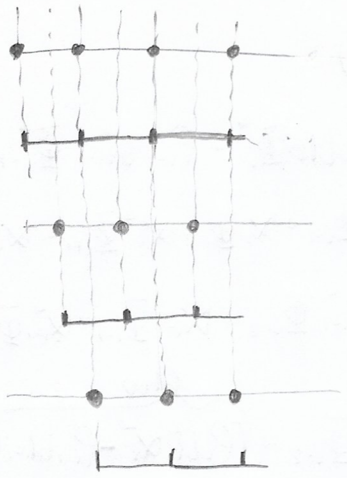
Information sheet



x : x positions

dx scalar cell size

xp $\frac{1}{2}$(x[0:-1] +x[1:]) Scalar nods position.

dxp velocity cell size

xu Velocity nod position.

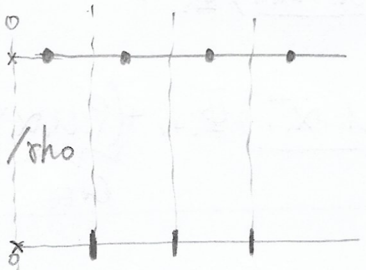
dxu scalar cell size

---

xp

⇓

Gamx/rho

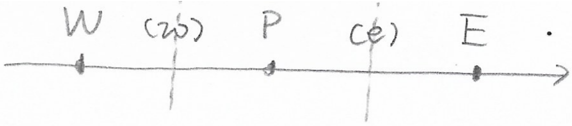


xu

⇓

Gamx_ew/
rho_ew

terme convective : $\frac{d}{dx}(\rho u \Phi) = 0$



$$\int_w^e \frac{d}{dx}(\rho u \bar{\Phi})\, dx = \rho_e u_e \bar{\Phi}_e - \rho_w u_w \bar{\Phi}_w = 0.$$

Schéma Upwind : $\bar{\Phi}_e = \begin{cases} \bar{\Phi}_P & (u_e > 0) \\ \bar{\Phi}_E & (u_e < 0) \end{cases}$ $\quad \bar{\Phi}_w = \begin{cases} \bar{\Phi}_W & (u_w > 0) \\ \bar{\Phi}_P & (u_w < 0) \end{cases}$

* $F_i = \rho_i u_i$ $\qquad$ * $a_P \bar{\Phi}_P = a_E \bar{\Phi}_E + a_W \bar{\Phi}_W + b_P.$

$$\Rightarrow \underbrace{[a_E + a_W + (F_e - F_w)]}_{a_P} \bar{\Phi}_P = \underbrace{\max(F_w, 0)}_{a_E} \bar{\Phi}_E + \underbrace{\max(-F_e, 0)}_{a_W} \bar{\Phi}_W.$$

---

terme diffusive : $\frac{d}{dx}\left(\Gamma \frac{d\Phi}{dx}\right) = 0 \Rightarrow \Gamma_e \left(\frac{d\Phi}{dx}\right)_e - \Gamma_w \left(\frac{d\Phi}{dx}\right)_w = 0$

$$\underbrace{\Gamma_e \frac{1}{\Delta x}}_{D_e}(\bar{\Phi}_E - \bar{\Phi}_P) - \underbrace{\Gamma_w \frac{1}{\Delta x}}_{D_w}(\bar{\Phi}_W - \bar{\Phi}_P) = 0 \qquad \underbrace{(D_w - D_e)}_{a_P} \bar{\Phi}_P = \underbrace{-D_e}_{a_E} \bar{\Phi}_E + \underbrace{D_w}_{a_W} \bar{\Phi}_W$$

Schéma hybride $\quad R = \frac{\rho u \delta x}{\Gamma} = \frac{F}{D}$

$\begin{cases} |R| < 2 & \text{Centré} \\ |R| > 2 & \text{upwind + diffu.} \to 0. \end{cases}$

(* Convective, centrée : $\frac{F_e - F_w}{2} \bar{\Phi}_P = -\frac{F_e}{2} \bar{\Phi}_E + \frac{F_w}{2} \bar{\Phi}_W$)

