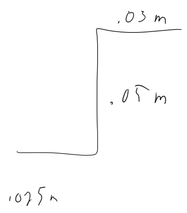
Logan Wessel

Acre 421 Assignment

$L = .5m \quad t = .001m \quad E = 70e9 \quad \nu = .25 \quad G = 28e9$



from ANSYS

$I_{yy} = .421e^{-7}\ m^4$

$I_{zz} = .133e^{-7}\ m^4$

$I_{yz} = .178e^{-7}\ m^4$

$A = .103e^{-3}\ m^2$

$$I_{p_1,p_2} = \frac{I_{yy}+I_{zz}}{2} \pm \sqrt{\left(\frac{I_{yy}-I_{zz}}{2}\right)^2 + I_{yz}^2}$$

$I_{p_1} = 5.06e{-8}\ m^4 \leftarrow min$

$I_{p_2} = 4.8e{-9}\ m^4 \leftarrow max$

a.

$P_{cr_{max}} = 13214.75\ N$

$P_{cr_{min}} = 139837.56\ N$

$C_w = .455e^{-11}$ $\quad \bar{y} = .061311\ m$

$\bar{J} = .347e^{-11}$ $\quad \bar{z} = .025689\ m$

$sc_y = .6016\ m$

$sc_z = .031611\ m$

$y_0 = -.000289\ m$

$z_0 = -.005922\ m$

$P_y = P_{cr_{max}}\ N$

$P_z = P_{cr_{min}}\ N$

$I_0 = 5.902089e^{-8}\ m^4$

$P_a = 23607.17477\ N$

$$\begin{bmatrix} P-P_z & 0 & Pz_0 \\ 0 & P-P_y & -Py_0 \\ Pz_0 & -Py_0 & \frac{-I_0}{A}(P-P_a) \end{bmatrix} \begin{bmatrix} C_1 \\ C_2 \\ C_3 \end{bmatrix} = 0$$

$P = 13896.389,\ 23711.159,\ 140499.879\ N$

b. $P_{cr} = 13896.389\ N$

	b_m	t_m	b/t	F_{cc_n}
1	.025	.001	25	24
2	.65	.001	50	27
3	.03	.001	30	18

$F_{cc} = 23714\ N$

d. $F_{cr} = F_{cc}\left(1 - \frac{F_{cc}}{4\pi^2 E}\left(\frac{L'}{\rho}\right)\right) = 23714\ N$