



Università degli Studi di Napoli "*Parthenope*"

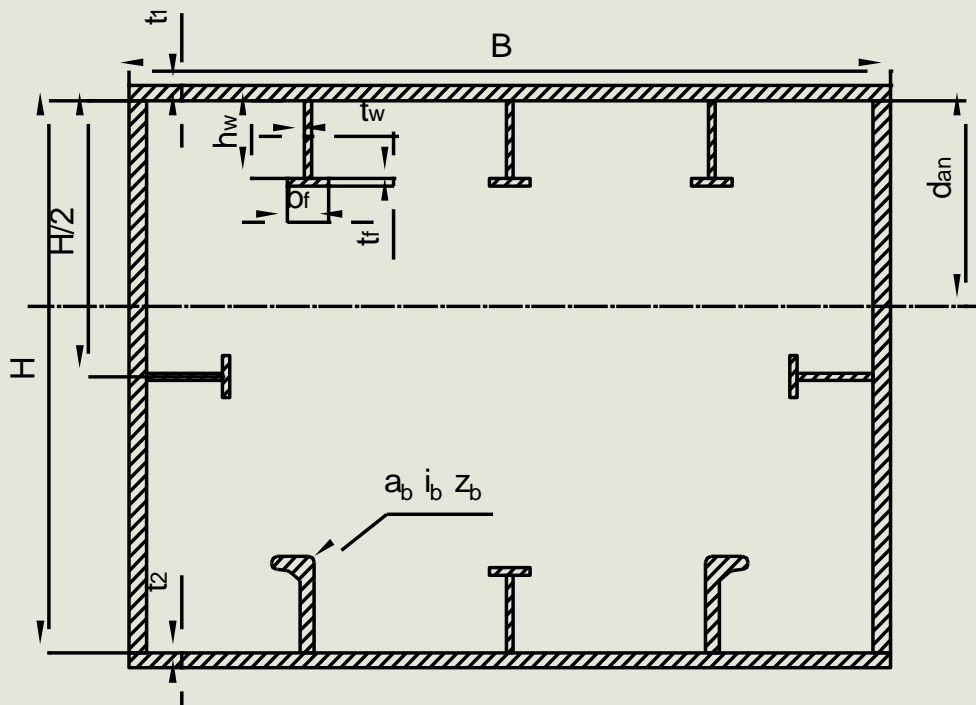
Dipartimento di Scienze e Tecnologie

Tecnologia delle costruzioni ed allestimento navale

Vincenzo Piscopo

Calcolo del modulo di resistenza di profilati navali e sezioni scatolari
composte – Parte II
Lezione 16 (32/48)

2.1 Sezione scatolare composta/1



La posizione dell'asse neutro della sezione scatolare in figura si determina con riferimento ad un sistema di assi cartesiani con origine in corrispondenza del lembo inferiore del fasciame superiore.

$$d_{an} = \frac{Bt_1\left(-\frac{t_1}{2}\right) + Bt_2\left(H + \frac{t_2}{2}\right) + 2Ht\left(\frac{H}{2}\right) + 3h_w t_w \frac{h_w}{2} + 3b_f t_f \left(h_w + \frac{t_f}{2}\right) +}{Bt_1 + Bt_2 + 2Ht + 6h_w t_w + 6b_f t_f + 2a_b}$$

$$+2h_w t_w \frac{H}{2} + 2b_f t_f \frac{H}{2} + 2a_b(H - z_b) + h_w t_w \left(H - \frac{h_w}{2}\right) + b_f t_f \left(H - h_w - \frac{t_f}{2}\right)$$

