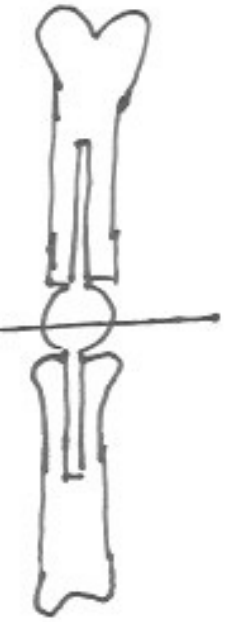
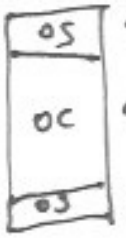


Omero

$$E_z = \frac{E_c^z \cdot E_s}{a_8 E_s + a_2 E_c^z}$$

$$E_{xy} = a_8 E_c^{xy} + a_2 E_{os}$$

ULNA



$$E_z^u = \frac{E_c^z \cdot E_s}{a_9 E_s + a_1 E_c^z}$$

$$E_{xy}^u = a_9 E_c^{xy} + a_1 E_{os}$$

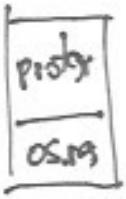
ρ_{st}^{om} h_{st}^{om} ρ_{giunta} $\rho_{granulo} = \rho_{gomito} = \rho_{ginglimo}$

$$\begin{cases} E_z = \dfrac{E_p \cdot E_{OR}^z}{f_p E_{OR}^z + f_{OR} E_p} \\ E_{xy} = E_p f_p + f_{OR} E_{OR} \\ f_p + f_{OR} = 1 \end{cases}$$

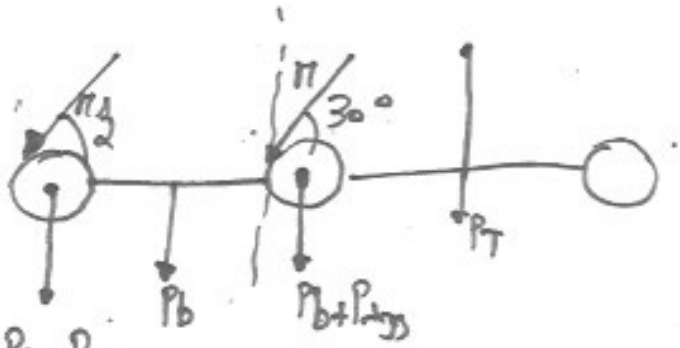
Omero

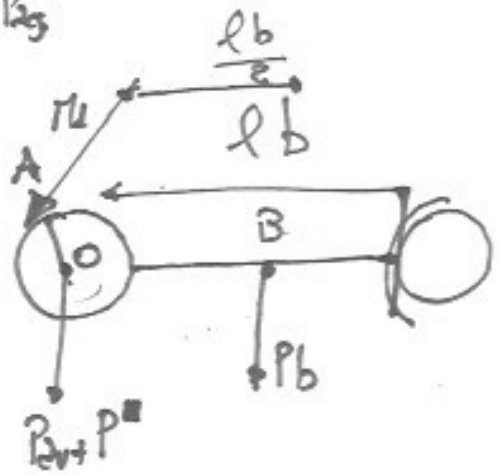
ULNA

ρ_{st}^{ul} h_{st}^{ul} $\rho_{granulo}$



$$\begin{cases} E_z = \dfrac{E_p \cdot E_{OR}^{ULNA\,z}}{f_p E_{OR}^{ULNA\,z} + f_{OR} E_p} \\ E_{xy} = E_p f_p + f_{OR} E_{OR}^{ULNA\,xy} \\ f_p + f_{OR} = 1 \end{cases}$$





