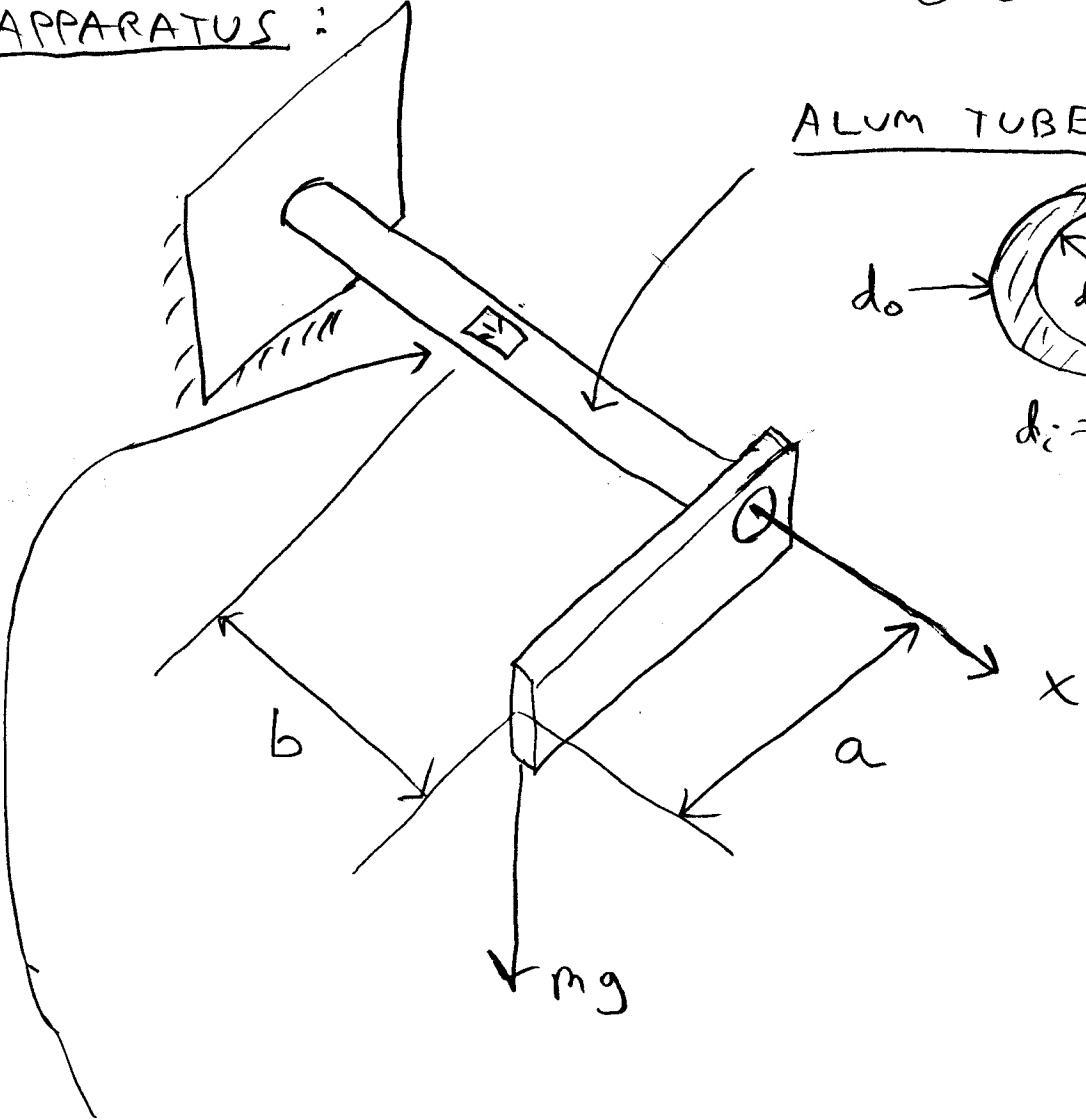


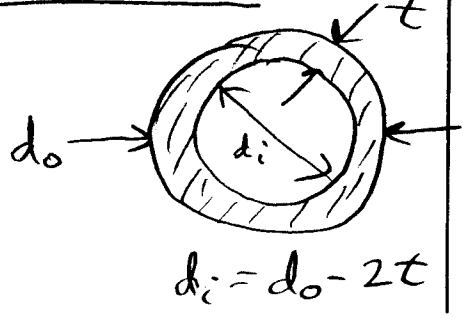
STRAIN GAGE LAB :