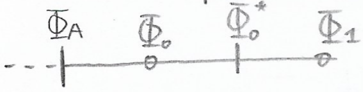
$|R| > 2$ aux limites : (reprends les formules de la partie diffusion)

WEST : $\Delta y \left[\underbrace{\left(-\frac{\Gamma_0}{\Delta x_{P_0}} - \frac{2\Gamma_A}{\Delta x_0} \right)}_{a_P} \bar{\Phi}_0 + \underbrace{\frac{\Gamma_0}{\Delta x_{P_0}}}_{a_E} \bar{\Phi}_1 \right] + \underbrace{\Gamma_A \frac{2\bar{\Phi}_A}{\Delta x_0}}_{-S_A} = 0$

négliger les termes diffusion internes $\Rightarrow$ supprimer les termes avec Γ_0 $\Rightarrow$ $a_P = -\frac{2\Gamma_A}{\delta x_0}$ $\quad a_E = 0$ $\quad S_A = -\Gamma_A \frac{2\bar{\Phi}_A}{\delta x_0}$

Idem pour EST

C.L. upwind



méthode 1

$$(\rho_e u_e \bar\Phi_e^* - \rho_w u_w \bar\Phi_w^*)\big|_{i=0} = \rho_0 u_0(\alpha_0\bar\Phi_0 + \alpha_0^+\bar\Phi_1) - \rho_A u_A \bar\Phi_A$$

$$= \underbrace{(\rho_0 u_0\alpha_0)}_{a_P}\bar\Phi_0 + \underbrace{(\rho_0 u_0\alpha_0^+)}_{a_E\ (\text{inchangé})}\bar\Phi_1 \underbrace{-\rho_A u_A\bar\Phi_A}_{-S_A}$$

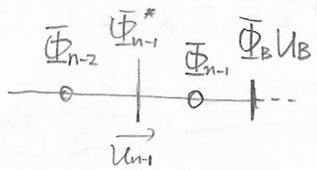
Method 2 $$(\rho_e u_e \bar\Phi_e^* - \rho_w u_w \bar\Phi_w^*)\big|_{i=0} = \rho_0 u_0(\alpha_0\bar\Phi_0 + \alpha_0^+\bar\Phi_1) - \rho_A u_A(\alpha_A\bar\Phi_A + \alpha_A^+\bar\Phi_0)$$

$$= \underbrace{(\rho_0u_0\alpha_0 - \rho_Au_A\alpha_A^+)}_{a_P}\bar\Phi_0 + \underbrace{\rho_0u_0\alpha_0^+}_{a_E\ (\text{inchangé})}\bar\Phi_1 \underbrace{-\rho_Au_A\alpha_A\bar\Phi_A}_{-S_A}$$

* En Générale: $$\rho_e u_e\bar\Phi_e - \rho_w u_w\bar\Phi_w\big|_i = \rho_i u_i(\alpha_i\bar\Phi_i + \alpha_i^+\bar\Phi_{i+1}) - \rho_{i-1}u_{i-1}(\alpha_{i-1}\bar\Phi_{i-1} + \alpha_{i-1}^+\bar\Phi_i)$$
$((\underline{AA}\cdot\underline{\Phi})_i)$

$$= \underbrace{\rho_{i-1}u_{i-1}\alpha_{i-1}}_{a_W}\bar\Phi_{i-1} + \underbrace{(\rho_iu_i\alpha_i - \rho_{i-1}u_{i-1}\alpha_{i-1}^+)}_{a_P}\bar\Phi_i + \underbrace{\rho_iu_i\alpha_i^+}_{a_E}\bar\Phi_{i+1}$$

