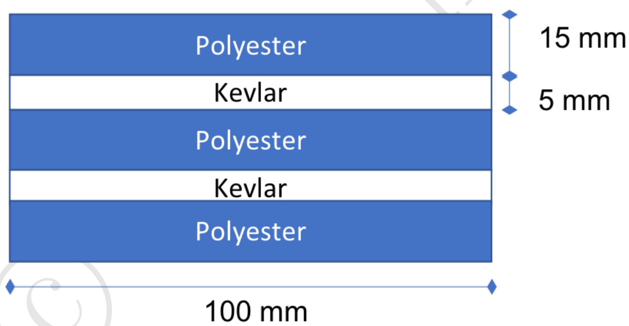
Homework 7

MEGN 498A

Due Tuesday 4/14/20 by 2pm (submitted online)
No Late Homeworks Accepted

Please only submit a single (preferably) PDF file of your homework on Canvas. You do not need to submit a copy of these questions with your turned in solutions.

Question 1:
A composite bar has a <u>cross-section</u> that comprises of kevlar fibers and polyester matrix, shown below (note that all layers have identical thickness to the ones labeled). The polyester has a modulus of 3000 N/mm^2 and Poisson's ratio of 0.16, and the Kevlar is 140,000 N/mm^2 and 0.28, respectively. If the bar is 1 m long and subjected to a compressive axial load of 500 kN, determine the shortening of the bar, the increase in its thickness, and the stresses the polyester and Kevlar.



Question 2:
Repeat Question 1 using MATLAB for compressive axial loads ranging from 300 to 750 kN increments of **75 kN**. Write out your final results as a table with the P (load from 300 to 750 kN), Δ_l in mm, Δ_t in mm, σ_m of the polyester in N/mm^2 and σ_f in N/mm^2 (Kevlar). Submit a copy of your MATLAB code with your homework package.

Question 3:
The reduced stiffnesses in a unidirectional ply are k_{11} = 50,000 N/mm^2, k_{21} = k_{12}= 4,000 N/mm^2, k_{22} = 15,000 N/mm^2, k_{33}= 6,000 N/mm^2. Calculate the elastic constants of the ply and the reduced compliances.

Question 4:
Direct stresses of 120 N/mm^2 and 60 N/mm^2 parallel to the x and y reference axes are applied to a generally orthotropic ply, respectively together, with a shear stress of 80 N/mm^2. If the ply angle is 45°, determine the direct and shear stresses referred to the material axes (i.e. longitudinal and transverse).

Question 5:
If a thin isotropic ply has a Young's modulus of 60,000 N/mm^2 and a Poisson's ratio of 0.25, determine the terms in the reduced stiffness and compliance matrices.