"RANCY SCALE"
FIND m GIVEN
ROSETTE
 $\epsilon_1, \epsilon_2, \epsilon_3$

APPARATUS :



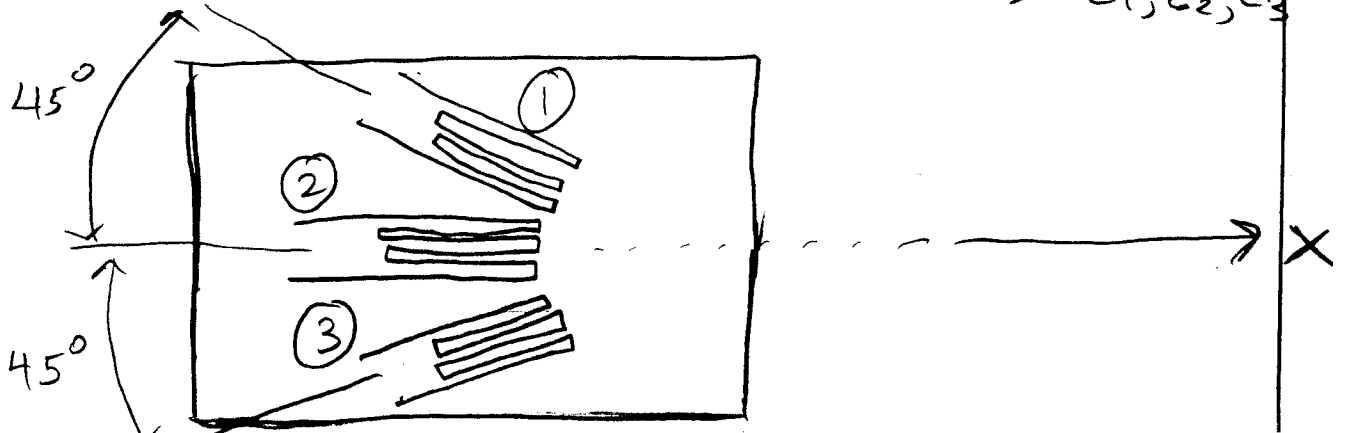
ALUM TUBE



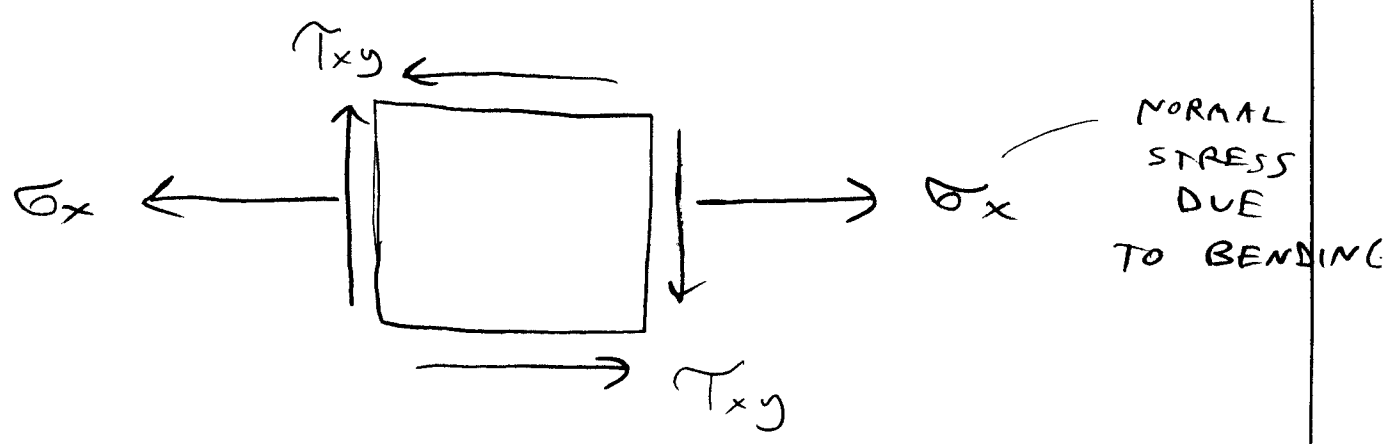
RECTANGULAR STRAIN GAGE ROSETTE

(MOUNTED ON TOP OF TUBE)


TOP VIEW :



THEORETICAL STATE OF STRESS :



