Lezione 21/4/2020

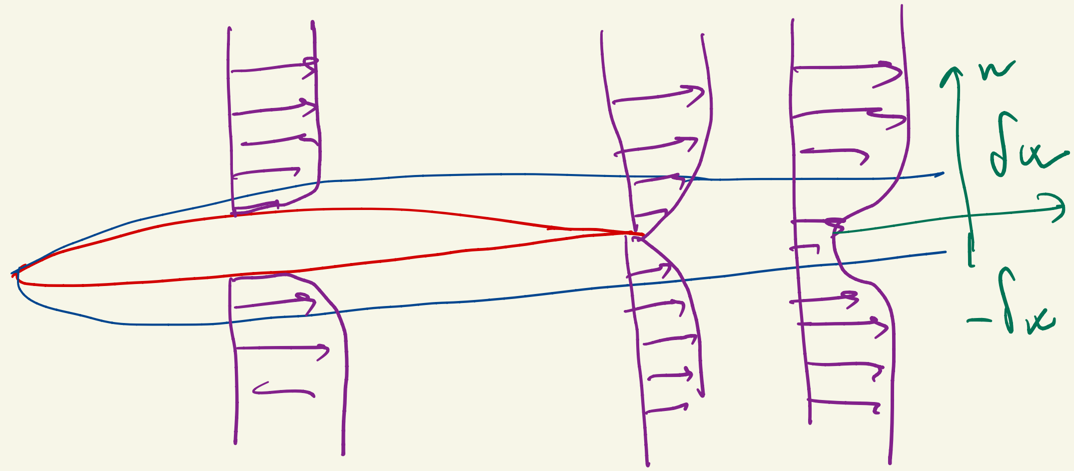
(Meet Streaming)

La Lezione inizia @ 14:20

La Lezione verra' video-registrata !!

$$v_* = -\nabla_* \int_{\partial B} U_\infty \cdot n \, g \, dS - \nabla_* \times \oint_{\partial B} n \times v \, g \, dS$$

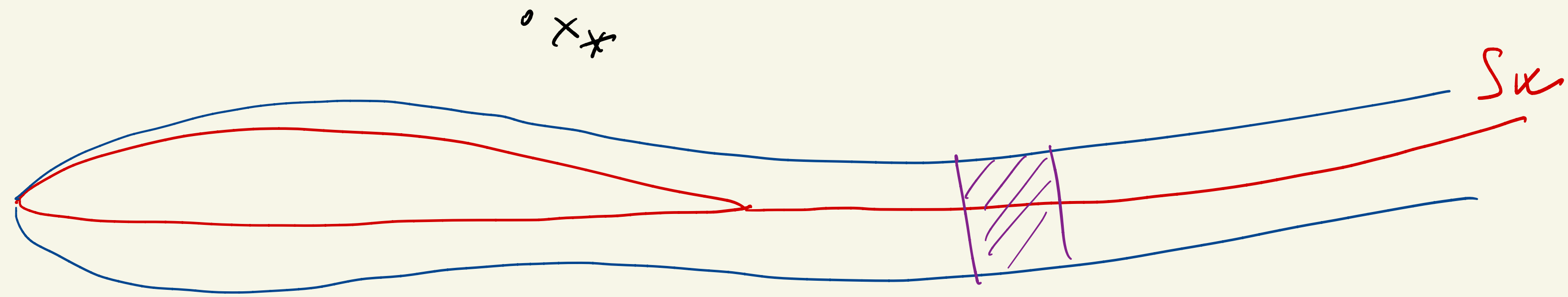
$$- \nabla_* \times \int_{D_w} \zeta_w \, g \, dV$$