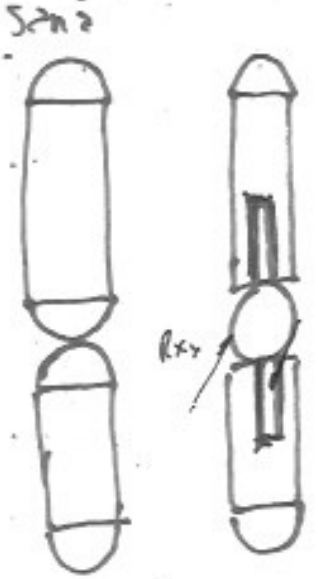
$\alpha = 30°$

$P^* = 100N$

$M_1 OA = P_b \cdot \frac{l_b}{2}$ $\quad M_1 = P_b \cdot \frac{l_b}{2OA}$

$R_{xz} = -P_b - P_{AV} - P^* - M_1 \sin\alpha$

$R_{xy} = -M_1 \cos\alpha$



$\rho_{st}^{om}, h_{st}^{om}$

$\rho_{st}^{ue}, h_{st}^{ue}$

ρ_{giunto}

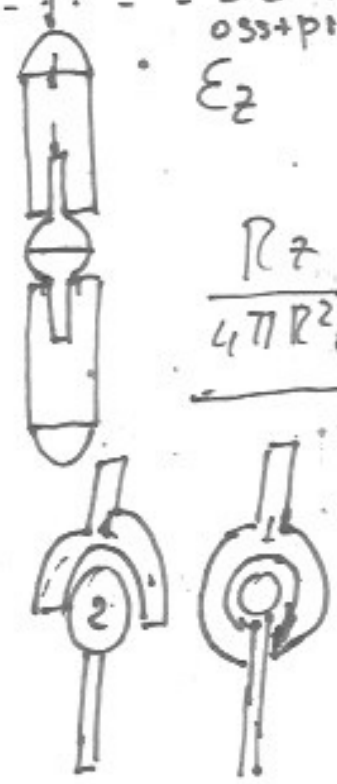
$\sigma_{Torsione}$ equilibrato da $l_b M_1$

$$\varepsilon_z^{\text{ossiamo}} = \frac{R_z}{2\pi R^2_{epom}} \cdot \frac{1}{E_{os}} + \frac{R_z}{\pi R^2_{om}} \cdot \frac{1}{E_{oc}^z} + \frac{R_z}{2\pi R^2_{ep2}} \cdot \frac{1}{E_{os}} +$$

$$\frac{R_z}{2\pi R^{2\,ucas}_{op1}} \cdot \frac{1}{E_{os}} + \frac{R_z}{\pi R^2_{ucas}} \cdot \frac{1}{E_{oc}^z} + \frac{R_z}{2\pi R^{2\,ucas}_{op1}} \cdot \frac{1}{E_{os}}$$

$$\varepsilon_{xy}^{\text{ossom}} = \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{ep1}}{h_{ep1}}} \cdot \frac{1}{E_{os}} + \frac{R_{xy}}{2\pi R_{om} h_{om}} \cdot \frac{1}{E_{oc}^{xy}} + \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{ep2}}{h_{ep2}}} \cdot \frac{1}{E_{os}} +$$

$$\frac{R_{xy}}{\frac{2}{3}\pi \frac{R^{3\,ucas}_{ep1}}{h_{op1}}} \cdot \frac{1}{E_{os}} + \frac{R_{xy}}{2\pi R_{ucas} h_{ucas}} \cdot \frac{1}{E_{oc}^{xy}} + \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^{3\,ucas}_{op2}}{h_{op2}}} \cdot \frac{1}{E_{os}}$$



oss+protesi

$$\varepsilon_z = \frac{R_z}{2\pi R^2_{ep2}} \cdot \frac{1}{E^*_{os}} + \frac{R_z}{\pi R^2_{om}} \cdot \frac{1}{E^{z*}_{oe}} + \frac{R_z}{\pi R^{2*}_{stom}} \cdot \frac{1}{E_p} +$$

$$\frac{R_z}{4\pi R^2_{g1}} + \frac{1}{E^{1\,II}_g} + \frac{R_z}{4\pi R^2_{g2}} \frac{1}{E^{2\,II}_g} + \frac{R_z}{\pi R^2_{stucas}} \cdot \frac{1}{E_{pu}} +$$

