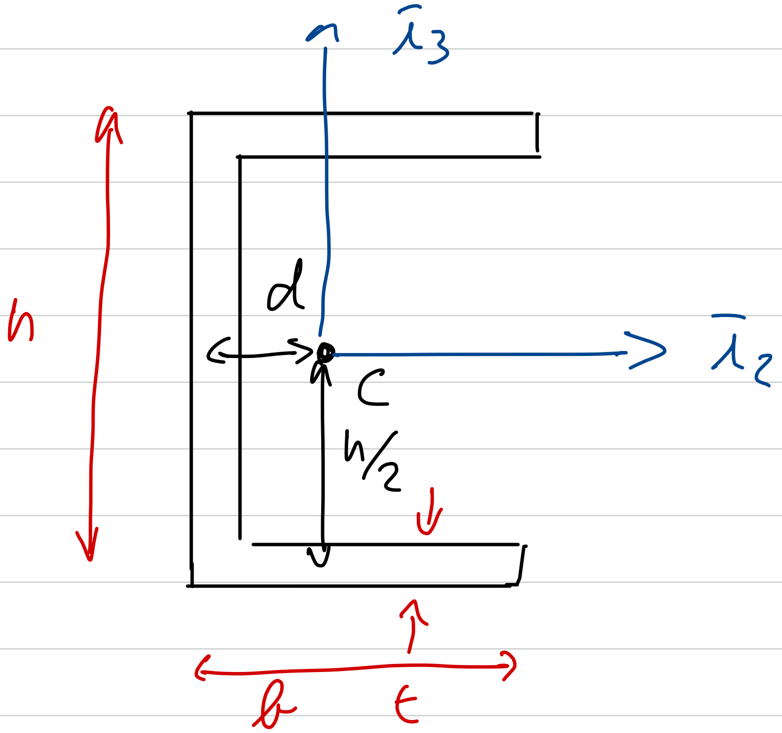
Example: Consider a "C" shaped thin-walled section subjected to a shear force V_3 ($V_2 = 0$). Find f.



$$d = \frac{b}{(2 + h/b)}$$

$$f(s) = C + \frac{Q_3 \cancel{H_{23}^c} - Q_2 H_{33}^c}{\Delta H} V_3$$

$$- \frac{Q_3 H_{22}^c - Q_2 \cancel{H_{23}^c}}{\Delta H} \cancel{V_2}$$

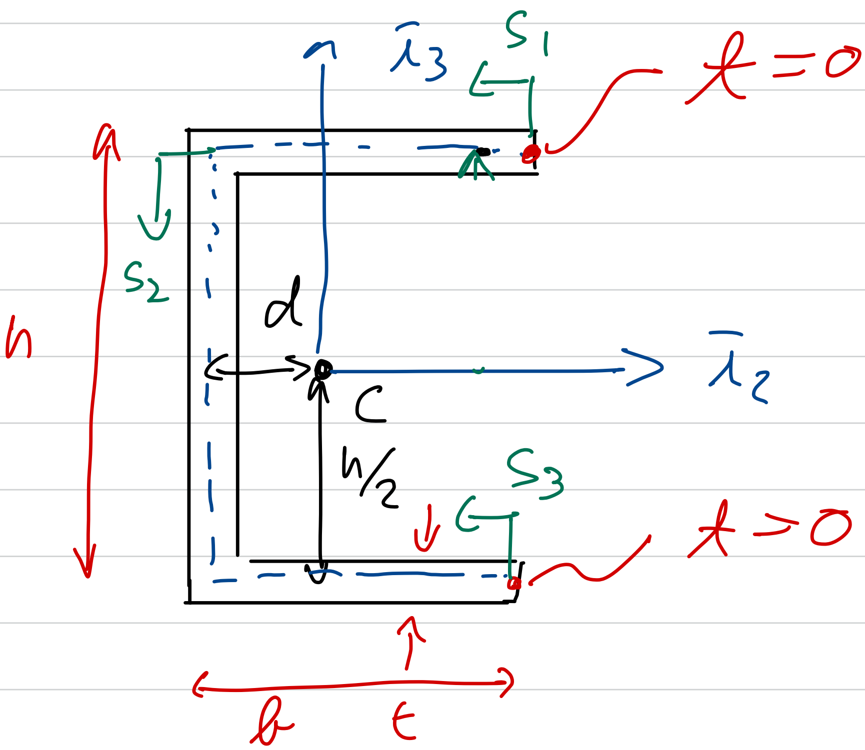
→ Due to symmetry $H_{23}^c = 0$

→ $V_2 = 0$

$$\boxed{f(s) = C - \frac{Q_2(s)}{H_{22}^c} V_3}$$

$$H_{22}^{c} = E\left[\frac{t h^3}{12} + 2\cdot\left[\cancel{\frac{b t^3}{12}}^{\approx 0} + (bt)\left(\frac{h}{2}\right)^2\right]\right]$$

$$\rightarrow H_{22}^{c} = E\left(\frac{h^3 t}{12} + \frac{1}{2}\, b t h^2\right)$$