$$\boxed{\alpha_i = (u_i > 0) \quad \alpha_i^+ = (u_i < 0)}$$



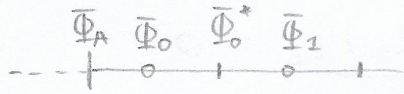
$$(\rho_e u_e\bar\Phi_e^* - \rho_w u_w\bar\Phi_w^*)\big|_{i=n-1} \underset{\substack{\uparrow \\ \text{method 1}}}{=} \rho_B u_B\bar\Phi_B - \rho_{n-1}u_{n-1}(\alpha_{n-1}\bar\Phi_{n-2} + \alpha_{n-1}^+\bar\Phi_{n-1})$$

$$= \underbrace{-\rho_{n-1}u_{n-1}\alpha_{n-1}}_{a_W}\cdot\bar\Phi_{n-2} \underbrace{-\rho_{n-1}u_{n-1}\alpha_{n-1}^+}_{a_P}\bar\Phi_{n-1} + \underbrace{\rho_Bu_B\bar\Phi_B}_{-S_B}$$

method2: $$(\rho_e u_e\bar\Phi_e^* - \rho_w u_w\bar\Phi_w^*)\big|_{i=n-1} = \rho_Bu_B(\alpha_B\bar\Phi_{n-1} + \alpha_B^+\bar\Phi_B) - \rho_{n-1}u_{n-1}(\alpha_{n-1}\bar\Phi_{n-2} + \alpha_{n-1}^+\bar\Phi_{n-1})$$

$$= \underbrace{-\rho_{n-1}u_{n-1}\alpha_{n-1}}_{a_W}\bar\Phi_{n-2} + \underbrace{(\rho_Bu_B\alpha_B - \rho_{n-1}u_{n-1}\alpha_{n-1}^+)}_{a_P}\bar\Phi_{n-1} + \underbrace{\rho_Bu_B\alpha_B^+\bar\Phi_B}_{-S_B}$$

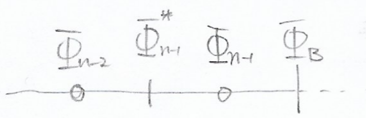
C.L. diffusive



$$\Delta y\left(\Gamma_e\frac{d\Phi}{dx}\Big|_e - \Gamma_w\frac{d\Phi}{dx}\Big|_w\right) = 0$$

$$= \Delta y\left(\Gamma_0\frac{\bar\Phi_1 - \bar\Phi_0}{\Delta x_{p_0}} - \Gamma_A\frac{\bar\Phi_0 - \bar\Phi_A}{\Delta x_0/2}\right)$$

$$= \Delta y\Big[\underbrace{\left(-\frac{\Gamma_0}{\Delta x_{p_0}} - \frac{2\Gamma_A}{\Delta x_0}\right)}_{a_P}\bar\Phi_0 + \underbrace{\frac{\Gamma_0}{\Delta x_{p_0}}}_{a_E}\bar\Phi_1\Big] + \underbrace{\Gamma_A\frac{2\bar\Phi_A}{\Delta x_0}}_{-S_A}$$



$$\Delta y\left(\Gamma_e\left(\frac{d\Phi}{dx}\right)\Big|_e - \Gamma_w\frac{d\Phi}{dx}\Big|_w\right) = \Delta y\left(\Gamma_B\frac{\bar\Phi_{n-1} - \bar\Phi_B}{\Delta x_{n-1}/2} - \Gamma_{n-1}\frac{\bar\Phi_{n-2} - \bar\Phi_{n-1}}{\Delta x_{p_{n-1}}}\right)$$

$$= \Delta y\Big[\underbrace{\left(-\frac{\Gamma_{n-1}}{\Delta x_{p_{n-1}}}\right)}_{a_W}\bar\Phi_{n-2} + \underbrace{\left(\frac{2\Gamma_B}{\Delta x_{n-1}} + \frac{\Gamma_{n-1}}{\Delta x_{p_{n-1}}}\right)}_{a_P}\bar\Phi_{n-1} \underbrace{-\frac{2\Gamma_B}{\Delta x_{n-1}}\bar\Phi_B}_{-S_B}\Big]$$

