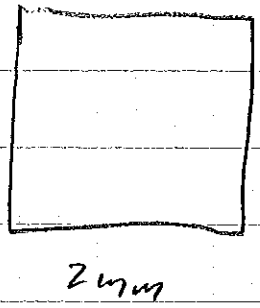
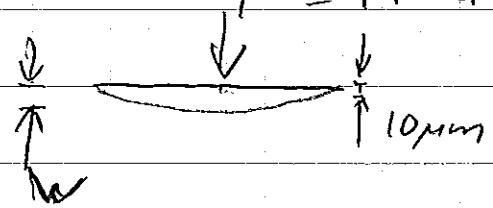
1) Square membrane



$$D = \frac{E t^3}{12(1-\nu^2)} = 1{,}718 \cdot 10^{-5}\ Pa\,m^3$$

$$= 1{,}718 \cdot 10^{13}\ Pa\,\mu m^3$$

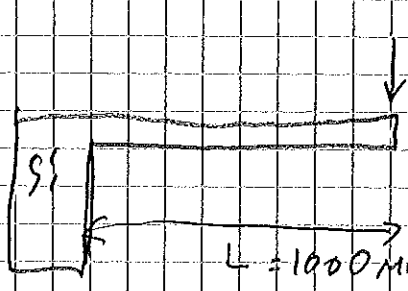


$$W = 0{,}001265 \cdot 1000 \cdot (2 \cdot 10^{+3})^4 / D$$

$$W = 1{,}178\ \mu m$$

$$W = 1{,}178 \cdot 10^{-6}\ m$$

2



[110] direction $\pi'_{44} = 70 \cdot 10^{-11}$

$$\frac{\Delta R}{R} = \pi'_{44}(\sigma_l - \sigma_t) \approx \pi'_{44}\sigma_l = 3\%$$

$$\sigma_{max} = \frac{0{,}03}{70 \cdot 10^{-11}} = 4{,}29 \cdot 10^{7}\ Pa$$

$$\sigma_{max} = \frac{QLt}{2I} \qquad I = \frac{a \cdot t^3}{12}$$

$$\sigma_{max} = \frac{QLt}{2} \cdot \frac{12}{a t^3} = \frac{QL \cdot 6}{a t^2}$$

$$a = \frac{6QL}{t^2 \sigma_{max}} = 156\ \mu m$$

Answer: 156 μm beam width will result in 3% resistance change for the proposed design.

3

$$F_0 = 0,161 \frac{t}{L^2} \left(\frac{E}{\rho}\right)^{1/2}$$

$\rho = 2,3\ g/cm^3 = 2,3 \cdot 10^3\ g/dm^3 = 2,3 \cdot 10^6\ g/m^3$
$= 2,3 \cdot 10^3\ kg/m^3$

$F_0 = 4,39\ kHz$