Treball Gasos

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1 Definició del problema

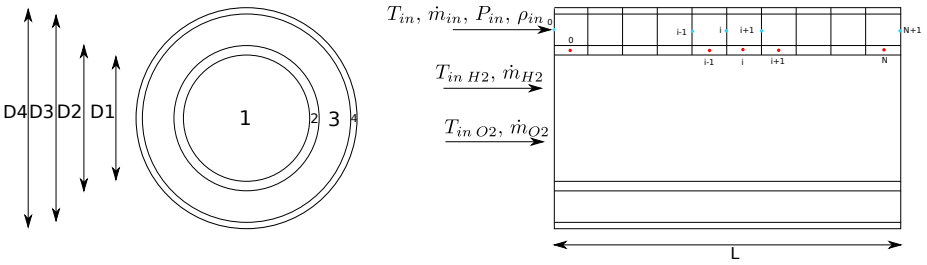

Figure 1: Representació del problema

2 Equacions de discretització

2.1 Fluid zona 3

Massa:

$$\rho_3[i]S_3v[i] = \rho_3[i+1]S_3v[i+1] = \dot{m}_{in} \tag{1}$$

Moment:

$$\begin{aligned} &v_3[i+1]^2\rho_3[i+1]S_3 - v_3[i]^2\rho_3[i]S_3 = p_3[i]S_3 - p_3[i+1]S_3 - \tau_w S_l \\ &= \dot{m}(v_3[i+1] - v_3[i]) = S_3(p_3[i] - p_3[i+1]) - f_i\frac{1}{2}\rho_i v_{3i}^2(S_{2ext} + S_{4int}) \end{aligned} \tag{2}$$

Energia:

$$\begin{aligned} &\dot{m}\left(h[i+1] - h[i] + \frac{v_3[i+1]^2 - v_3[i]^2}{2}\right) = \dot{Q} \\ &\dot{m}c_p(T_3[i+1] - T_3[i]) + \dot{m}\left(\frac{v_3[i+1]^2 - v_3[i]^2}{2}\right) \\ &= \alpha_3[i](T_2[i] - T_{3i}[i])S_{2ext} - \alpha_3[i](T_{3i} - T_4[i])S_{4int} \end{aligned} \tag{3}$$

Equació d'estat:

$$\rho RT = p \tag{4}$$

On:
$S_3 = \frac{D_3^2 - D_2^2}{4}\pi$, $S_{2ext} = D_2\pi\Delta x$, $S_{4int} = D_3\pi\Delta x$, $v_{3i} = \frac{v_3[i+1]+v_3[i]}{2}$, $T_{3i} = \frac{T_3[i+1]+T_3[i]}{2}$, $\rho_{3i} = \frac{\rho_3[i+1]+\rho_3[i]}{2}$

2.2 Tub 2

L'equació de discretització sobre un volum de control i serà:

$$\begin{aligned}
&-\lambda_w \frac{T_2[i] - T_2[i-1]}{\Delta x} S_w + \lambda_e \frac{T_2[i+1] - T_2[i]}{\Delta x} S_e + \\
&+ \alpha_3[i](T_{3i} - T_2[i]) S_{2int} - \alpha_3[i](T_2[i] - T_{3i}) S_{2ext} = 0 \Rightarrow \\
&\Rightarrow T_2[i] \left(\frac{\lambda_w S_w}{\Delta x} + \frac{\lambda_e S_e}{\Delta x} + \alpha_3[i] S_{2int} + \alpha_3[i] S_{2ext} \right) = \\
&= T_2[i-1] \frac{\lambda_w S_w}{\Delta x} + T_2[i+1] \frac{\lambda_e S_e}{\Delta x} + T_{3i}\alpha_3[i] S_{2int} + \alpha_3[i] T_{3i} S_{2ext}
\end{aligned} \tag{5}$$

Que es pot fàcilment reescriure com a una equació del tipus:

$$a_P T_P = a_E T_E + a_W T_W + b_P \tag{6}$$

on: $a_E = \frac{\lambda_e S_e}{\Delta x}$, $a_W = \frac{\lambda_w S_w}{\Delta x}$, $a_P = a_E + a_W + \alpha_3[i] S_{2int} + \alpha_3[i] S_{2ext}$ i

$b_P = T_{3i}\alpha_3[i] S_{2int} + T_{3i}\alpha_3[i] S_{2ext}$, $S_{2int} = \pi D_2 \Delta x$, $S_{2ext} = \pi D_3 \Delta x$