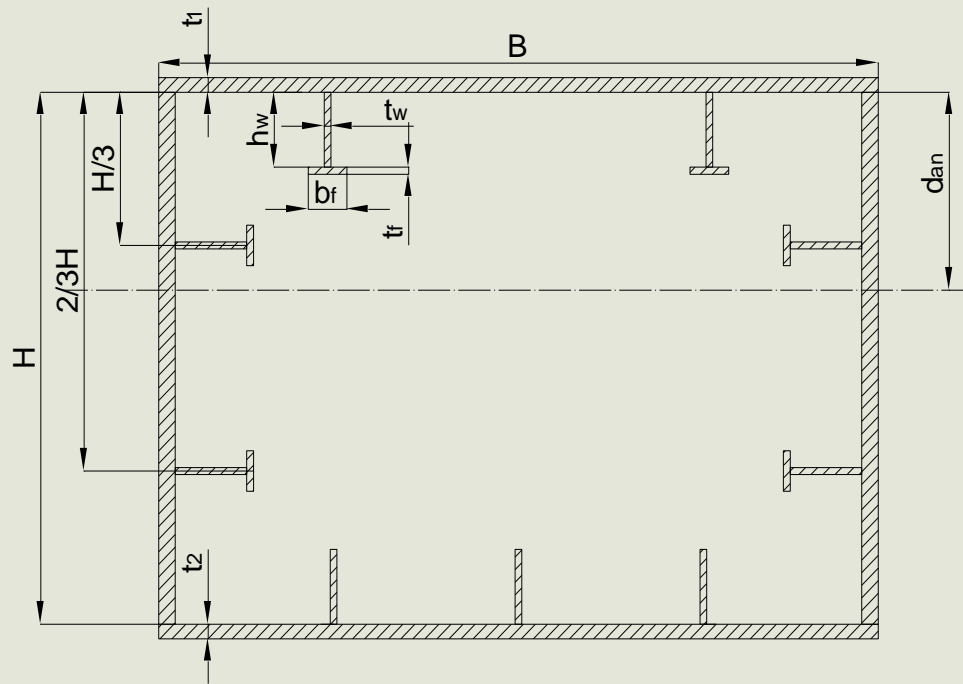
■ ■ ■ ■

$$\begin{aligned}
I_{an} = & \frac{Bt_1^3}{12} + \frac{Bt_2^3}{12} + 2\frac{tH^3}{12} + 4\frac{t_w h_w^3}{12} + 2\frac{h_w t_w^3}{12} + 4\frac{b_f t_f^3}{12} + 2\frac{t_f b_f^3}{12} + 2i_b + Bt_1 \left(d_{an} + \frac{t_1}{2}\right)^2 + \\
& + Bt_2 \left(H + \frac{t_2}{2} - d_{an}\right)^2 + 2Ht \left(\frac{H}{2} - d_{an}\right)^2 + 3h_w t_w \left(d_{an} - \frac{h_w}{2}\right)^2 + 3b_f t_f \left(d_{an} - h_w - \frac{t_f}{2}\right)^2 \\
& + 2h_w t_w \left(\frac{H}{2} - d_{an}\right)^2 + 2b_f t_f \left(\frac{H}{2} - d_{an}\right)^2 + 2a_b (H - z_b - d_{an})^2 + h_w t_w \left(H - \frac{h_w}{2} - d_{an}\right)^2 \\
& + b_f t_f \left(H - h_w - \frac{t_f}{2} - d_{an}\right)^2
\end{aligned}$$

$$W_1 = \frac{I_{an}}{d_{an} + t_1}$$

$$W_2 = \frac{I_{an}}{H - d_{an} + t_2}$$

2.2 Sezione scatolare composta/2



$$W_1 = \frac{I_{an}}{d_{an} + t_1}$$

$$W_2 = \frac{I_{an}}{H - d_{an} + t_2}$$

La posizione dell'asse neutro della sezione scatolare in figura si determina con riferimento ad un sistema di assi cartesiani con origine in corrispondenza del lembo inferiore del fasciame superiore.

$$d_{an} = \frac{Bt_1 \left(-\frac{t_1}{2}\right) + Bt_2 \left(H + \frac{t_2}{2}\right) + 2Ht \left(\frac{H}{2}\right) + 2h_w t_w \frac{h_w}{2} + 2b_f t_f \left(h_w + \frac{t_f}{2}\right) +}{Bt_1 + Bt_2 + 2Ht + 6h_w t_w + 6b_f t_f + 3h_w t_w}$$

$$+ 2h_w t_w \frac{H}{3} + 2b_f t_f \frac{H}{3} + 2h_w t_w \frac{2H}{3} + 2b_f t_f \frac{2H}{3} + 3h_w t_w \left(H - \frac{h_w}{2}\right)$$

...

