2113]
 [  -4.4529  -11.2113 2118.8941]]
```

Loads

```
M [N] :
[-28694.2500    0.0000    0.0000]

N [N/m] :
[0, 0, 0]
```

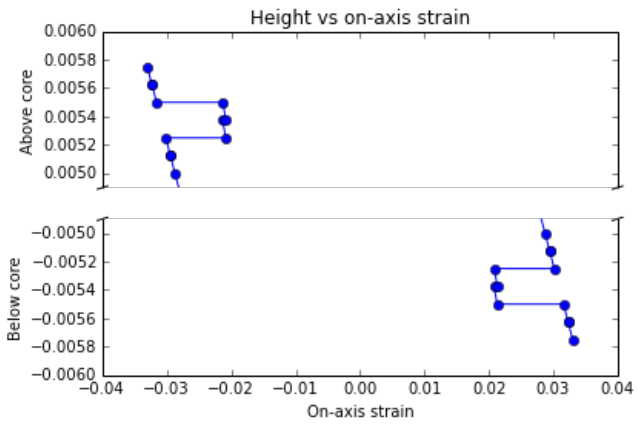
Curvature

```
K [m] :
[  -5.7479    4.4677    0.1278]
```

Results

```
See Appendix A
```

Strain distribution



Maximum strain and deflection

```
Maximum allowable deflection [cm] :
0.5
Maximum allowable strain [-] :
0.002


Maximum deflection [cm] : 12.9519
Too large!
Maximum strain [-]      : 0.0331
Too large!
```