22-141 50 SHEETS
 22-142 100 SHEETS
 22-144 200 SHEETS



BENDING

$$\sigma_x = \frac{M c}{I}$$

$$M = m g b \quad (\text{bending moment})$$

$$c = d_o / 2 \quad (\text{dist. from N.A.})$$

$$I = \frac{\pi}{64} (d_o^4 - d_i^4) \quad (\text{area mom. of inertia of section})$$

$$\sigma_x = \frac{m g b d_o}{2 I}$$

TORSION

$$\tau_{xy} = \frac{T c}{J}$$

$$T = m g a \quad (\text{torque})$$

$$J = 2 I$$

(polar moment of inertia for section)

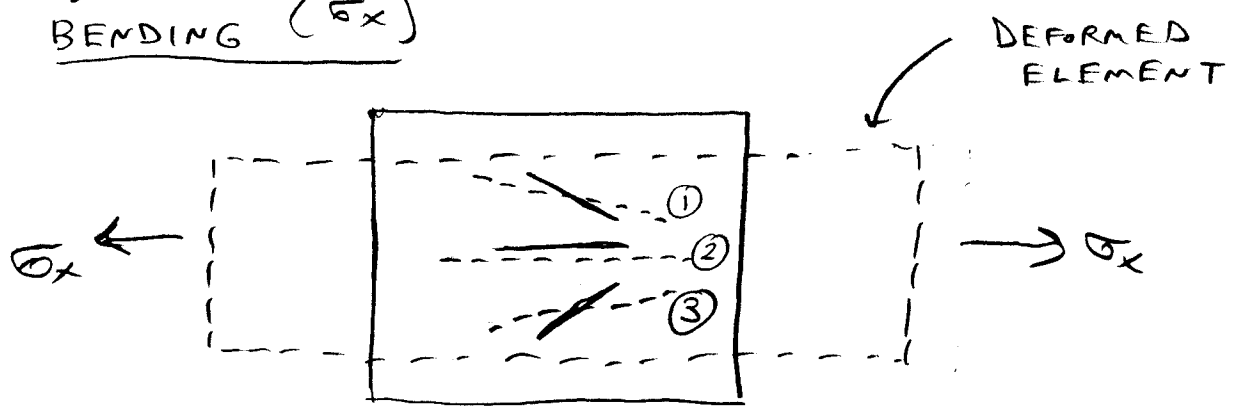
$$\tau_{xy} = \frac{m g a d_o}{4 I}$$

NOTE : $\sigma_x = \left(\frac{2b}{a}\right) \tau_{xy}$

SO FOR $2b > a$, BENDING IS DOMINANT FACTOR

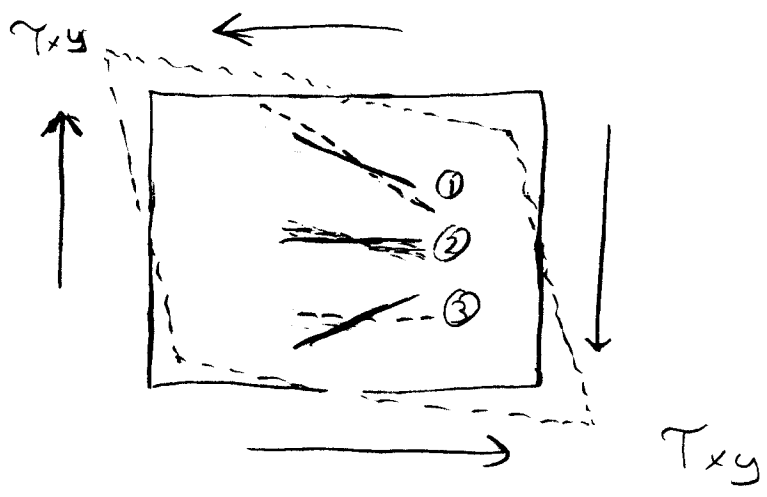
STRAINS RESULTING FROM STRESSES

DUE TO BENDING (σ_x)



$\epsilon_2 > \epsilon_1 = \epsilon_3 > 0$ (ALL IN TENSION)

DUE TO TORSION (τ_{xy})