Condition aux limites Quick :

$$\underline{\underline{Int}} = (\alpha_i) \quad \begin{array}{cccc} W & P & E & EE \\ \end{array}$$

$$\begin{bmatrix} \alpha_i & \alpha_i^+ & \alpha_i^{++} & & \\ \alpha_i^- & \ddots & \ddots & \ddots & \\ & \ddots & \ddots & \ddots & \alpha_i^{++} \\ & & \alpha_i^- & \alpha_i & \alpha_i^+ \end{bmatrix}$$

$$\alpha_i^- = \left(-\frac{1}{8}\right)\times(u_e>0)$$

$$\alpha_i = \frac{3}{8} + \left(\frac{3}{8}\right)\times(u_e>0)$$

$$\alpha_i^+ = \frac{3}{8} + \left(\frac{3}{8}\right)\times(u_e<0)$$

$$\alpha_i^{++} = \left(-\frac{1}{8}\right)\times(u_e<0)$$

	W	P	E	EE
indice	i-1	i	i+1	i+2
$u_e>0$	$-\frac{1}{8}$	$\frac{6}{8}$	$\frac{3}{8}$	
$u_e<0$		$\frac{3}{8}$	$\frac{6}{8}$	$-\frac{1}{8}$

$*$ (Général)

$$\underline{\underline{AA}}\,\bar{\Phi}_i = \rho_i u_i \bar{\Phi}_i^* - \rho_{i-1} u_{i-1} \bar{\Phi}_{i-1}^*$$

$$= \rho_i u_i \left(\alpha_i^- \bar{\Phi}_{i-1} + \alpha_i \bar{\Phi}_i + \alpha_i^+ \bar{\Phi}_{i+1} + \alpha_i^{++} \bar{\Phi}_{i+2}\right)$$

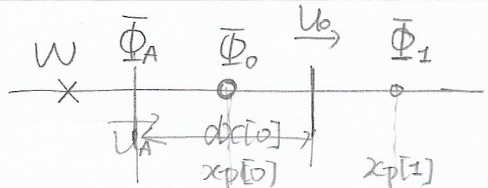
$$- \rho_{i-1} u_{i-1} \left(\alpha_{i-1}^- \bar{\Phi}_{i-2} + \alpha_{i-1} \bar{\Phi}_{i-1} + \alpha_{i-1}^+ \bar{\Phi}_i + \alpha_{i-1}^{++} \bar{\Phi}_{i+1}\right)$$

$$= \overbrace{\left(\rho_{i-1} u_{i-1} \alpha_{i-1}^-\right)}^{a_{WW}} \bar{\Phi}_{i-2} + \overbrace{\left(\rho_i u_i \alpha_i^- - \rho_{i-1} u_{i-1} \alpha_{i-1}\right)}^{a_W} \bar{\Phi}_{i-1}$$

$$+ \underbrace{\left(\rho_i u_i \alpha_i - \rho_{i-1} u_{i-1} \alpha_{i-1}^+\right)}_{a_P} \bar{\Phi}_i$$

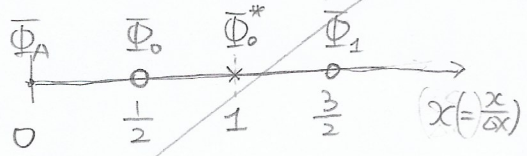
$$+ \underbrace{\left(\rho_i u_i \alpha_i^+ - \rho_{i-1} u_{i-1} \alpha_{i-1}^{++}\right)}_{a_E} \bar{\Phi}_{i+1} + \underbrace{\left(\rho_i u_i \alpha_i^{++}\right)}_{a_{EE}} \bar{\Phi}_{i+2}$$

