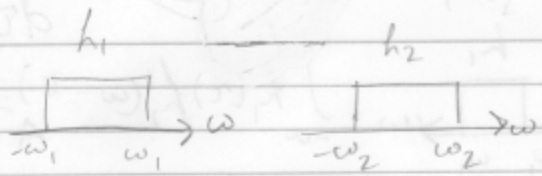
Matthew Borga

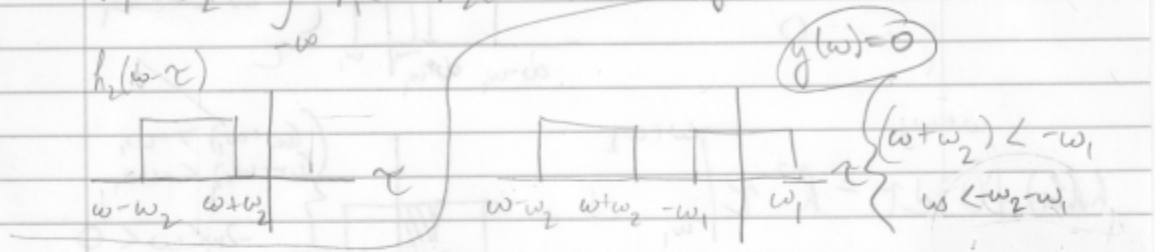
Bonus 6



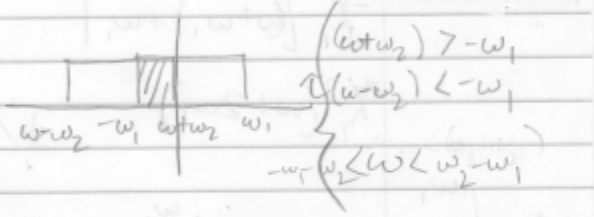
$\omega_2 \neq \omega_1$

$\omega_2 < \omega_1$

$$h_1 * h_2 = \int_{-\infty}^{\infty} h_1(\tau)\, h_2(\omega-\tau)\, d\tau = y(\omega)$$



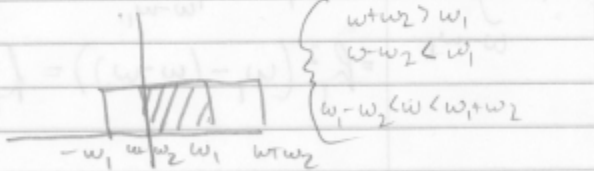
$$h_1 * h_2 = \int_{-\omega_1}^{\omega+\omega_2} (1)\, d\tau = \tau \Big|_{-\omega_1}^{\omega+\omega_2}$$



$$= (\omega+\omega_2) - -\omega_1$$

$$= \omega+\omega_2+\omega_1$$

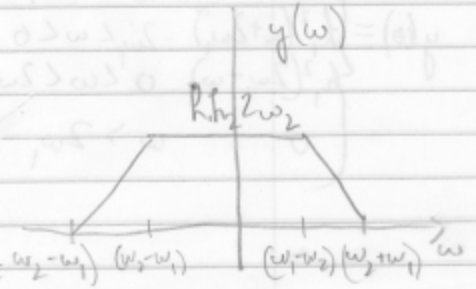
$$h_1 * h_2 = \int_{\omega-\omega_2}^{\omega_1} (1)\, d\tau = \tau \Big|_{\omega-\omega_2}^{\omega_1}$$



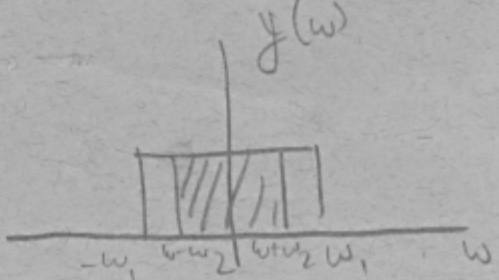
$$= \omega_1 - (\omega-\omega_2)$$

$\omega-\omega_2 > \omega_1$ → 0

$$y(\omega) = \begin{cases} 0 & \omega < -(\omega_1+\omega_2) \\ h_1 * h_2(\omega_2+\omega_1+\omega) & -(\omega_1+\omega_2) < \omega < \omega_2-\omega_1 \\ h_1 * h_2(2\omega_2) & (\omega_2-\omega_1) < \omega < (\omega_1-\omega_2) \\ h_1 * h_2(\omega_1+\omega_2-\omega) & (\omega_1-\omega_2) < \omega < (\omega_1+\omega_2) \\ 0 & \omega > \omega_1+\omega_2 \end{cases}$$



$$h_1 h_2 \int_{w-w_2}^{w+w_2} (1)\, d\tau$$



$$= h_1 h_2 \tau \Big|_{w-w_2}^{w+w_2} = [(w+w_2)-(w-w_2)]\, h_1 h_2$$

$$= h_1 h_2 2w_2$$

$$\begin{cases} w+w_2 < w_1 \\ w-w_2 > -w_1 \\ (w_2-w_1) < w < (w_1-w_2) \end{cases}$$