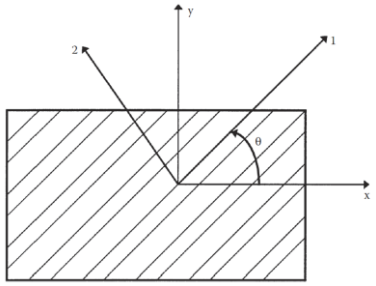
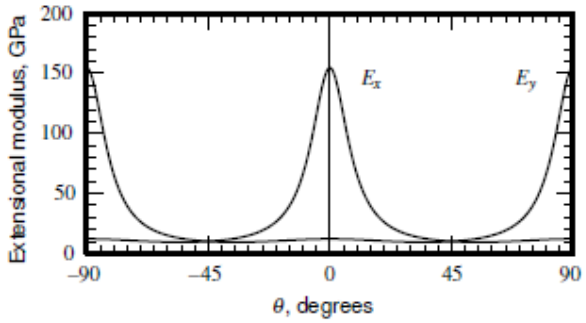
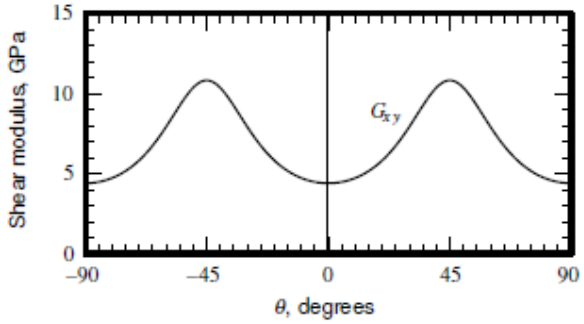
Name:

Using the provided Matlab functions create the below plots showing the variation of engineering properties with respect to the fiber angle θ for graphite-reinforced composite. The material properties are given on the next page.







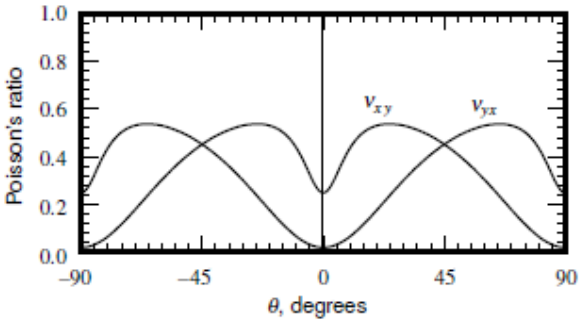


TABLE 2.1. *Typical engineering properties of several materials*

	Graphite-polymer composite[1]	Glass-polymer composite	Aluminum
E_1	155.0 GPa	50.0 GPa	72.4 GPa
E_2	12.10 GPa	15.20 GPa	72.4 GPa
E_3	12.10 GPa	15.20 GPa	72.4 GPa
ν_{23}	0.458	0.428	0.300
ν_{13}	0.248	0.254	0.300
ν_{12}	0.248	0.254	0.300
G_{23}	3.20 GPa	3.28 GPa	—[2]
G_{13}	4.40 GPa	4.70 GPa	—[2]
G_{12}	4.40 GPa	4.70 GPa	—[2]
α_1	-0.01800×10^{-6}/°C	6.34×10^{-6}/°C	22.5×10^{-6}/°C
α_2	24.3×10^{-6}/°C	23.3×10^{-6}/°C	22.5×10^{-6}/°C
α_3	24.3×10^{-6}/°C	23.3×10^{-6}/°C	22.5×10^{-6}/°C
β_1	146.0×10^{-6}/%M	434×10^{-6}/%M	0
β_2	4770×10^{-6}/%M	6320×10^{-6}/%M	0
β_3	4770×10^{-6}/%M	6320×10^{-6}/%M	0

[1] In the chapters to follow it will be assumed that a layer thickness is 150×10^{-6} m, or 0.150 mm.
[2] $G = E/2(1 + \nu)$.

$$E_x = \frac{E_1}{m^4 + \left(\frac{E_1}{G_{12}} - 2\nu_{12}\right) n^2 m^2 + \frac{E_1}{E_2} n^4}$$

$$E_y = \frac{E_2}{m^4 + \left(\frac{E_2}{G_{12}} - 2\nu_{21}\right) n^2 m^2 + \frac{E_2}{E_1} n^4}$$

$$G_{xy} = \frac{G_{12}}{n^4 + m^4 + 2\left(2\frac{G_{12}}{E_1}(1 + 2\nu_{12}) + 2\frac{G_{12}}{E_2} - 1\right) n^2 m^2}$$

$$\nu_{xy} = \frac{\nu_{12}(n^4 + m^4) - \left(1 + \frac{E_1}{E_2} - \frac{E_1}{G_{12}}\right) n^2 m^2}{m^4 + \left(\frac{E_1}{G_{12}} - 2\nu_{12}\right) n^2 m^2 + \frac{E_1}{E_2} n^4}$$

$$\nu_{yx} = \frac{\nu_{21}(n^4 + m^4) - \left(1 + \frac{E_2}{E_1} - \frac{E_2}{G_{12}}\right) n^2 m^2}{m^4 + \left(\frac{E_2}{G_{12}} - 2\nu_{21}\right) n^2 m^2 + \frac{E_2}{E_1} n^4}$$