C.L (Est)



$$\underline{\underline{AA}}\,\bar{\Phi}\Big|_{i=0} = \rho_0 u_0 \bar{\Phi}_0^* - \rho_A u_A \bar{\Phi}_A \quad ; \quad \bar{\Phi}_0^* = \begin{cases} u_e<0 & \frac{3}{8}\bar{\Phi}_0 + \frac{6}{8}\bar{\Phi}_1 - \frac{1}{8}\bar{\Phi}_2 \quad ✓ \\ u_e>0 & -\frac{1}{8}\bar{\Phi}_{-1} + \frac{6}{8}\bar{\Phi}_0 + \frac{3}{8}\bar{\Phi}_1 \quad \times \end{cases}$$

(2) $u_e>0 \Rightarrow$ Interpolation :



$$\bar{\Phi}(x) = \frac{(x-\frac{1}{2})(x-\frac{3}{2})}{(0-\frac{1}{2})(0-\frac{3}{2})}\bar{\Phi}_A + \frac{(x-0)(x-\frac{3}{2})}{(\frac{1}{2}-0)(\frac{1}{2}-\frac{3}{2})}\bar{\Phi}_0 + \frac{(x-0)(x-\frac{1}{2})}{(\frac{3}{2}-0)(\frac{3}{2}-\frac{1}{2})}\bar{\Phi}_1$$

$$\Rightarrow \bar{\Phi}_0^* = \bar{\Phi}(x=1) = -\frac{1}{3}\bar{\Phi}_A + \bar{\Phi}_0 + \frac{1}{3}\bar{\Phi}_1$$

$$\Rightarrow \underline{\underline{AA}}\,\bar{\Phi}\Big|_{\substack{i=0\\u_e>0}} = \rho_0 u_0 \left(-\frac{1}{3}\bar{\Phi}_A + \bar{\Phi}_0 + \frac{1}{3}\bar{\Phi}_1\right) - \rho_A u_A \bar{\Phi}_A$$

$$= \underbrace{\rho_0 u_0}_{a_P^*} \bar{\Phi}_0 + \underbrace{\frac{1}{3}\rho_0 u_0}_{a_E^*} \bar{\Phi}_1 \underbrace{- \left(\frac{1}{3}\rho_0 u_0 + \rho_A u_A\right)\bar{\Phi}_A}_{-S_A^*}$$

$*$ observ.
a_{EE}^* inchangé.

$u_e<0$:

$$\underline{\underline{AA}}\,\bar{\Phi}\Big|_{\substack{i=0\\u_e<0}} = \rho_0 u_0 \left(\frac{3}{8}\bar{\Phi}_0 + \frac{6}{8}\bar{\Phi}_1 - \frac{1}{8}\bar{\Phi}_2\right) - \rho_A u_A \bar{\Phi}_A$$

$$= \underbrace{\frac{3}{8}\rho_0 u_0}_{a_P^*} \bar{\Phi}_0 + \underbrace{\frac{6}{8}\rho_0 u_0}_{a_E^*} \bar{\Phi}_1 \underbrace{- \frac{1}{8}\rho_0 u_0}_{a_{EE}^*} \bar{\Phi}_2 \underbrace{- \rho_A u_A \bar{\Phi}_A}_{-S_A^*}$$

$\underline{AA}\,\overline{\Phi}\big|_{i=0} = \rho_0 U_0 \overline{\Phi}_0^* - \rho_A U_A \overline{\Phi}_A \quad ; \quad \overline{\Phi}_0^* = -\frac{1}{8}\overline{\Phi}_{-1} + \frac{6}{8}\overline{\Phi}_0 + \frac{3}{8}\overline{\Phi}_1 \quad (U_e > 0)$

$* \ \overline{\Phi}_{-1} = ?$ $\quad \overline{\Phi}_{-1} \ \overline{\Phi}_A \ \overline{\Phi}_0 \quad \overline{\Phi}_A = \frac{\overline{\Phi}_{-1} + \overline{\Phi}_0}{2} \Rightarrow \boxed{\overline{\Phi}_{-1} = 2\overline{\Phi}_A - \overline{\Phi}_0}$

