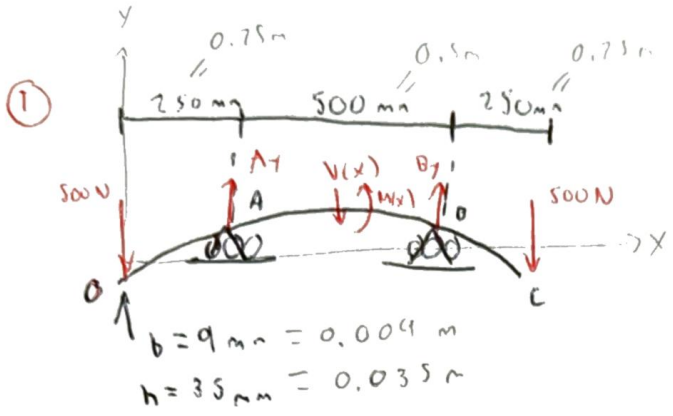
Examen 2° Parcial



$E = 207\ GPa$

Análisis estático

$\sum F_y = 0$

$A_y + B_y - 500 - 500 = 0$

$A_y + B_y = 1000$ (1)

$\sum M_A = 0$

$0.5B_y - 0.75(500) + 0.25(500) = 0$

$\therefore B_y = 500\ N$ (2)

Sustituyendo (2) en (1)

$A_y = 500\ N$ (3)

Ecuación de fuerza cortante

$\sum F_{izq} = 0$

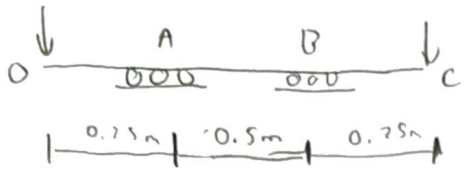
$-500 + A_y \langle x-0.25\rangle^0 + B_y \langle x-0.75\rangle^0 - V(x) = 0$

$\therefore V(x) = A_y \langle x-0.25\rangle^0 + B_y \langle x-0.75\rangle^0 - 500$

Ecuación de momento flector

$M(x) = \int V(x)\,dx$

$\therefore M(x) = A_y \langle x-0.25\rangle + B_y \langle x-0.75\rangle - 500x$



Ecuación de la elastica

$$I_x = \frac{bh^3}{12} = \frac{(0.004)(0.035)^3}{12} = 3.215 \times 10^{-3}\ m^4$$

$$y(x) = \frac{1}{EI}\iint(A_y\langle x-0.25\rangle + B_y\langle x-0.75\rangle - 500x)\,dx\,dx$$

$$y(x) = \frac{1}{EI}\left(A_y\frac{\langle x-0.25\rangle^3}{6} + B_y\frac{\langle x-0.75\rangle^3}{6} - 500\frac{x^3}{6} + C_1x + C_2\right)$$

Aplicando condiciones de frontera

$y(0.25) = 0 \qquad y(0.75) = 0$

$\therefore -C_1 = 26.042 \qquad C_2 = 5.2083$

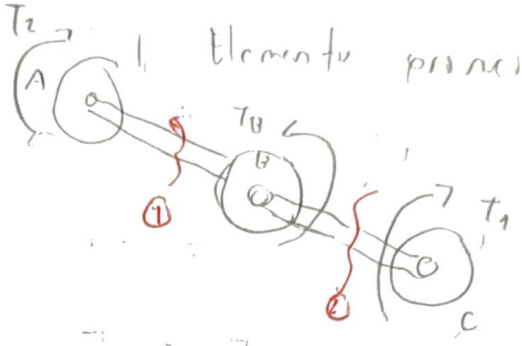
$\therefore$ Ecuacion elastica:

$$y(x) = \frac{1}{6.468\times10^{8}}\left(500\frac{\langle x-0.25\rangle^3}{6} + 500\frac{\langle x-0.75\rangle^3}{6} - 500\frac{x^3}{6} + 26.042x + 5.2083\right)$$

$\therefore$ $y(.1) = -24.154 \times 10^{-9}\ m$ ← Deflexión en C

$y(0.5) = 12.078 \times 10^{-9}\ m$ ← Deflexión en el centro de la viga

(2) Determinar T_1 y T_2, para que los ángulos de deformación en los engranajes A y C sea de 0.04 rad.