$$\frac{}{E_p \qquad\qquad E_{pu}}$$

$$\frac{R_z}{\pi(R^2_{ucas} - R^2_{stucas})} \cdot \frac{1}{E^{*z}_{ocucas}} + \frac{R_z}{2\pi R^2_{ep2}} \cdot \frac{1}{E^*_{osu}}$$

oss pubbi

$$\varepsilon_{xy} = \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{ep1}}{h_{ep1}}} \cdot \frac{1}{E^*_{os}} + \frac{R_{xy}}{2\pi \rho_{om} h_{om}} \cdot \frac{1}{E^{*xy}_c} + \frac{R_{xy}}{2\pi R_{st} h_{st}} \cdot \frac{1}{E_p} +$$

$$+ \frac{R_{xy}}{4\pi R^2_{g1}} \cdot \frac{1}{E_{g1}} + \frac{R_{xy}}{4\pi R^2_{g2}} \cdot \frac{1}{E_{g2}} + \frac{R_{xy}}{2\pi R_{vetro} h_{vetro}} \cdot \frac{1}{E^{*xy}_{c\,vetro}} +$$

$E_{g1} = E_p$; $E_{g2} = E_{p1}$

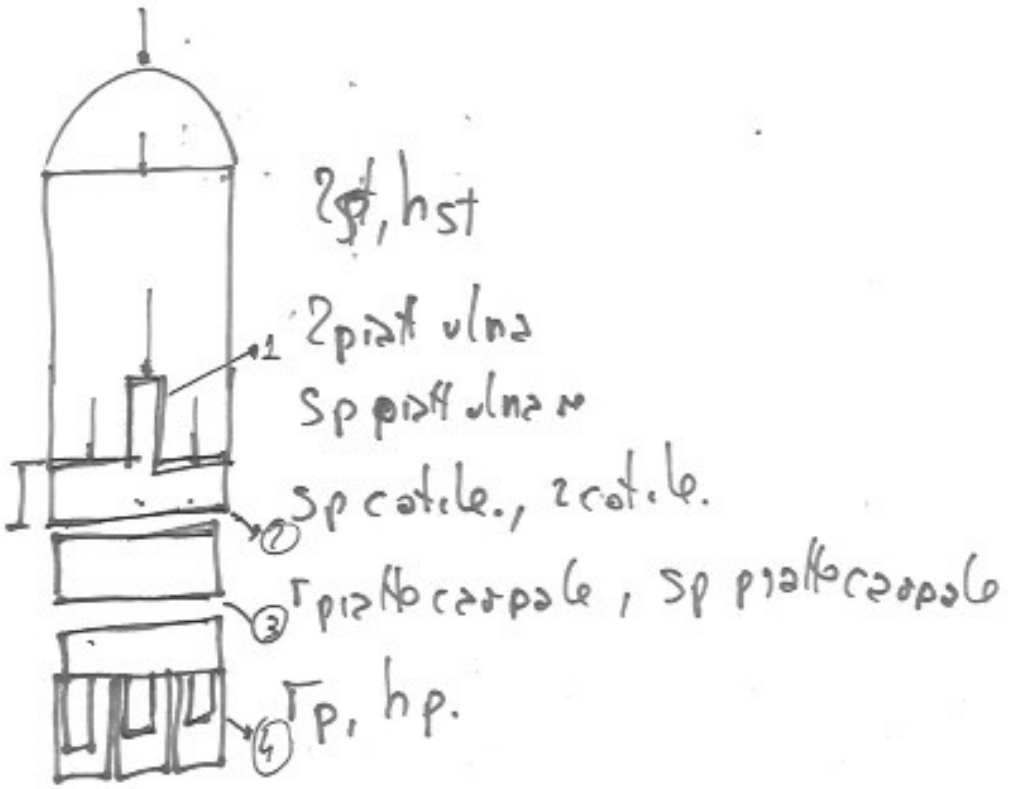
$$+ \frac{R_{xy}}{2\pi R_{st\,vetro} h_{vetro}} \cdot \frac{1}{E_{p1}} + \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{ep2}}{h_{ep2}}} \cdot \frac{1}{E^*_{os\,vetro}}$$

$$\frac{R_z}{\pi R^2_{stom}} = \frac{R_{xy}}{2\pi R_{stom} h_{stom}}$$

$$\frac{R_z}{\pi R^2_{st\,vetro}} = \frac{R_{xy}}{2\pi R_{st\,vetro} h_{st\,vetro}}$$

