TAM 554-Homework #4 Name_____

Due October 26, 2015

1. The beam AB shown below is bent into a circular arc AC in a plane strain deformation. The motion is described by the mapping

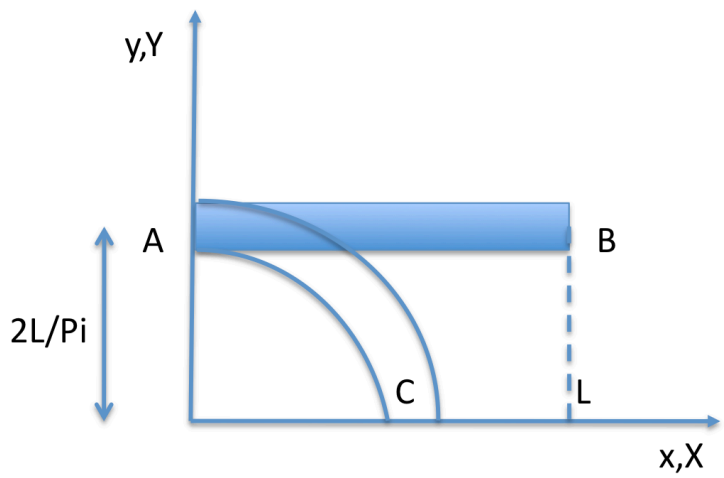
$$\underset{\sim}{x} = f(Y)(Cos\theta \underset{\sim}{i} + Sin\theta \underset{\sim}{j})$$

where f is a function of Y, $\theta = \pi / 2(1 - X / L)$, $\underset{\sim}{x}$ is the deformed configuration and (X, Y) is the undeformed configuration.

(1) Determine $f(Y)$ so the motion is incompressible.

(2) What is the Green strain for the beam.

(3) The tensile side of the beam has a true stress $\sigma_0 \underset{\sim}{e}_\theta \underset{\sim}{e}_\theta$ where σ_0 is a constant and $\underset{\sim}{e}_\theta$ is a unit vector tangential to the beam center line. What is the nominal stress (Second PK stress) on the tensile side of the beam?



2.The single crystal constitutive equations were given in class. The slip systems in fcc are {111}<011>. Consider the deformation of a single crystal pulled in [001] direction. Determine the stress-strain curve by writing a **code** incorporating large deformation plasticity. No latent hardening occurs.

The six single crystal material constants to be used are, $C_{11} = 221$ GPa, $C_{12} = 134$ GPa, $C_{44} = 102$ GPa, $\tau_o = 248$ MPa, $h = 28$ MPa.