



McGILL UNIVERSITY

MECHANICS OF COMPOSITE MATERIALS

MECH 530

Assignment 4

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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] :
[[0.1821 0.0124 0.0000]
[0.0124 0.0160 0.0000]
[0.0000 0.0000 0.0163]]

a [m/GN] :
[[5.7979 -4.5109 -0.0000]
[-4.5109 66.0994 -0.0000]
[0.0000 0.0000 61.2628]]

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] :
[-2869.4250 0.0000 0.0000]

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

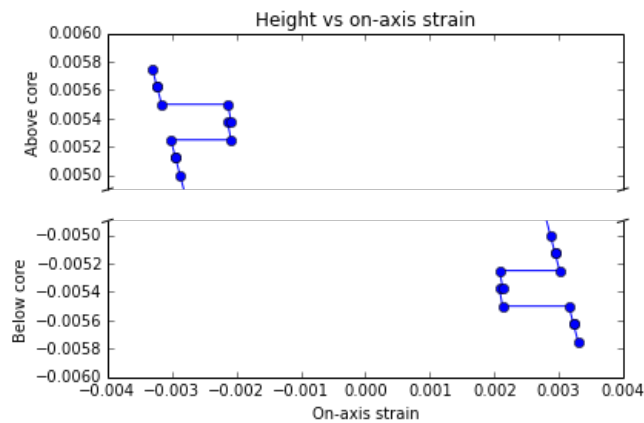
Curvature

K [m] :
[-0.5748 0.4468 0.0128]

Results

See Appendix A

Strain distribution



Maximum strain and deflection

Maximum deflection [cm] : 1.2952
Maximum allowable [cm] : 0.5000
Too large!

Maximum strain [-] : 0.0033
Maximum allowable [-] : 0.0020
Too large!

Appendix A

Table 1: Strains and stresses. Stresses are in [GPa].

Ply	ϵ_1	ϵ_2	ϵ_6	ϵ_x	ϵ_y	ϵ_s	σ_x	σ_y	σ_s
0 (0°) - Bot	0.0033	-0.0026	-0.0001	0.0033	-0.0026	-0.0001	0.4388	-0.0147	-0.0004
0 (0°) - Top	0.0032	-0.0025	-0.0001	0.0032	-0.0025	-0.0001	0.4292	-0.0144	-0.0004
1 (0°) - Bot	0.0032	-0.0025	-0.0001	0.0032	-0.0025	-0.0001	0.4292	-0.0144	-0.0004
1 (0°) - Top	0.0032	-0.0025	-0.0001	0.0032	-0.0025	-0.0001	0.4197	-0.0141	-0.0004
2 (25°) - Bot	0.0032	-0.0025	-0.0001	0.0021	-0.0014	-0.0043	0.2835	-0.0074	-0.0222
2 (25°) - Top	0.0031	-0.0024	-0.0001	0.0021	-0.0014	-0.0043	0.2770	-0.0073	-0.0217
3 (-25°) - Bot	0.0031	-0.0024	-0.0001	0.0021	-0.0014	0.0042	0.2840	-0.0076	0.0212
3 (-25°) - Top	0.0030	-0.0023	-0.0001	0.0021	-0.0014	0.0041	0.2774	-0.0074	0.0207
4 (0°) - Bot	0.0030	-0.0023	-0.0001	0.0030	-0.0023	-0.0001	0.4006	-0.0134	-0.0003
4 (0°) - Top	0.0029	-0.0023	-0.0001	0.0029	-0.0023	-0.0001	0.3911	-0.0131	-0.0003
5 (0°) - Bot	0.0029	-0.0023	-0.0001	0.0029	-0.0023	-0.0001	0.3911	-0.0131	-0.0003
5 (0°) - Top	0.0029	-0.0022	-0.0001	0.0029	-0.0022	-0.0001	0.3815	-0.0128	-0.0003
6 (0°) - Bot	-0.0029	0.0022	0.0001	-0.0029	0.0022	0.0001	-0.3815	0.0128	0.0003
6 (0°) - Top	-0.0029	0.0023	0.0001	-0.0029	0.0023	0.0001	-0.3911	0.0131	0.0003
7 (0°) - Bot	-0.0029	0.0023	0.0001	-0.0029	0.0023	0.0001	-0.3911	0.0131	0.0003
7 (0°) - Top	-0.0030	0.0023	0.0001	-0.0030	0.0023	0.0001	-0.4006	0.0134	0.0003
8 (-25°) - Bot	-0.0030	0.0023	0.0001	-0.0021	0.0014	-0.0041	-0.2774	0.0074	-0.0207
8 (-25°) - Top	-0.0031	0.0024	0.0001	-0.0021	0.0014	-0.0042	-0.2840	0.0076	-0.0212
9 (25°) - Bot	-0.0031	0.0024	0.0001	-0.0021	0.0014	0.0043	-0.2770	0.0073	0.0217
9 (25°) - Top	-0.0032	0.0025	0.0001	-0.0021	0.0014	0.0043	-0.2835	0.0074	0.0222
10 (0°) - Bot	-0.0032	0.0025	0.0001	-0.0032	0.0025	0.0001	-0.4197	0.0141	0.0004
10 (0°) - Top	-0.0032	0.0025	0.0001	-0.0032	0.0025	0.0001	-0.4292	0.0144	0.0004
11 (0°) - Bot	-0.0032	0.0025	0.0001	-0.0032	0.0025	0.0001	-0.4292	0.0144	0.0004
11 (0°) - Top	-0.0033	0.0026	0.0001	-0.0033	0.0026	0.0001	-0.4388	0.0147	0.0004