Datos

$d_{ABC} = 0.06\ m$

$d_{EH} = 0.08\ m$

$\phi_A = 0.04\ rad$

$\phi_C = 0.04\ rad$

1 Elemento principal

Análisis estático

Sección (1)

$\Sigma M_z = 0$

$-T_2 + T_{AB} = 0$

$T_{AB} = T_2 \quad (1)$

Sección (2)

$\Sigma M_z = 0$

$-T_2 + T_B + T_{BC} = 0$

$T_{BC} = T_2 - T_B \quad (2)$

$T_1 = T_{BC} \quad (3)$

Análisis de deformaciones

$\phi_E = \phi_{ED} + \phi_D$

$\phi_E = 0$

$\therefore \quad \phi_{ED} + \phi_D = 0 \quad (4)$

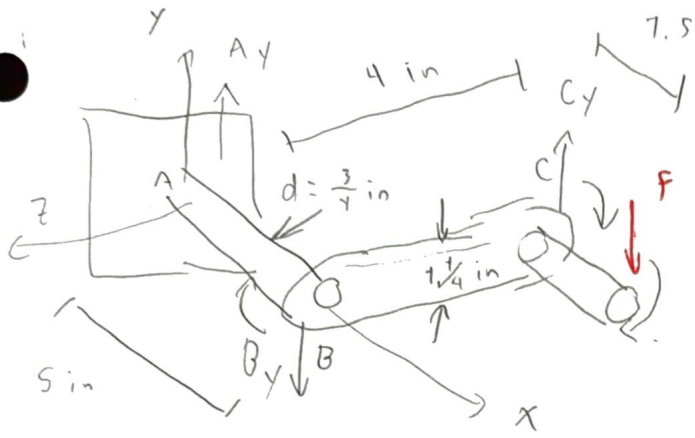
Relación de engranajes

$r_B \phi_B = r_D \phi_D$

$\phi_D = \frac{r_B}{r_D} \phi_B$

$\phi_A = \phi_{AB} + \phi_B + \phi_{BC}$

③ Determinar esfuerzo máximo de eje AB



$C_y = F$

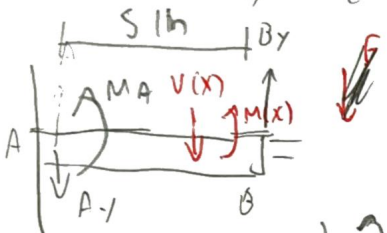
D.C.L en X

$\uparrow \Sigma F_y = 0$

$B_y - F = 0$

$B_y = F = 300\ lb$

D.C.L en Z



$\uparrow \Sigma F_y = 0$

$B_y + A_y = 0$

$A_y = -B_y$

$A_y = -300\ lb$

$\circlearrowleft \Sigma M_A = 0$

$-M_A + B_y(5) = 0$

$M_A = -1500\ lb \cdot in$

Ecuación de fuerza cortante

$\Sigma F_{izq} = 0$

$-300 - V(x) = 0$

$V(x) = -300$

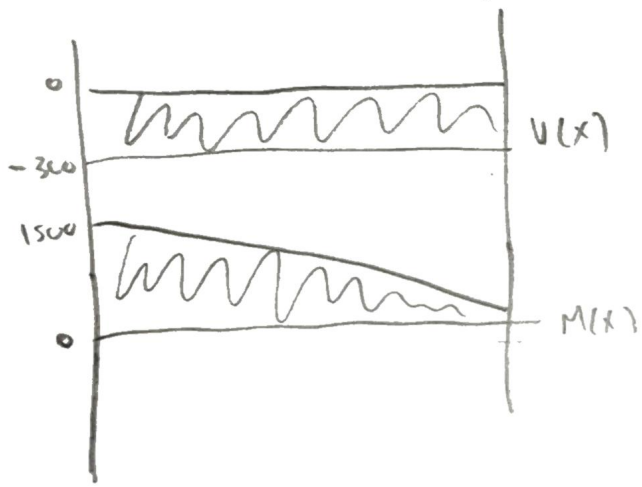
$M(x) = \int V(x)\, dx$

$M(x) = -300x + C_1$

$M(0) = -1500$

$\therefore C_1 = +1500$

$\therefore M(x) = -300x + 1500$



Análisis de esfuerzos

Esfuerzo normal:

$M(x)_{max} = 1500\ lb \cdot in$

$I = \frac{\pi}{64} d^4 = \frac{\pi}{64}\left(\frac{3}{4}\right)^4 = 0.01553$

$\sigma_{max} = \frac{M(x)_{max}\, c}{I} = \frac{1500\,(3/8)}{0.01553}$

$\sigma_{max} = 32.286 \times 10^3\ psi$

Esfuerzo cortante: $V(x)_{max} = 300\ lb$

$$\tau_{max} = \left(\frac{4}{3}\right)\left(\frac{V(x)_{max}}{A}\right) = \left(\frac{4}{3}\right)\left(\frac{300}{0.4417}\right) = 905.4444\ psi$$

$$A = \pi r^2 = \pi\left(\frac{3}{8}\right)^2 = 0.4417\ in^2$$

Esfuerzo de torsion

$$\tau = \frac{T\,c}{J} = \frac{1700\ (4\ in)}{0.03106} = 154.574 \times 10^3\ psi$$

$$J = \frac{\pi}{32} d^4 = \frac{\pi}{32}\left(\frac{3}{4}\right)^4 = 0.03106\ in^4$$

$$T = C_y\ (4\ in) = 300\ (4) = 1700\ lb \cdot in$$