① $U_0 > 0$ $\quad \underline{AA}\,\overline{\Phi}\big|_{i=0} = \rho_0 U_0 \left[-\frac{1}{8}(2\overline{\Phi}_A - \overline{\Phi}_0) + \frac{6}{8}\overline{\Phi}_0 + \frac{3}{8}\overline{\Phi}_1 \right] - \rho_A U_A \overline{\Phi}_A$

$$= \underbrace{\frac{7}{8}\rho_0 U_0}_{a_P} \overline{\Phi}_0 + \underbrace{\frac{3}{8}\rho_0 U_0}_{a_E} \overline{\Phi}_1 \underbrace{- \left(\frac{\rho_0 U_0}{4} + \rho_A U_A \right) \overline{\Phi}_A}_{-S_A}$$

② $U_0 < 0$ $\quad \underline{AA}\,\overline{\Phi}\big|_i = \rho_0 U_0 \left(\frac{3}{8}\overline{\Phi}_0 + \frac{6}{8}\overline{\Phi}_1 - \frac{1}{8}\overline{\Phi}_2 \right) - \rho_A U_A \overline{\Phi}_A$

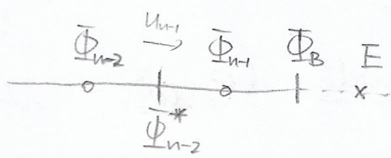
$$= \underbrace{\frac{3}{8}\rho_0 U_0}_{a_P^*} \overline{\Phi}_0 + \underbrace{\frac{6}{8}\rho_0 U_0}_{a_E^*} \overline{\Phi}_1 \underbrace{- \frac{1}{8}\rho_0 U_0}_{a_{EE}^*} \overline{\Phi}_2 \underbrace{- \rho_A U_A \overline{\Phi}_A}_{-S_A}$$

$\underline{AA}\,\overline{\Phi}\big|_{i=1} = \rho_1 U_1 \overline{\Phi}_1^* - \rho_0 U_0 \overline{\Phi}_0^* \quad \left(* \ U_0 > 0 \quad \overline{\Phi}_0^* = \left(-\frac{1}{4}\overline{\Phi}_A + \frac{7}{8}\overline{\Phi}_0 + \frac{3}{8}\overline{\Phi}_1 \right) \right)$

$$= \rho_1 U_1 \left(\alpha_1^- \overline{\Phi}_0 + \alpha_1 \overline{\Phi}_1 + \alpha_1^+ \overline{\Phi}_2 + \alpha_1^{++} \overline{\Phi}_3 \right) - \rho_0 U_0 \left(-\frac{1}{4}\overline{\Phi}_A + \frac{7}{8}\overline{\Phi}_0 + \frac{3}{8}\overline{\Phi}_1 \right)$$

$$= \underbrace{\left(\rho_1 U_1 \alpha_1^- - \frac{7}{8}\rho_0 U_0 \right)}_{a_W} \overline{\Phi}_0 + \underbrace{\left(\rho_1 U_1 \alpha_1 - \frac{3}{8}\rho_0 U_0 \right) \overline{\Phi}_1 + (xx)\overline{\Phi}_2 + (xx)\overline{\Phi}_3}_{\text{inchangé}} \underbrace{+ \frac{\rho_0 U_0}{4}\overline{\Phi}_A}_{-S_1}$$

$* \ U_0 < 0$: inchangé. $\Rightarrow a_W = \rho_1 U_1 \alpha_1^- - \rho_0 U_0 \alpha_0 = \rho_1 U_1 \alpha_1^- - \rho_0 U_0 \frac{8}{3}$



$\underline{AA}\,\overline{\Phi}\big|_{i=-1} = \rho_B U_B \overline{\Phi}_B - \rho_{n-1} U_{n-1} \overline{\Phi}_{n-2}^*$

$\overline{\Phi}_{n-1}^* = \left(\alpha_{n-1}^- \overline{\Phi}_{n-3} + \alpha_{n-1} \overline{\Phi}_{n-2} + \alpha_{n-1}^+ \overline{\Phi}_{n-1} + \alpha^{++} \overline{\Phi}_n \right)$

