Homework 4

Problem 1:

Theta = 0

Sbar =

1.0e-09 *

0.0021	-0.0007	0
-0.0007	0.1613	0
0	0	0.1792

Theta = 15

Sbar =

1.0e-09 *

0.0137	-0.0016	-0.0429
-0.0016	0.1515	-0.0367
-0.0429	-0.0367	0.1756

Theta = 45

Sbar =

1.0e-09 *

0.0853	-0.0043	-0.0796
-0.0043	0.0853	-0.0796
-0.0796	-0.0796	0.1647

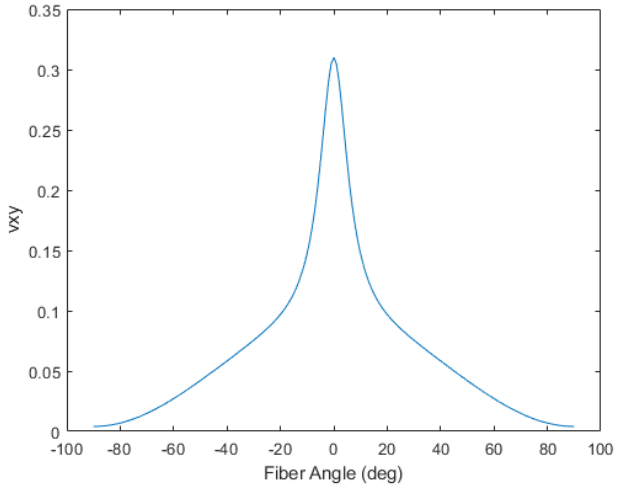
Theta = 90

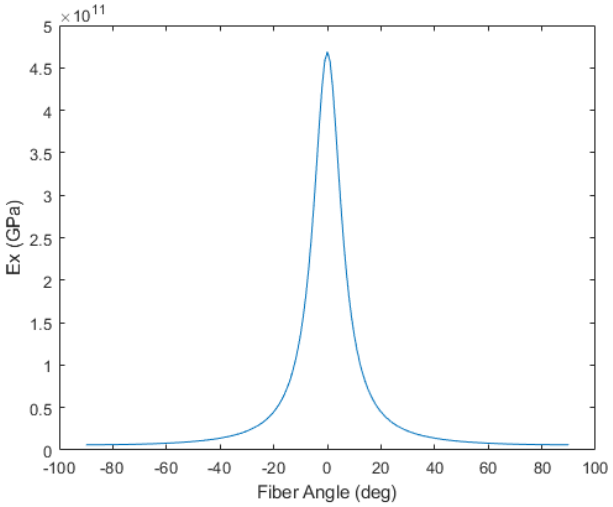
Sbar =

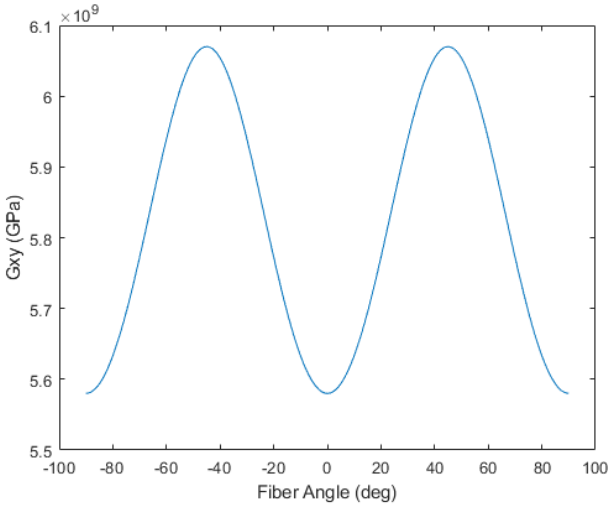
1.0e-09 *

0.1613	-0.0007	0
-0.0007	0.0021	0
0	0	0.1792

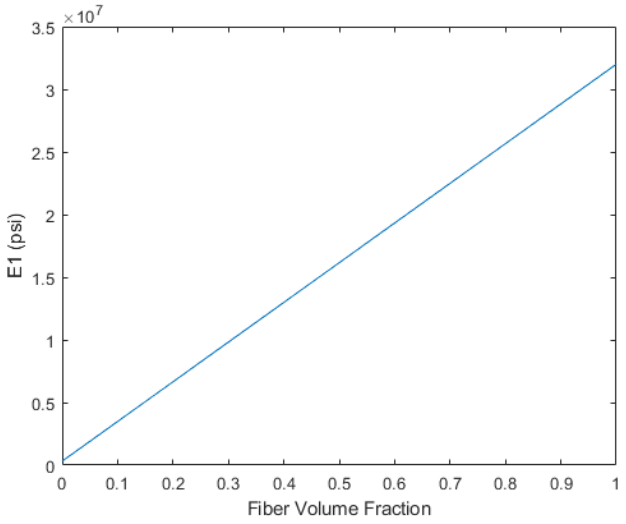
Problem 2:

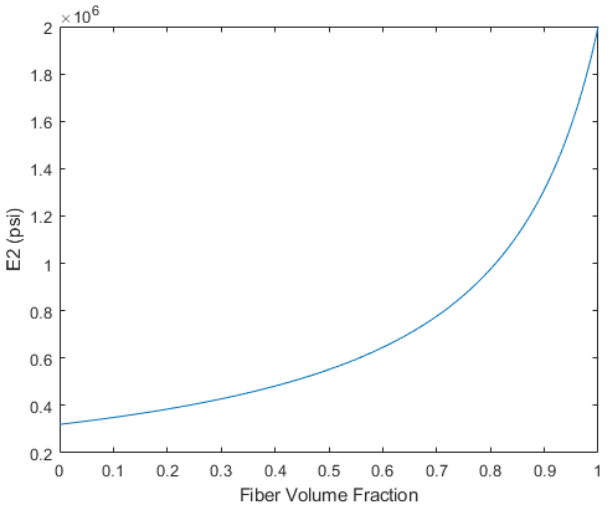

vxy
Fiber Angle (deg)

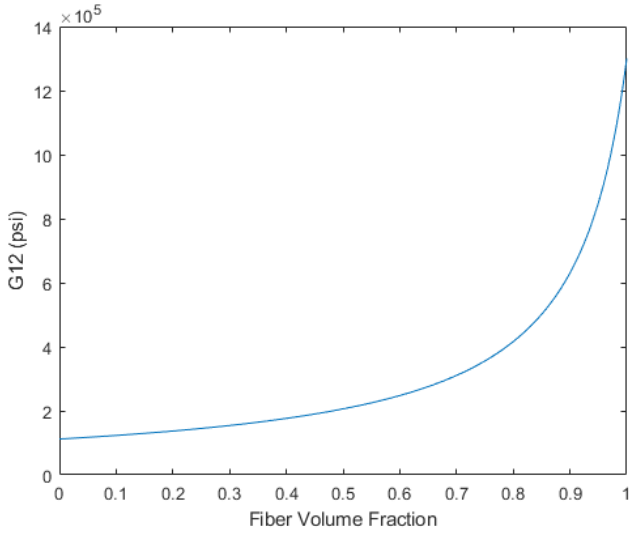

×10^11
Ex (GPa)
Fiber Angle (deg)


×10^9
Gxy (GPa)
Fiber Angle (deg)

Problem 3:


×10^7
3.5
3
2.5
2
1.5
1
0.5
0
E1 (psi)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Fiber Volume Fraction


×10^6
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
E2 (psi)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Fiber Volume Fraction


×10^5
14
12
10
8
6
4
2
0
G12 (psi)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Fiber Volume Fraction

Code:

```
function Sbar = transReducedComplianceMatrix(E1,E2,G12,v12,theta)

Qbar = transReducedStiffnessMatrix(E1,E2,G12,v12,theta);
Sbar = Qbar^-1;

end
```

Main Script:

```
clc;clear;

%Problem 1
%p-100/ERL 1962
E1=468.9e9;
E2=6.2e9;
G12=5.58e9;
v12=0.31;
theta = [0 15 45 90];

for i=1:length(theta)
    fprintf('Theta = %g',theta(i))
    Sbar = transReducedComplianceMatrix(E1,E2,G12,v12,theta(i));
    display(Sbar)
end

%Problem 2
thetas=-90:90;

Ex=E1./(cosd(thetas).^4+(((E1/G12)-
(2*v12)).*sind(thetas).^2.*cosd(thetas).^2)+(E1.*sind(thetas).^4/E2));
Gxy=G12./(sind(thetas).^4+cosd(thetas).^4+2*((2*G12/E1)*(1+2*v12)+(2*G12/E2)-
1).*sind(thetas).^2.*cosd(thetas).^2);
vxy=(v12.*(sind(thetas).^4+cosd(thetas).^4)-(1+(E1/E2)-
(E1/G12)).*sind(thetas).^2.*cosd(thetas).^2)./(cosd(thetas).^4+(((E1/G12)-
(2*v12)).*sind(thetas).^2.*cosd(thetas).^2)+(E1.*sind(thetas).^4/E2));

figure
plot(thetas,Ex)
xlabel('Fiber Angle (deg)')
ylabel('Ex (GPa)')

figure
plot(thetas,Gxy)
xlabel('Fiber Angle (deg)')
ylabel('Gxy (GPa)')

figure
plot(thetas,vxy)
xlabel('Fiber Angle (deg)')
ylabel('vxy')

%Problem 3
```

```
vf=0:0.001:1;
E1f=32e6;
E2f=2E6;
G12f=1.3e6;
Em=0.32e6;
vm=0.43;
Gm=Em/(2*(1+vm));

E1=E1f*vf+Em*(1-vf);
E2=((vf./E2f)+((1-vf)./Em)).^-1;
G12=((vf./G12f)+((1-vf)./Gm)).^-1;

figure
plot(vf,E1)
xlabel('Fiber Volume Fraction')
ylabel('E1 (psi)')

figure
plot(vf,E2)
xlabel('Fiber Volume Fraction')
ylabel('E2 (psi)')

figure
plot(vf,G12)
xlabel('Fiber Volume Fraction')
ylabel('G12 (psi)')
```