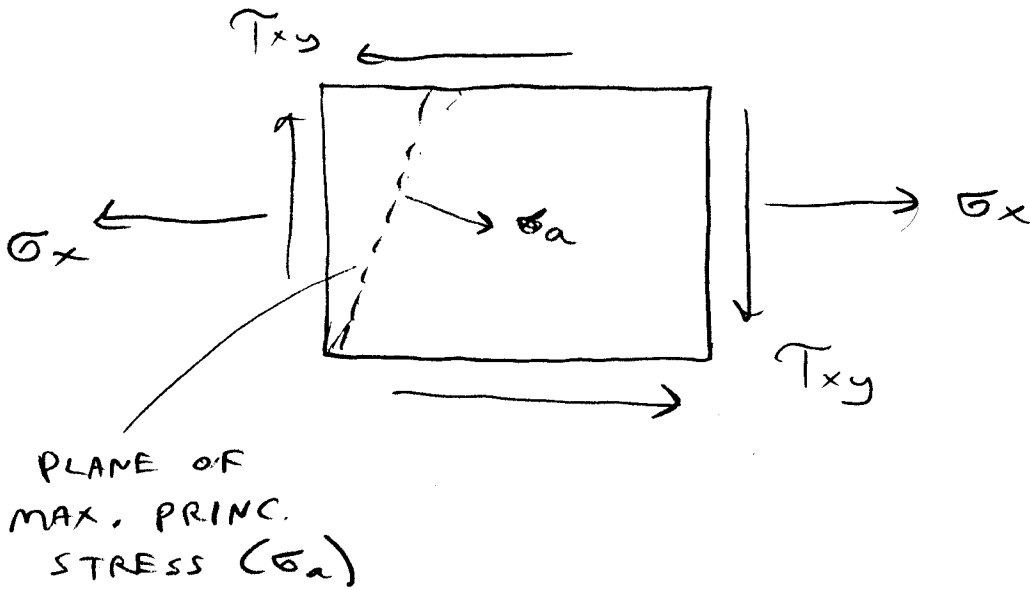
$\epsilon_1 > 0$ (TENSION) $\epsilon_2 \approx 0$ (NOT ZERO SINCE GAGE HAS FINITE SIZE BUT CLOSE) $\epsilon_3 < 0$

COMBINED EFFECTS

W/ BENDING DOMINANT,

$\epsilon_2 > \epsilon_1 > \epsilon_3$

PRINCIPAL STRESS DIRECTION



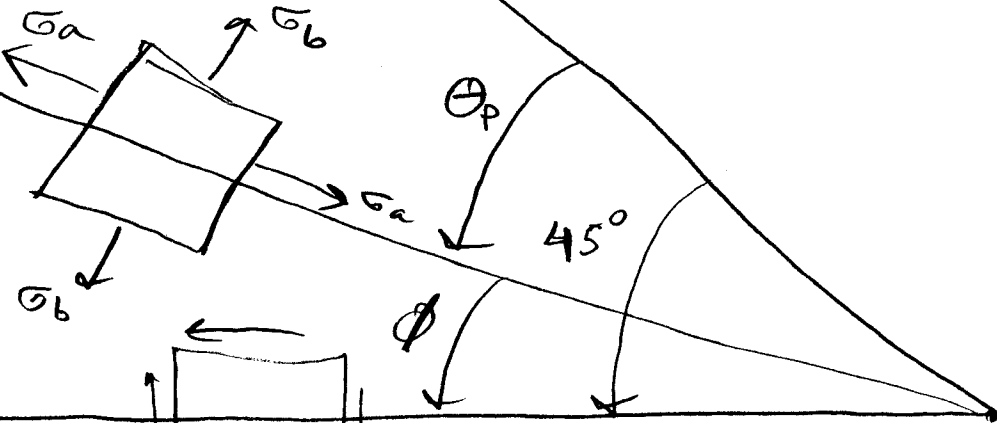
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS



