



McGILL UNIVERSITY

MECHANICS OF COMPOSITE MATERIALS

MECH 530

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# Assignment 1

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## 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 :    8.960e+00  [GPA] '  
'      es :    7.100e+00  [GPA] '  
'      nux :    3.000e-01  [-] '  
'      xt :    1.447e+03  [MPa] '  
'      xc :    1.447e+03  [MPa] '  
'      yt :    5.170e+01  [MPa] '  
'      yc :    2.060e+02  [MPa] '  
'      sc :    9.300e+01  [MPa] '  
'      h0 :    1.250e-01  [mm] '  
'      nuy :    1.948e-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  1.116e-01  0.0]
 [ 0.0      0.0  1.408e-01]]
Q_on [GPa] :
[[ 1.388e+02  2.704e+00  0.0]
 [ 2.704e+00  9.013e+00  0.0]
 [ 0.0      0.0  7.100e+00]]
```

## Footnotes

[1] : [http://bit.ly/selimb\\_HW1\\_mech530](http://bit.ly/selimb_HW1_mech530)

[2] : `assert(expr)` returns an *AssertionError* if *expr* is *False*.

No errors returned in this case