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
\[ \chi = f(Y)(\cos \theta \mathbf{i} + \sin \theta \mathbf{j}) \]
where \( f \) is a function of \( Y \), \( \theta = \pi / 2(1 - X / L) \), \( \chi \) 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 \( \sigma_0 e_\theta \) where \( \sigma_0 \) is a constant and \( e_\theta \) 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?

![Diagram of the beam AB with arc AC](image)

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, \( C_{11} = 221 \text{ GPa}, C_{12} = 134 \text{ GPa}, C_{44} = 102 \text{ GPa}, \tau_0 = 248 \text{ MPa}, h = 28 \text{ MPa}. \)