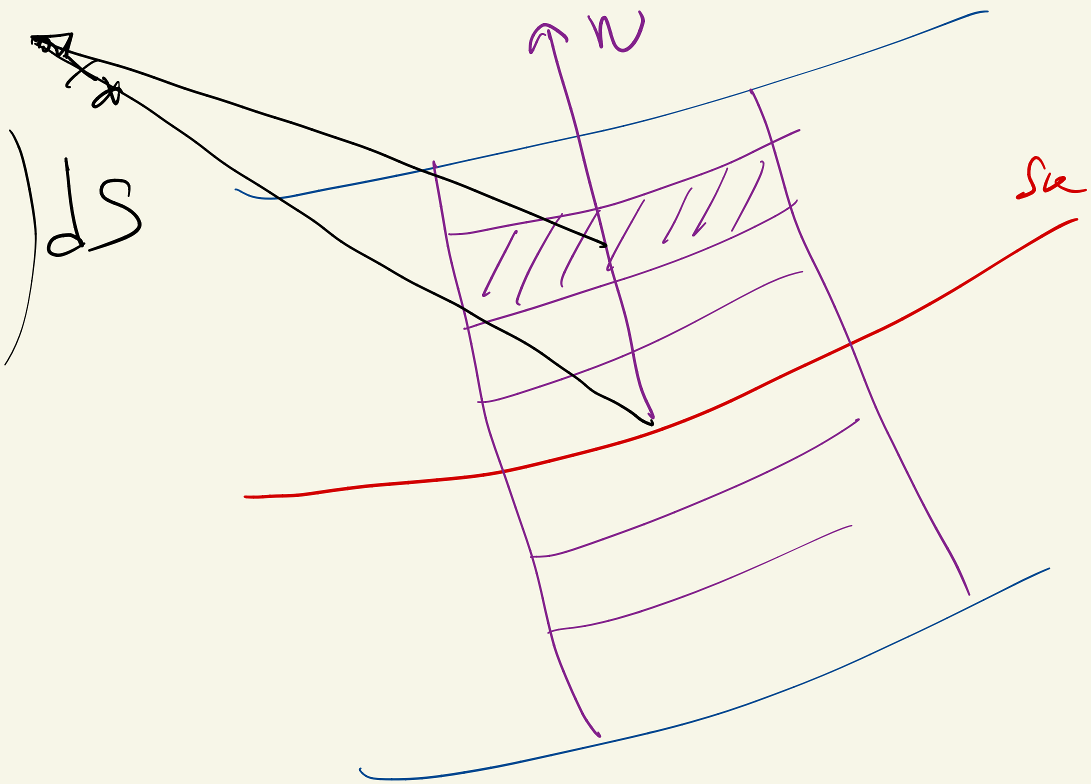


$2\delta_w$ $\quad -\delta_w \leq n \leq \delta_w$ $\quad \lim_{Re \to \infty} \delta_w \to 0$

$\nabla = n \frac{\partial}{\partial n} + \nabla_\pi$ $\quad U = U_n n + U_\pi$ $\quad \nabla \times U \simeq - - -$

$$\nabla \times u \simeq \hat{n} \times \frac{\partial u_\pi}{\partial n} + O(1/\sqrt{Re})$$





$$\int_{D_n} \zeta_w\, g\, dV = \int_{S_w} g \left(\int_{-\delta_w}^{\delta_w} \zeta_\pi \, dn \right) dS$$