$U_{n-1} > 0 \Rightarrow$ ok $\qquad U_{n-1} < 0 \quad \overline{\Phi}_n ? \Rightarrow \overline{\Phi}_n = \overline{\Phi}_E = 2\overline{\Phi}_B - \overline{\Phi}_{n-1}$

① $U_{n-1} < 0$: $\rho_B U_B \overline{\Phi}_B - \rho_{n-1} U_{n-1} \left[\frac{3}{8}\overline{\Phi}_{n-2} + \frac{6}{8}\overline{\Phi}_{n-1} - \frac{1}{8}(2\overline{\Phi}_B - \overline{\Phi}_{n-1}) \right] = 0$

$$\underbrace{- \rho_{n-1} U_{n-1} \times \frac{3}{8}}_{a_W} \overline{\Phi}_{n-2} \underbrace{- \rho_{n-1} U_{n-1} \frac{7}{8}}_{a_P} \overline{\Phi}_{n-1} + \underbrace{\left(\rho_B U_B + \frac{1}{4}\rho_{n-1} U_{n-1} \right) \overline{\Phi}_B}_{-S_B} = 0$$

② $U_{n-1} > 0$ $\quad \rho_B U_B \overline{\Phi}_B - \rho_{n-1} U_{n-1} \left(-\frac{1}{8}\overline{\Phi}_{n-3} + \frac{6}{8}\overline{\Phi}_{n-2} + \frac{3}{8}\overline{\Phi}_{n-1} \right) = 0$

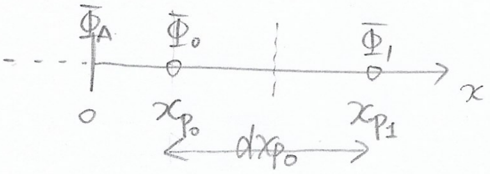
$$\underbrace{+ \frac{1}{8}\rho_{n-1} U_{n-1}}_{a_{WW}} \overline{\Phi}_{n-3} \underbrace{- \frac{6}{8}\rho_{n-1} U_{n-1}}_{a_W} \overline{\Phi}_{n-2} \underbrace{- \frac{3}{8}\rho_{n-1} U_{n-1}}_{a_P} \overline{\Phi}_{n-1} + \underbrace{\rho_B U_B \overline{\Phi}_B}_{-S_B} = 0$$

$\underline{AA}\,\overline{\Phi}\big|_{i=-2}$ (inchangé quand $U_{n-2} > 0$)

$* \ U_{n-2} < 0$: a_E vais changer : $a_E = \rho_{n-1} U_{n-1} \frac{7}{8} - \rho_{n-2} U_{n-2} \alpha_{n-2}^{++} \qquad S_{-2} = \frac{\rho_{-1} U_{-1}}{4} \overline{\Phi}_B$

$* \ U_{n-2} > 0$ (inchangé) $a_E = \rho_{n-1} U_{n-1} \frac{3}{8} - \rho_{n-2} U_{n-2} \alpha_{n-2}^{++}$

diffusion pour Quick (interpolation 3 pts)



$$\bar{\Phi}(x) = \bar{\Phi}_A \frac{(x-x_{P_0})(x-x_{P_1})}{x_{P_0}\,x_{P_1}} + \bar{\Phi}_0 \frac{x(x-x_{P_1})}{-x_{P_0}(x_{P_0}-x_{P_1})} + \bar{\Phi}_1 \frac{x(x-x_{P_0})}{x_{P_1}(x_{P_1}-x_{P_0})} \qquad (dx_{P_0} = x_{P_1}-x_{P_0})$$