⑤ $$\underline{G_T} = \frac{(R_{xy} R_1) \cdot P_1}{I} = \frac{M_1}{\pi R^2_{stom} + \pi R^2_{st\,vetro} + 4\pi R^2_{g1}}$$

$$I = \frac{\pi}{2} R^4_1$$



GLENOID

ρ testa ulnare = ρ ULNARE ANATOMICO

ρ piatto carpale = ρ piatto carpale anatomico

ρ cotile = ρ testa ulnare

Sp. cotile = 0,5 < ρ < 1 cm

r_{st}, h_{st} ULNA

Sp. ULNARE

Sp. piatto carpale

r_p, h_p

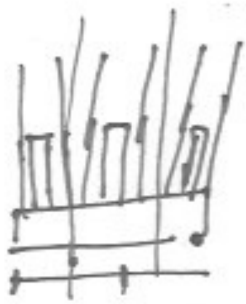
δ_{ROT}

$\delta_{usura} = 100 \mu m / anno$

$0.5 < \delta_{ROT} \leq 1$ cm

$\delta_{ROT} = \delta_{SCAFOIDE}$

ulna/radiale



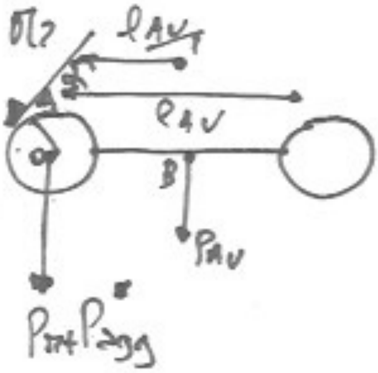
carpale.