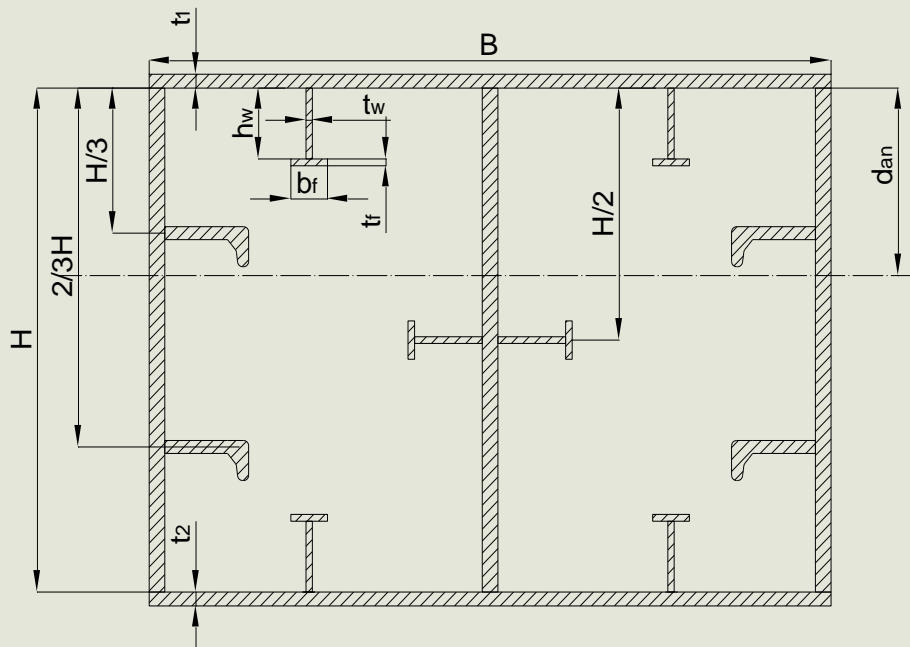
$$I_{an} = \frac{Bt_1^3}{12} + \frac{Bt_2^3}{12} + 2\frac{tH^3}{12} + 2\frac{t_w h_w^3}{12} + 4\frac{h_w t_w^3}{12} + 2\frac{b_f t_f^3}{12} + 4\frac{t_f b_f^3}{12} + 3\frac{t_w h_w^3}{12} + Bt_1 \left(d_{an} + \frac{t_1}{2}\right)^2 +$$

$$+ Bt_2 \left(H + \frac{t_2}{2} - d_{an}\right)^2 + 2Ht \left(\frac{H}{2} - d_{an}\right)^2 + 2h_w t_w \left(d_{an} - \frac{h_w}{2}\right)^2 + 2b_f t_f \left(d_{an} - h_w - \frac{t_f}{2}\right)^2$$

$$+ 2h_w t_w \left(\frac{H}{3} - d_{an}\right)^2 + 2b_f t_f \left(\frac{H}{3} - d_{an}\right)^2 + 2h_w t_w \left(\frac{2H}{3} - d_{an}\right)^2 + 2b_f t_f \left(\frac{2H}{3} - d_{an}\right)^2$$

$$+ 3h_w t_w \left(H - \frac{h_w}{2} - d_{an}\right)^2$$

2.3 Sezione scatolare composta/3



$$W_1 = \frac{I_{an}}{d_{an} + t_1}$$

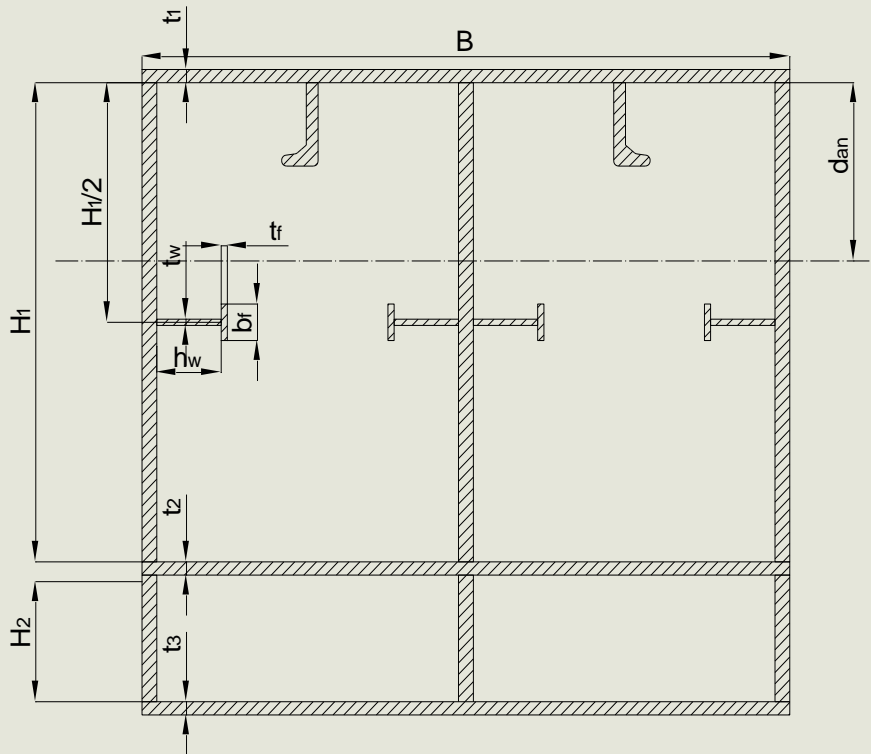
$$W_2 = \frac{I_{an}}{H - d_{an} + t_2}$$