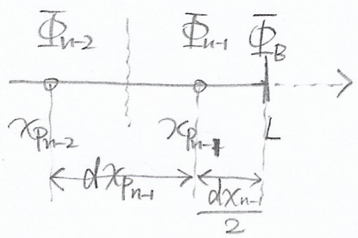
$$\Rightarrow \bar{\Phi}'(x) = \frac{\bar{\Phi}_A}{x_{P_0}x_{P_1}}\left(2x-(x_{P_0}+x_{P_1})\right) - \frac{\bar{\Phi}_0}{x_{P_0}\,dx_{P_0}}(2x-x_{P_1}) + \frac{\bar{\Phi}_1\,(2x-x_{P_0})}{x_{P_1}\,dx_{P_0}}$$

$$\bar{\Phi}'(x=0) = \left.\frac{d\bar{\Phi}}{dx}\right|_A = -\bar{\Phi}_A \frac{(x_{P_0}+x_{P_1})}{x_{P_0}x_{P_1}} + \frac{x_{P_1}}{x_{P_0}}\frac{\bar{\Phi}_0}{dx_{P_0}} - \frac{x_{P_0}}{x_{P_1}}\frac{\bar{\Phi}_1}{dx_{P_0}}$$

diffusion : $\left.\Gamma_e \bar{\Phi}'_e - \Gamma_w \bar{\Phi}'_w\right|_{i=0} = \Gamma_0 \dfrac{\bar{\Phi}_1-\bar{\Phi}_0}{dx_{P_0}} - \Gamma_A\left[-\bar{\Phi}_A \dfrac{x_{P_0}+x_{P_1}}{x_{P_0}+x_{P_1}} + \dfrac{x_{P_1}}{x_{P_0}}\dfrac{\bar{\Phi}_0}{dx_{P_0}} - \dfrac{x_{P_0}}{x_{P_1}}\dfrac{\bar{\Phi}_1}{dx_{P_0}}\right]$

$$= \underbrace{\left(-\frac{\Gamma_A}{dx_{P_0}}\frac{x_{P_1}}{x_{P_0}} - \frac{\Gamma_0}{dx_{P_0}}\right)}_{a_P}\bar{\Phi}_0 + \underbrace{\left(\frac{x_{P_0}}{x_{P_1}}\frac{\Gamma_A}{dx_{P_0}} + \frac{\Gamma_0}{dx_{P_0}}\right)}_{a_E}\bar{\Phi}_1 + \underbrace{\Gamma_A \frac{x_{P_0}+x_{P_1}}{x_{P_1}\cdot x_{P_0}}\bar{\Phi}_A}_{-S_A}$$

Idem (Est)



$$\bar{\Phi}'_B = \bar{\Phi}_{n-2}\frac{dx_{n-1}/2}{dx_{P_{n-1}}(dx_{P_{n-1}}+dx_{n-1}/2)} - \frac{dx_{P_{n-1}}+\frac{dx_{n-1}}{2}}{dx_{P_{n-1}}\times\frac{dx_{n-1}}{2}}\bar{\Phi}_{n-1} + \frac{dx_{P_{n-1}}+dx_{n-1}}{\frac{dx_{n-1}}{2}\left(dx_{P_{n-1}}+\frac{dx_{n-1}}{2}\right)}\bar{\Phi}_B$$

diffusion : $\Gamma_B \bar{\Phi}'_B - \Gamma_{n-1}\dfrac{\bar{\Phi}_{n-1}-\bar{\Phi}_{n-2}}{dx_{P_{n-1}}}$

$$= \left(\Gamma_B \frac{dx_{n-2}/2}{dx_{P_{n-1}}(dx_{P_{n-1}}+dx_{n-1}/2)} + \frac{\Gamma_{n-1}}{dx_{P_{n-1}}}\right)\bar{\Phi}_{n-2} - \left(\Gamma_B\frac{dx_{P_{n-1}}+\frac{dx_{n-1}}{2}}{dx_{P_{n-1}} * \frac{dx_{n-1}}{2}} + \frac{\Gamma_{n-1}}{dx_{P_{n-1}}}\right)\bar{\Phi}_{n-1}$$

$$+\Gamma_B\frac{dx_{P_{n-1}}+dx_{n-1}}{\frac{dx_{n-1}}{2}\left(dx_{P_{n-1}}+\frac{dx_{n-1}}{2}\right)}\bar{\Phi}_B$$