- r ULNA
- st ULNA
- sp piatto ulnare
- r piatto ULNA → r anatomico ulnare

r parte carpale
sp parte carpale
h perno, r perno

post comp = 1-2%
pint spong = 97-98%

3

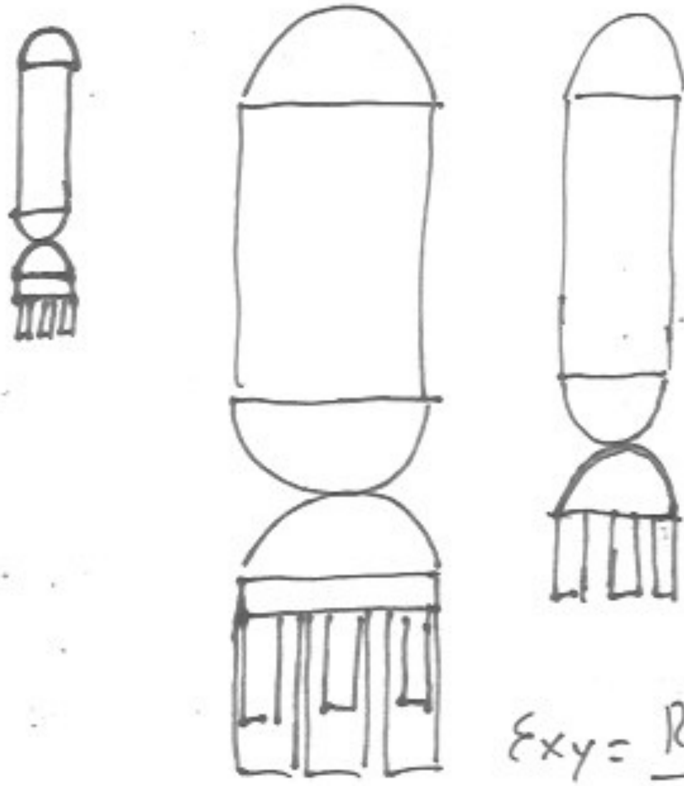


$\alpha = 30°$

$$M_{2OA} = P_{AV} \frac{l_{AV}}{2} \qquad M_2 = P_{AV} \frac{l_{AV}}{2OA}$$

$$R_z = -P_{nAmo} - P_{agg} - P_{AV} - M_z \sin\alpha$$

$$R_{xy} = -M_2 \cos\alpha.$$



$$\varepsilon_z = \frac{R_z}{2\pi R^2_{ep1}} \frac{1}{E_{os}} + \frac{R_z}{\pi R^2_{can}} \cdot \frac{1}{E^z_{oc}} + \frac{R_z}{2\pi R^2_{ep2}} \frac{1}{E_{os}} + \frac{R_z}{2\pi R^2_{carp}} \cdot \frac{1}{E_{os}} + \frac{R_z}{3\pi R^2_{mei}} \cdot \frac{1}{E_{os}}.$$

$$\varepsilon_{xy} = \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{ep1}}{h_{ep1}}} \frac{1}{E_{os}} + \frac{R_{xy}}{2\pi R_{can} h_{can}} \frac{1}{E^{xy}_{oc}} + \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{ep1}}{h_{ep2}}} \cdot \frac{1}{E_{os}} + \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{can}}{h_{epar}}} \cdot \frac{1}{E^{xy}_{oc}} + \frac{R_{xy}}{3 \cdot 2\pi R_{mot} h_{mot}} \cdot \frac{1}{E^{xy}_{oc}}$$

$$\varepsilon_z = \frac{R_z}{2\pi R^2_{epl}} \cdot \frac{1}{E^*_{os}} + \frac{R_z}{\pi R^2_{ULNA}} \cdot \frac{1}{E^*_{ocz}} + \frac{R_z}{\pi R^2_{STULNA}} \frac{1}{E_P} + \frac{R_z}{\pi R^2_{CARP}}$$

$$+ \frac{R_z}{\pi(R^2_{ULNA\,DIS} - R^2_{ST.ULN})} \cdot \frac{1}{E_P} + \frac{R_z}{\pi R^2_{ULNA\,DIS}} \cdot \frac{1}{E_{CST}} + \frac{R_z}{\pi R^2_{CARP}} \cdot \frac{1}{E_{Pz}} +$$

$$+ \frac{R_z}{3\cdot\pi R^2_P} \frac{1}{E_{Pz}} + \frac{R_z}{3\pi(R^2_{CARP} - R^2_P)} \cdot \frac{1}{E^*_{OS}}$$

$$\varepsilon_{xy} = \frac{R_{xy}}{\frac{2}{3}\pi \frac{R^3_{epl}}{h_{epl}}} \cdot \frac{1}{E^*_{OS}} + \frac{R_{xy}}{2\pi R_{ULNA} h_{ULNA}} \cdot \frac{1}{E^*_{ocxy}} + \frac{R_{xy}}{2\pi R_{ST} h_{ST}} \cdot \frac{1}{E_P} +$$

$$+ \frac{R_{xy}}{2\pi Sp_{ULN.} R_{ULNA}} \cdot \frac{1}{E_P} + \frac{R_{xy}}{2\pi R_{ULNA} \cdot Sp_{CST.}} \frac{1}{E_{CST}} + \frac{R_{xy}}{2\pi R_{CARP} \cdot Sp_{CAR}} \frac{1}{E_{Pz}}$$

$$+ \frac{R_{xy}}{3\cdot 2\pi R_D \cdot h_D} \cdot \frac{1}{E^*_{oc}} + \frac{R_{xy}}{3\cdot 2\pi R_P \cdot h_P} \cdot \frac{1}{E_P}$$

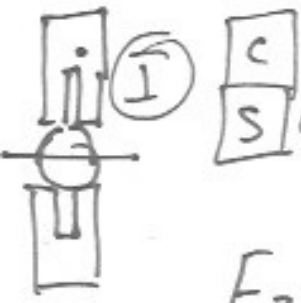
---

(1) $\frac{R_z}{\pi R^2_{ST}} = \frac{R_{xy}}{2\pi R_{ST} h_{ST}}$

(2) $\frac{R_z}{\pi R^2_{ULNA\,DIS}} = \frac{R_{xy}}{2\pi Sp_{ULNA} \cdot R_{ULNA}}$

