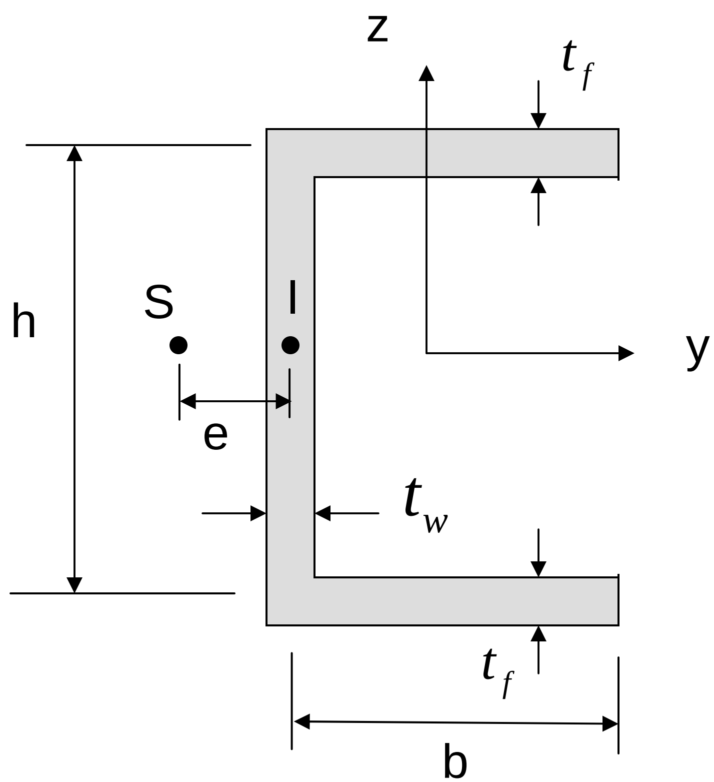
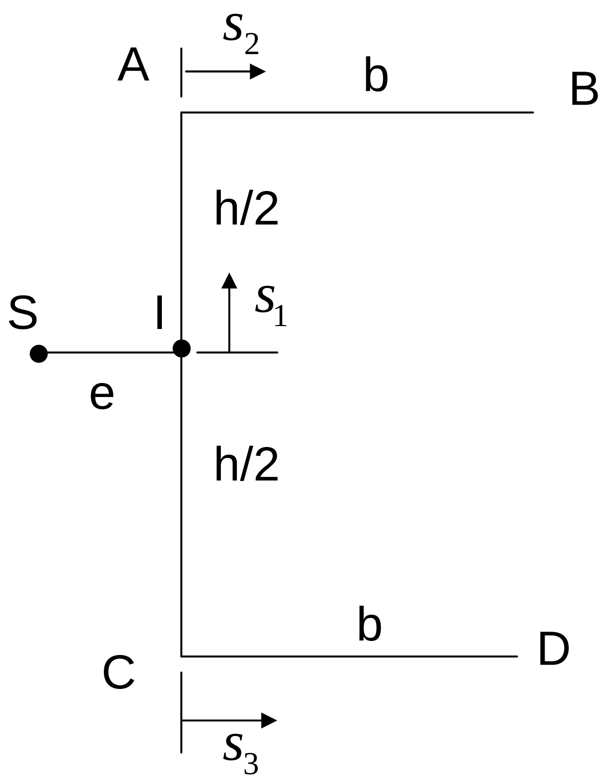
For the C-section shown below, using the initial point I for the integration, determine the distance, e, to the shear center and the constant, ω_0 , using the conditions

$$\int \omega dA = 0$$

$$\int y\omega dA = 0$$

$$\int z\omega dA = 0$$





for AC

$$\omega = \omega_0 + e s_1 \quad \left(-h/2 \le s_1 \le h/2\right)$$

for AB

$$\omega = \omega_0 + eh/2 - hs_2/2 \quad \left(0 \le s_2 \le b\right)$$

for CD

$$\omega = \omega_0 - eh/2 + hs_3/2 \quad \left(0 \le s_3 \le b\right)$$

Set $\int \omega dA = 0$

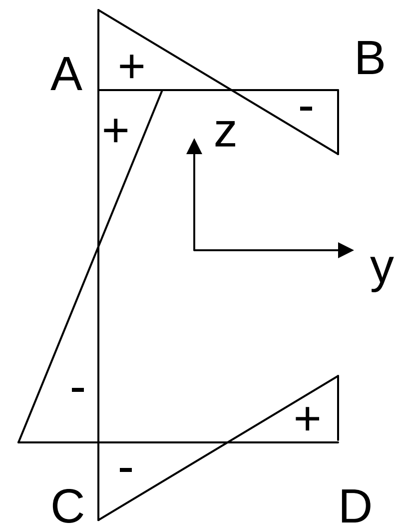
odd

$$t_w \int_{-h/2}^{+h/2} \left(\omega_0 + e s_1\right) ds_1 + t_f \int_0^b \left(\omega_0 + eh/2 - hs_2/2\right) ds_2$$

$$+t_f \int_0^b \left(\omega_0 - eh/2 + hs_3/2\right) ds_3 = 0$$

$$\left(t_w h + 2 t_f b\right)\omega_0 = 0 \quad \Rightarrow \quad \omega_0 = 0$$

With $\omega_0 = 0$ the ω distribution looks like:



By inspection: $\int y\omega dA = 0$

so now consider $\int z\omega dA = 0$

on AC $z = s_1$

on AB $z = h/2$

on CD $z = -h/2$

so we have

$$\int z\omega dA = t_w \int_{-h/2}^{+h/2} e s_1^2 ds_1 + t_f h/2 \int_0^b \left(eh/2 - hs_2/2\right) ds_2$$

$$+t_f\left(-h/2\right)\int_0^b \left(-eh/2 + hs_2/2\right) ds_2 = 0$$

these are the same

$$t_w e \frac{h^3}{12} + 2 \times \left[t_f \frac{h}{2}\left(e\frac{h}{2} b - \frac{h}{2}\frac{b^2}{2}\right)\right] = 0 \quad \Rightarrow \quad e = \frac{3t_f b^2}{ht_w + 6bt_f}$$