**Due: 8:30 a.m. November 2, Tuesday, 2021 (No late homework accepted)**

1. [20 points] (*Linear elastic isotropic material*) Derive $G = E / 2\,(1+\nu)$ for linear elastic isotropic materials. $E$, $G$ (or $\mu$ according to the Bower textbook), and $\nu$ are Young's modulus, shear modulus, and Poisson's ratio, respectively.

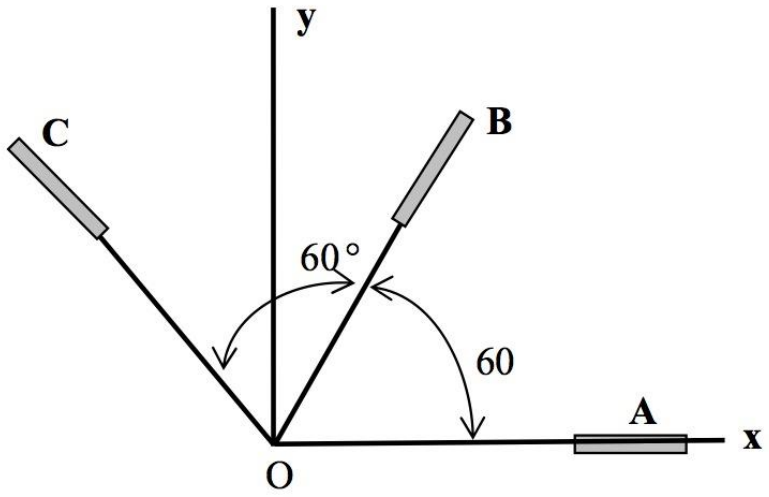
2. [30 points] (*Constitutive relationship*) Derive constitutive relationship under the plane strain and stress conditions (i.e., derive expressions in Sec. 3.2.3. in the Bower book from the full 3D expressions).

3. [20 points] (Constitutive relationship) Given a state of strain at a point in an isotropic material,

$$e = \begin{bmatrix} 0.001 & 0.001 & -0.002 \\ 0.001 & 0 & 0.005 \\ -0.002 & 0.005 & 0 \end{bmatrix}$$

Determine stress tensor. Assume $E = 200$ GPa and $\nu = 0.3$.

4. [30 points] (*Coordinate transformation*) An equi-triangular strain rosette is mounted on the surface of a body as shown below.



The strain gauge readings are:

$$\varepsilon_{0^\circ} = 0.005, \qquad \varepsilon_{60^\circ} = 0.002, \qquad \varepsilon_{120^\circ} = -0.001$$

The material properties are $E$ = 200 GPa and $v$ = 0.3. Find the stress tensor along the $xy$ axes at point O.