(3) $\frac{R_z}{\pi R^2_{CARP}} = \frac{R_{xy}}{2\pi Sp_{CARP} R_{CARP}}$

(4) $\frac{R_z}{\pi R^2_P} = \frac{R_{xy}}{2\pi R_P h_P}$

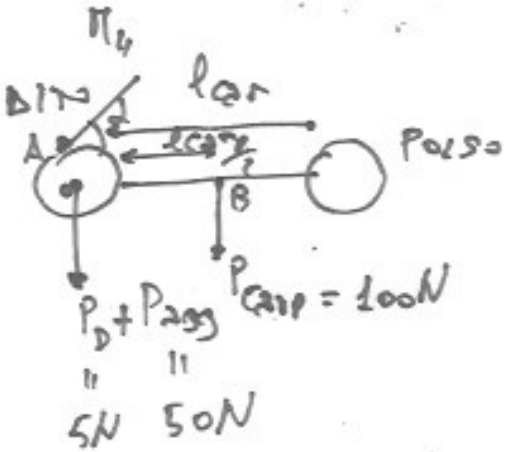


$$E_z = \underset{\text{0.5}}{E''_{os}} = \frac{E^*_{os} \cdot E_p}{\rho_p E^*_{os} + \rho^*_{os} E_p}$$

$$E_{xy} = \underset{\text{17 GPa}}{E''_{oc}} = \rho_{os} E^*_{oc} + \rho_{ps} \cdot E_p.$$

$\rho_{os} + \rho_p = 1$ $\quad$ $\rho_p, h_p.$

$\alpha = 30°$

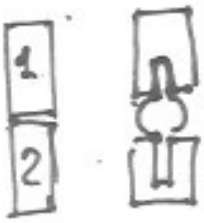


$$\Pi_4 \cdot OA = P_{carp} \cdot \frac{l_{carp}}{2}$$

$$\Pi_4 = P_{carp} \cdot \frac{l_{carp}}{2OA}$$

$$R_z = -P_D - P_{agg} - P_{carp} - \Pi_4 \sin\alpha.$$

$$R_{xy} = -\Pi_4 \cos\alpha.$$



$$\varepsilon_z = \frac{R_z}{\pi R_1^2} \cdot \frac{1}{E_{os}} + \frac{R_z}{\pi R_2^2} \cdot \frac{1}{E_{os}}$$

$$\varepsilon_{xy} = \frac{R_{xy}}{2\pi R_1 h_1} \cdot \frac{1}{E_{oc}^{xy}} + \frac{R_z}{2\pi R_2 h_1} \frac{1}{E_{oc}^{xy}}$$

$$\varepsilon_z = \frac{R_z}{\pi R_1^2} \cdot \frac{1}{E_{os}} + \frac{R_z}{\pi R_{st}^2} \cdot \frac{1}{E_p} + \frac{R_z}{4\pi R_g^2} \cdot \frac{1}{E_p} + \frac{R_z}{\pi R_{st2}^2} \cdot \frac{1}{E_p}$$

R_{worek}

$$+ \frac{R_z}{\pi R_2^2 - \pi R_{st_2}^2} \cdot \frac{1}{E_{os}}$$

$$\varepsilon_{xy} = \frac{R_{xy}}{2\pi R_1 h_1} \cdot \frac{1}{E_{ocxy}} + \frac{R_{xy}}{2\pi R_s h_{st}} \cdot \frac{1}{E_p} + \frac{R_{xy}}{4\pi R_g^2} \cdot \frac{1}{E_p}$$

R_{worek}

$$+ \frac{R_{xy}}{2\pi R_2 h_2} \cdot \frac{1}{E_{oc}^{xy}} + \frac{R_{xy}}{2\pi R_{s_2} h_{st_1}} \frac{1}{E_p}$$