McGill University

Mechanics of Composite Materials

MECH 530

Assignment 1

Student Name:
Selim Belhaouane

Student ID:
260450544

September 16, 2014

MECH-530 Assignment 1

Selim Belhaouane 260450544

Question 1)

In [1]:

```
cd source
```

```
c:\Users\Selimb\Documents\GitHub\mech_530\source
```

In [2]:

```
#Module "laminate" contains "Laminate" class.
#Source is available at link at the bottom [1].
from laminate import Laminate
```

Let's define a laminate. An ID and a formatted layup must be given.

Core thickness is completely ignored for this assignment.

In [3]:

```
my_layup = '90_2/p40/p20/0s'
my_materialID = 2 #This corresponds to (AS/H3501)
my_laminate = Laminate(layup = my_layup,
                       materialID = my_materialID)
```

Output laminate orientation (ply-by-ply)

Output total number of plies

In [4]:

```
my_laminate.get_orientation()
print "Total number of plies :"
print len(my_laminate.layers)
```

```
Orientation [degrees] :
[90, 90, 40, -40, 20, -20, 0, 0, -20, 20, -40, 40, 90, 90]
Total number of plies :
14
```

Output material properties

In [5]:

```
my_laminate.print_param()
```

```
'          ID :              2  [-]'
'fiber/matrix :       AS/H3501  [-]'
'        name : Graphite/Epoxy  [-]'
'          ex :      1.380e+02  [GPA]'
'          ey :          8.960  [GPA]'
'          es :          7.100  [GPA]'
'         nux :          0.300  [-]'
'          xt :      1.447e+03  [MPA]'
'          xc :      1.447e+03  [MPA]'
'          yt :         51.700  [MPA]'
'          yc :      2.060e+02  [MPA]'
'          sc :           93.0  [MPA]'
'          h0 :          0.125  [mm]'
'         nuy :           0.02  [-]'
```

Question 2)

Output "on-axis" [S] and [Q] matrices for first layer

Verify that [S] and [Q] are the same for each layer

In [6]:

```
first_pass = True
for a_layer in my_laminate.layers:
    Q_new,S_new = a_layer.get_matrix('QSon',
                                     do_print = first_pass)
    if first_pass:
        first_pass = False
        Q_old,S_old = Q_new,S_new
    else:
        assert(Q_new.all() == Q_old.all() and
               S_new.all() == S_old.all()
               ) #[2]
```

```
S_on [1/GPa] :
[[7.246e-03 -2.174e-03       0.0]
 [-2.174e-03     0.112       0.0]
 [      0.0       0.0     0.141]]
Q_on [GPa] :
[[1.388e+02     2.704       0.0]
 [    2.704     9.013       0.0]
 [      0.0       0.0     7.100]]
```

Footnotes

[1] : http://bit.ly/selimb_HW1_mech530

[2] : assert(*expr*) returns an *AssertionError* if *expr* is *False*.
No errors returned in this case