1st strain gage axis

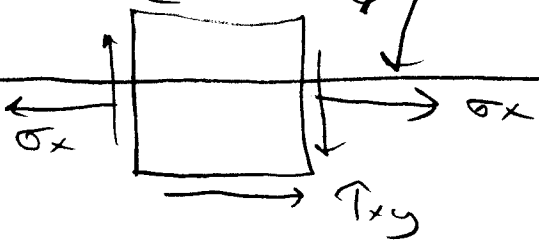
①

max. princ. stress axis



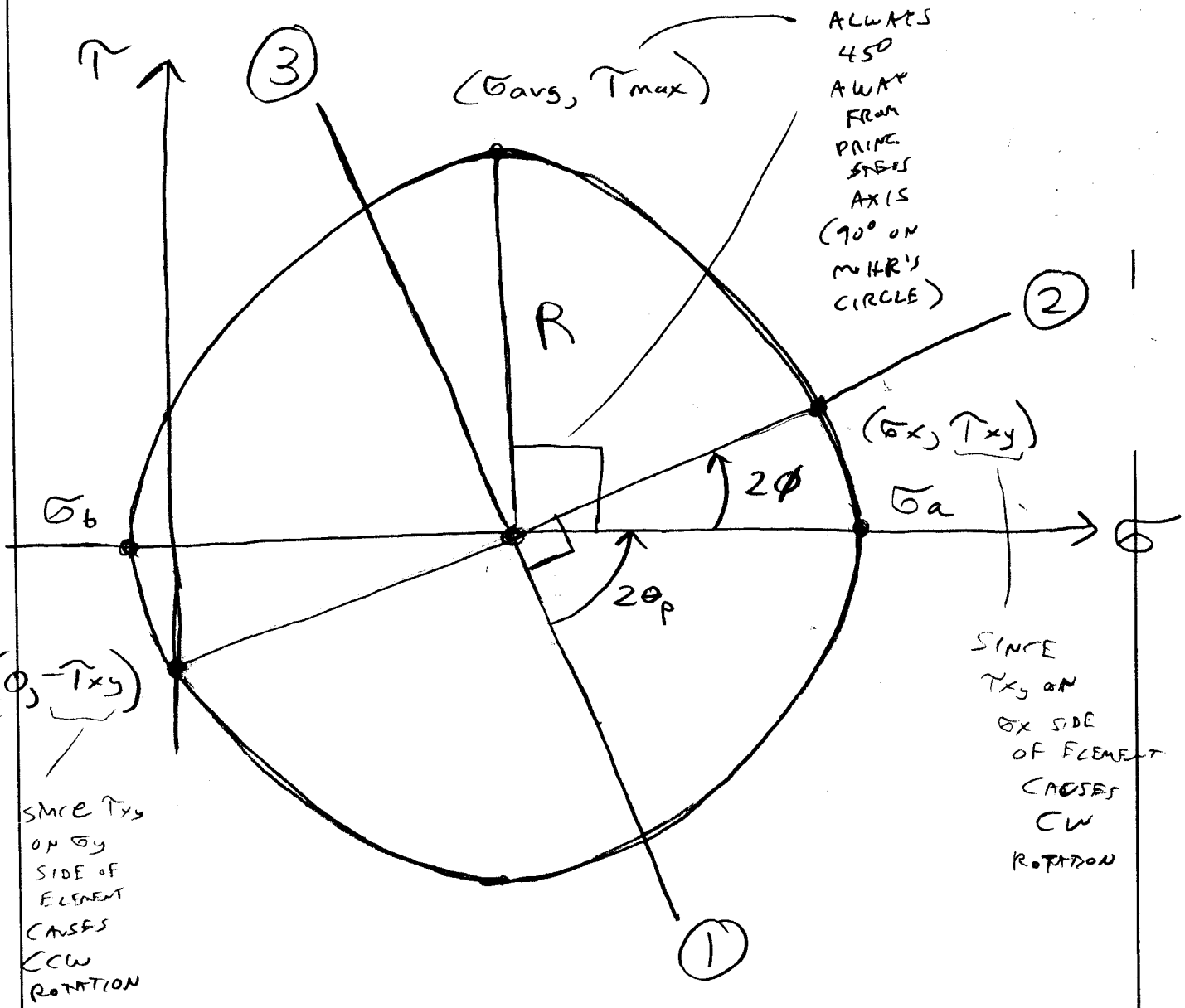
②

2nd strain gage axis



$$\phi = 45^\circ - \theta_p$$

MOHR'S CIRCLE



$$\sigma_{avg} = \frac{(\sigma_a + \sigma_b)}{2}$$

$$R = \tau_{max} = \frac{(\sigma_a - \sigma_b)}{2}$$

$$\sigma_x = \sigma_{avg} + R \cos 2\phi$$

$$\tau_{xy} = R \sin 2\phi$$

22-141 50 SHEETS
 22-142 100 SHEETS
 22-144 200 SHEETS



SINCE τ_{xy} ON σ_y SIDE OF ELEMENT CAUSES CCW ROTATION

SINCE τ_{xy} ON σ_x SIDE OF ELEMENT CAUSES CW ROTATION

ALWAYS 45° AWAY FROM PRINCIPAL STRESS AXIS (90° ON MOHR'S CIRCLE)