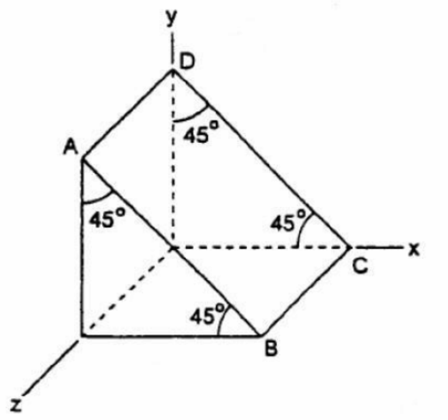
EAS4200C Aerospace Structures Homework #2 (Due: Sep. 11th)

1. Consider a unit cube of a solid occupying the region $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$. After loads are applied, the displacements are given by $u = \alpha x,\ v = \beta y,\ w = 0$. (a) Sketch the deformed shape for $\alpha = 0.03,\ \beta = -0.01$. (b) Calculate the six strain components. (c) Find the volume change ΔV [$\Delta V = V$ (the volume after deformation) $- V_0$ (the original volume)] for this unit cube. Show that $\varepsilon_{xx} + \varepsilon_{yy} + \varepsilon_{zz} \approx \Delta V$.



2. The state of stress in a body is uniform and is given by $\sigma_{xx} = 4\mathrm{MPa},\ \sigma_{yy} = 3\mathrm{MPa},\ \sigma_{zz} = 0\mathrm{MPa},\ \tau_{xy} = 2\mathrm{MPa},\ \tau_{yz} = 0\mathrm{MPa},\ \tau_{xz} = 0\mathrm{MPa}$. (a) Find the three components of the stress vector t on the surface ABCD as shown in the figure. (b) Find the normal component σ_n of the stress vector.

3. Find the principal stresses and corresponding principal directions for the stresses given in Problem 2. Check the result with other methods such as Mohr's circle.