Part (1)

$$f(s_1) = C_1 - \frac{Q_2(s_1)\, V_3}{H_{22}^{c}}$$

$C_1 = 0$ since $f(s_1 = 0) = 0$

$$Q_2(s_1) = E(t s_1)(h/2)$$

$$\rightarrow f(s_1) = -\frac{E t s_1 h}{2}\cdot\frac{V_3}{H_{22}}$$

Part (2)

$$f(S_2) = C_2 - Q_2(S_1)\frac{V_3}{H^c_{22}}$$

$$Q_2(S_2) = E(S_2 t)\left(\frac{h}{2} - \frac{S_2}{2}\right)$$

* We must have continuity at the shear flow!

$$f(S_1 = b) = f(S_2 = 0)$$

$$f(S_2) = C_2 - E(S_2 t)\left(\frac{h}{2} - \frac{S_2}{2}\right)\frac{V_3}{H^c_{22}}$$

$$f(S_2 = 0) = C_2$$

$$f(S_1 = b) = -\frac{E t b h}{2}\frac{V_3}{H^c_{22}} = C_2$$

$$\rightarrow f(S_2) = E t \frac{V_3}{H^c_{22}}\left(-\frac{bh}{2} - \frac{S_2 h}{2} + \frac{S_2^2}{2}\right)$$

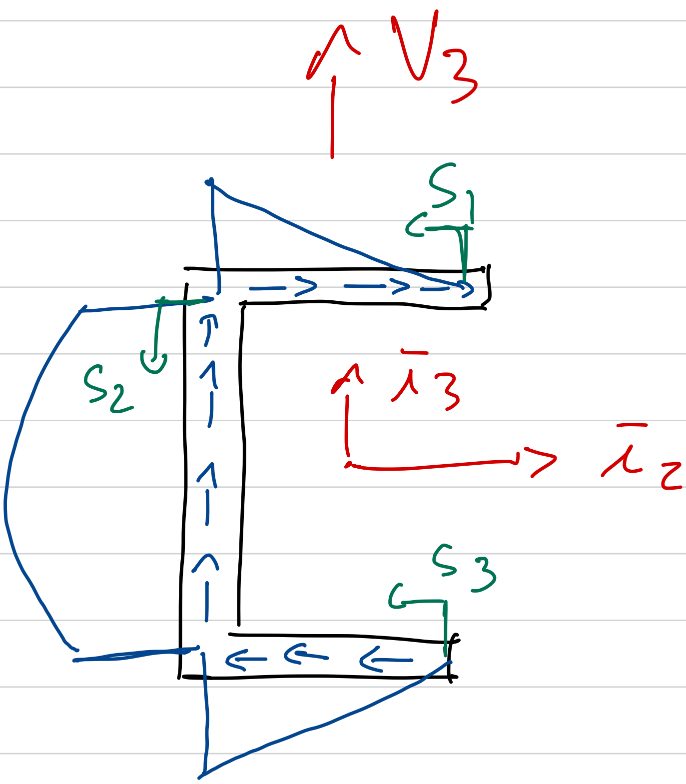
Part 3

$$t(s_3) = C_3 - Q_2(s_3)\,\frac{V_3}{H_{22}^c}$$

$C_3 = 0$ Since $t(s_3 = 0) = 0$

$$Q_2(s_3) = E(t s_3)(-h/2)$$

$$\rightarrow t(s_3) = \frac{E t s_3 h}{2}\,\frac{V_3}{H_{22}^c}$$



t_{max} @ $s_2 = h/2$

Sanity check.

Check # 1 : Continuity @ $S_2 = h$ and $S_3 = b$

$$f(S_2 = h) = -f(S_3 = b)$$

$$f(S_3 = b) = \frac{Etbh}{2} \frac{V_3}{H_{22}^c}$$

$$f(S_2 = h) = Et\frac{V_3}{H_{22}^c}\left(-\frac{bh}{2} - \cancel{\frac{h^2}{2}} + \cancel{\frac{h^2}{2}}\right)$$

$$Et\frac{V_3}{H_{22}^c}\left(-\frac{bh}{2}\right) = -Et\frac{V_3}{H_{22}^c}\frac{bh}{2} \checkmark$$

Check #2 :

$$-V_3 = \int_0^h f(S_2)\, dS_2$$

$$= \int_0^h Et\frac{V_3}{H_{22}^c}\left(-\frac{bh}{2} - \frac{S_2 h}{2} + \frac{S_2^2}{2}\right) dS_2$$

$$= Et\frac{V_3}{H_{22}^c}\left[-\frac{bh}{2}S_2 - \frac{h}{2}\frac{S_2^2}{2} + \frac{S_2^3}{6}\right]_0^h$$

$$-V_3 = -Et\frac{V_3}{H_{22}^c}\left[\frac{bh^2}{2} + \frac{h^3}{12}\right]$$

$$H^{c}_{22} = E\left(\frac{h^3 t}{12} + \frac{1}{2} b t h^2\right)$$

$$-V_3 \overset{?}{=} = -\cancel{E}\, t\, V_3 \left(\cancel{\frac{b h^2}{2}} + \frac{h^3}{12}\right)$$

$$\cdot \frac{1}{\cancel{Et}}\left(\frac{h^3}{12} + \cancel{\frac{b h^2}{2}}\right)^{-1}$$

$$\int_0^b t(s_1)\, ds_1 - \int_0^b t(s_3)\, ds_3 = V_2 = 0$$