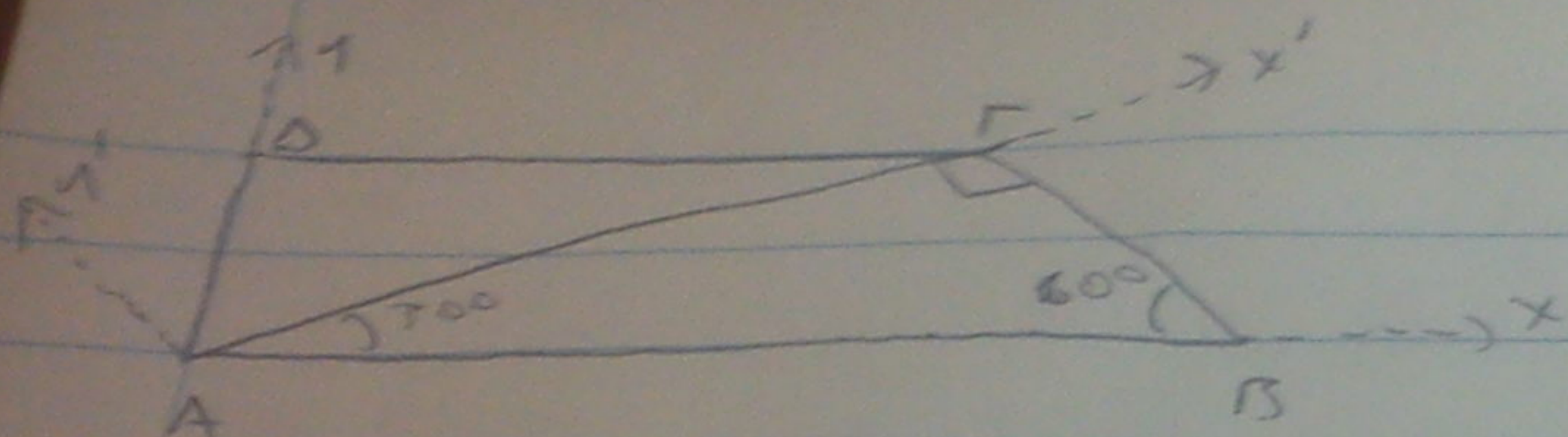




$$E = 220 \text{ GPa} \quad \nu = 0.17$$

Από επιρροή $\sigma_x = 0$ $\sigma_{x'y'} = 0$ $\epsilon_{x'} = 2 \cdot 10^{-3}$

Επειδή έχουμε επίπεδη κατάσταση $\sigma_z = \sigma_{z'} = 0$

$$\epsilon_x = \frac{1}{E} [\sigma_x - \nu (\sigma_y + \sigma_z)] = 2 \cdot 10^{-3} \cdot 220 \cdot 10^9 = \sigma_x' - 0.17 \sigma_y' =$$

$$420 = \sigma_x' - 0.17 \sigma_y' \Rightarrow \boxed{\sigma_x' = 420 + 0.17 \sigma_y'} \quad (1)$$

$$\theta = +30^\circ$$

$$\sigma_{x'y'} = 0 \Rightarrow \frac{\sigma_x}{2} - \frac{\sigma_y}{2} \sin 60^\circ + \sigma_{xy} \cos 60^\circ = 0 \Rightarrow$$

$$\frac{\sigma_y \sqrt{3}}{4} + \frac{\sigma_{xy}}{2} = 0 \Rightarrow \boxed{\sigma_{xy} = -\frac{\sigma_y \sqrt{3}}{2}}$$

$$\sigma_x' = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 60^\circ + \sigma_{xy} \sin 60^\circ \Rightarrow$$

$$\frac{\sigma_y \cdot \sqrt{3}}{4} + \frac{\sigma_{xy}}{2} = 0 \Rightarrow \boxed{\sigma_{xy} = -\frac{\sigma_y \sqrt{3}}{2}}$$

$$\sigma_{x'} = \frac{\sigma_x}{2} + \frac{\sigma_y}{2} + \frac{\sigma_x - \sigma_y \cos 60^\circ}{2} + \sigma_{xy} \sin 60^\circ \Rightarrow$$

$$\sigma_{x'} = \frac{\sigma_y}{2} - \frac{\sigma_y}{2} \cdot \frac{1}{2} + (-\frac{\sigma_y \sqrt{3}}{2}) \cdot \frac{\sqrt{3}}{2} \Rightarrow$$

$$\sigma_{x'} = \frac{2\sigma_y}{4} - \frac{\sigma_y}{4} - \frac{3\sigma_y}{4} \Rightarrow \boxed{\sigma_{x'} = -\frac{1}{2} \sigma_y}$$

$$\sigma_{y'} = \frac{\sigma_x}{2} + \frac{\sigma_y}{2} - \frac{\sigma_x - \sigma_y \cos 60^\circ}{2} - \sigma_{xy} \sin 60^\circ \Rightarrow$$

$$\sigma_{y'} = \frac{\sigma_y}{2} + \frac{\sigma_y}{2} \cdot \frac{1}{2} + \frac{\sigma_y \sqrt{3}}{2} \cdot \frac{\sqrt{3}}{2} \Rightarrow$$

$$\sigma_{y'} = \frac{2\sigma_y}{4} + \frac{\sigma_y}{4} + \frac{3\sigma_y}{4} \Rightarrow \boxed{\sigma_{y'} = \frac{3}{2} \sigma_y}$$

Άρα από ① έχω $-\frac{1}{2} \sigma_y = 420 + 0,3 \cdot \frac{3}{2} \cdot \sigma_y \Rightarrow$

$$-\frac{1}{2} \sigma_y - \frac{0,9}{2} \sigma_y = 420 \Rightarrow -\frac{1,9}{2} \sigma_y = 420 \Rightarrow$$

$$\boxed{\sigma_y = -442,2 \text{ MPa}}$$

Para $\sigma_{x'} = 221,05 \text{ Mpa}$ $\sigma_{y'} = -663,25$

$\sigma_{xy} = 382,87 \text{ Mpa}$

Para $\epsilon_x = \epsilon_{AB} = \frac{1}{E} [\sigma_x - \nu(\sigma_y + \sigma_z)] = \frac{1}{220 \cdot 10^3} [-0,3 \cdot (-442,2)] =$

$0,63 \cdot 10^{-3}$

$\epsilon_y = \epsilon_{AD} = \frac{1}{E} [\sigma_y - \nu(\sigma_x + \sigma_z)] = \frac{-442,2 \text{ Mpa}}{220 \cdot 10^3 \text{ Mpa}} = -2 \cdot 10^{-3}$