La posizione dell'asse neutro della sezione scatolare in figura si determina con riferimento ad un sistema di assi cartesiani con origine in corrispondenza del lembo inferiore del fasciame superiore.

$$d_{an} = \frac{Bt_1 \left(-\frac{t_1}{2}\right) + Bt_2 \left(H + \frac{t_2}{2}\right) + 3Ht \left(\frac{H}{2}\right) + 2h_w t_w \frac{h_w}{2} + 2b_f t_f \left(h_w + \frac{t_f}{2}\right) + 2h_w t_w \frac{H}{2} + 2b_f t_f \frac{H}{2} + 2h_w t_w \left(H - \frac{h_w}{2}\right) + 2b_f t_f \left(H - h_w - \frac{t_f}{2}\right) + 2a_b \frac{H}{3} + 2a_b \frac{2H}{3}}{Bt_1 + Bt_2 + 3Ht + 6h_w t_w + 6b_f t_f + 4a_b} \dots$$

$$I_{an} = \frac{Bt_1^3}{12} + \frac{Bt_2^3}{12} + 3 \frac{tH^3}{12} + 4 \frac{t_w h_w^3}{12} + 2 \frac{h_w t_w^3}{12} + 4 \frac{b_f t_f^3}{12} + 2 \frac{t_f b_f^3}{12} + Bt_1 \left(d_{an} + \frac{t_1}{2}\right)^2 + Bt_2 \left(H + \frac{t_2}{2} - d_{an}\right)^2 + 3Ht \left(\frac{H}{2} - d_{an}\right)^2 + 2h_w t_w \left(d_{an} - \frac{h_w}{2}\right)^2 + 2b_f t_f \left(d_{an} - h_w - \frac{t_f}{2}\right)^2 + 2h_w t_w \left(\frac{H}{2} - d_{an}\right)^2 + 2b_f t_f \left(\frac{H}{2} - d_{an}\right)^2 + 2a_b \left(\frac{H}{3} - d_{an}\right)^2 + 2a_b \left(\frac{2H}{3} - d_{an}\right)^2 + 2h_w t_w \left(H - \frac{h_w}{2} - d_{an}\right)^2 + 2b_f t_f \left(H - h_w - \frac{t_f}{2} - d_{an}\right)^2$$

2.4 Sezione scatolare composta/4



La posizione dell'asse neutro della sezione scatolare in figura si determina con riferimento ad un sistema di assi cartesiani con origine in corrispondenza del lembo inferiore del fasciame superiore.

$$d_{an} = \frac{Bt_1 \left(-\frac{t_1}{2}\right) + Bt_2 \left(H_1 + \frac{t_2}{2}\right) + Bt_3 \left(H_1 + t_2 + H_2 + \frac{t_3}{2}\right) + 3H_1t \left(\frac{H_1}{2}\right) + 3H_2t \left(H_1 + t_2 + \frac{H_2}{2}\right) + 4h_w t_w \left(\frac{H_1}{2}\right) + 4b_f t_f \left(\frac{H_1}{2}\right) + 2a_b z_b}{Bt_1 + Bt_2 + Bt_3 + 3H_1t + 3H_2t + 4h_w t_w + 4b_f t_f + 2a_b}$$

$$I_{an} = \frac{Bt_1^3}{12} + \frac{Bt_2^3}{12} + \frac{Bt_3^3}{12} + 3\frac{tH_1^3}{12} + 3\frac{tH_2^3}{12} + 4\frac{h_w t_w^3}{12} + 4\frac{t_f b_f^3}{12} + 2i_b + Bt_1 \left(d_{an} + \frac{t_1}{2}\right)^2 + Bt_2 \left(H_1 + \frac{t_2}{2} - d_{an}\right)^2 + Bt_3 \left(H_1 + t_2 + H_2 + \frac{t_3}{2} - d_{an}\right)^2 + 3H_1t \left(\frac{H_1}{2} - d_{an}\right)^2 + 3H_2t \left(H_1 + t_2 + \frac{H_2}{2} - d_{an}\right)^2 + 4h_w t_w \left(\frac{H_1}{2} - d_{an}\right)^2 + 4b_f t_f \left(\frac{H_1}{2} - d_{an}\right)^2 + 2a_b (d_{an} - z_b)^2$$

$$W_1 = \frac{I_{an}}{d_{an} + t_1} \quad W_2 = \frac{I_{an}}{H_1 + t_2 + H_2 + t_3 - d_{an}}$$