P3| Análogo a los problemas 1 y 2

$$\frac{\partial \hat{p}}{\partial x} = \frac{-\gamma H}{L}$$

- $$u(y) = \frac{1}{\mu}\frac{\partial \hat{p}}{\partial x}\frac{y^2}{2} + cy + d$$

- bajo la cinta transportadora:

cond. de borde:

- $u(y=0) = 0 \Rightarrow d = 0$
- $u(y=h_1) = -\omega R \Rightarrow -\omega R = \frac{1}{\mu}\frac{\partial \hat{p}}{\partial x}\frac{h_1^2}{2} + c h_1$

$$\Rightarrow c = -\frac{1}{\mu}\frac{\partial \hat{p}}{\partial x}\frac{h_1}{2} - \frac{\omega R}{h_1}$$

$$u(y) = \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x} y^2 - \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x} h_1 y - \frac{\omega R}{h_1} y$$

$$u(y) = \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x} y(y-h_1) - \frac{\omega R}{h_1} y$$

$$q_1 = \int_0^{h_1} u(y)\,dy = \int_0^{h_1}\left[\frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x} y(y-h_1) - \frac{\omega R}{h_1} y\right] dy$$

$$q_1 = \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x}\left(\frac{y^3}{3} - h_1\frac{y^2}{2}\right) \quad \frac{\omega R}{h_1}\frac{y^2}{2}\Bigg|_0^{h_1}$$

$$q_1 = -\frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x}\frac{h_1^3}{6} - \frac{\omega R h_1}{2} = \frac{\gamma H h_1^3}{12\mu L} - \frac{\omega R h_1}{2}$$

- sobre la cinta transportadora:

cond. de borde:

- $u(y=0) = \omega R \Rightarrow d = \omega R$
- $\left.\frac{\partial u}{\partial y}\right|_{y=h_2} = 0$ (superficie libre)

$$\frac{\partial u}{\partial y} = \frac{1}{\mu}\frac{\partial \hat{p}}{\partial x} y + C \Rightarrow 0 = \frac{1}{\mu}\frac{\partial \hat{p}}{\partial x} h_2 + C$$

$$C = -\frac{1}{\mu}\frac{\partial \hat{p}}{\partial x} h_2$$

$$\Rightarrow u(y) = \frac{1}{\mu}\frac{\partial \hat{p}}{\partial x}\frac{y^2}{2} - \frac{1}{\mu}\frac{\partial \hat{p}}{\partial x} h_2 y + \omega R$$

$$= \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x} y(y-2h_2) + \omega R$$

$$q_2 = \int_0^{h_2} u(y)\,dy = \int_0^{h_2}\left[\frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x} y(y-2h_2) + \omega R\right] dy$$

$$= \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x}\left[\frac{y^3}{3} - h_2 y^2\right] + \omega R y \Big|_0^{h_2}$$

$$= \frac{1}{2\mu}\frac{\partial \hat{p}}{\partial x}\left[\frac{h_2^3}{3} - h_2^3\right] + \omega R h_2$$

$$q_2 = -\frac{1}{3\mu}\frac{\partial \hat{p}}{\partial x} h_2^3 + \omega R h_2 = \frac{\gamma H h_2^3}{3\mu L} + \omega R h_2$$

$$q = q_1 + q_2 = \frac{\gamma H h_1^3}{12\mu L} + \frac{\gamma H h_2^3}{3\mu L} - \frac{\omega R h_1}{2} + \omega R h_2$$

$$q = \frac{\gamma H}{\mu L}\left(\frac{h_1^3}{12} + \frac{h_2^3}{3}\right) + \omega R\left(h_2 - \frac{h_1}{2}\right)$$