$$= \int_{S_w} g \;\hat{n} \times [v]\, dS$$

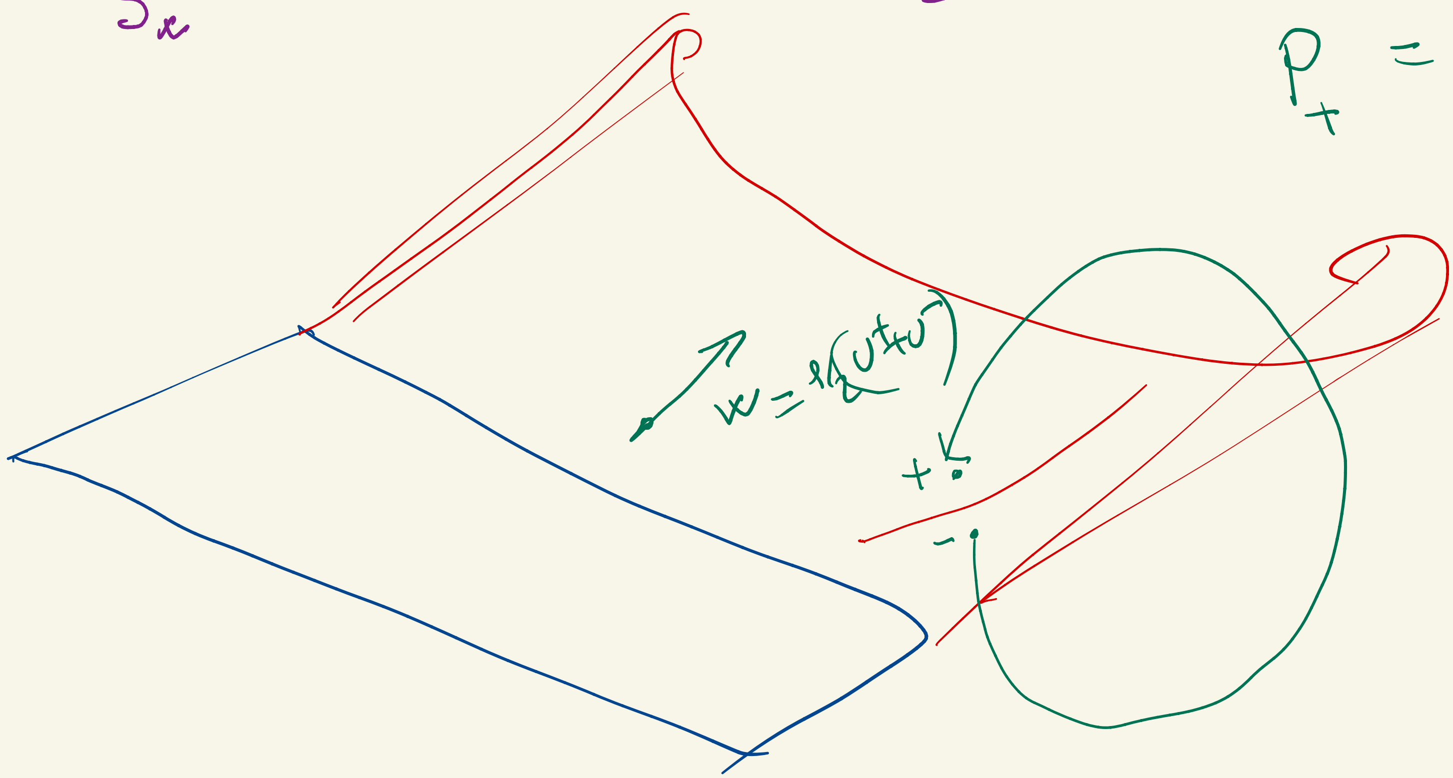
$$V_x = -\nabla_x \int_{\partial B} U_\infty \cdot n \, g \, dS - \nabla_x \times \oint_{\partial B} n \times V \, g \, dS$$

$$-\nabla_x \times \int_{S_x} n \times \underbrace{[V]}_{[U]} \, g \, dS$$

$U = V + U_\infty \longrightarrow$

$[U] = [V]$

$p_+ = p_-$



$$(\rho v_n)^+ = (\rho v_n)^- \rightarrow \rho_0 = \text{cst} \quad v_n^+ = v_n^- = w_n \quad \boxed{v_n^+ = v_n^-}$$

$$(\rho v_n v + p\hat{n})^+ = (\rho v_n v + p\hat{n})^- \qquad \rho = \rho_0$$

$$[\rho_0 v_n] = 0 \qquad \dot{m} = \rho_0 v_n$$

$[v_n], [p] = 0 \rightarrow \dot{m} = 0$

$\dot{m} \neq 0$, $\dot{m} = 0$

$$(\dot{m} v + p\hat{n})^+ = (\dot{m} v + p\hat{n})^-$$

$$\dot{m}[v] + [p]\hat{n} = 0$$

$$\begin{cases} \dot{m}[v_n] + [p] = 0 \\ \dot{m}[v_\tau] = 0 \longrightarrow \quad [v_\tau] = 0 \end{cases}$$

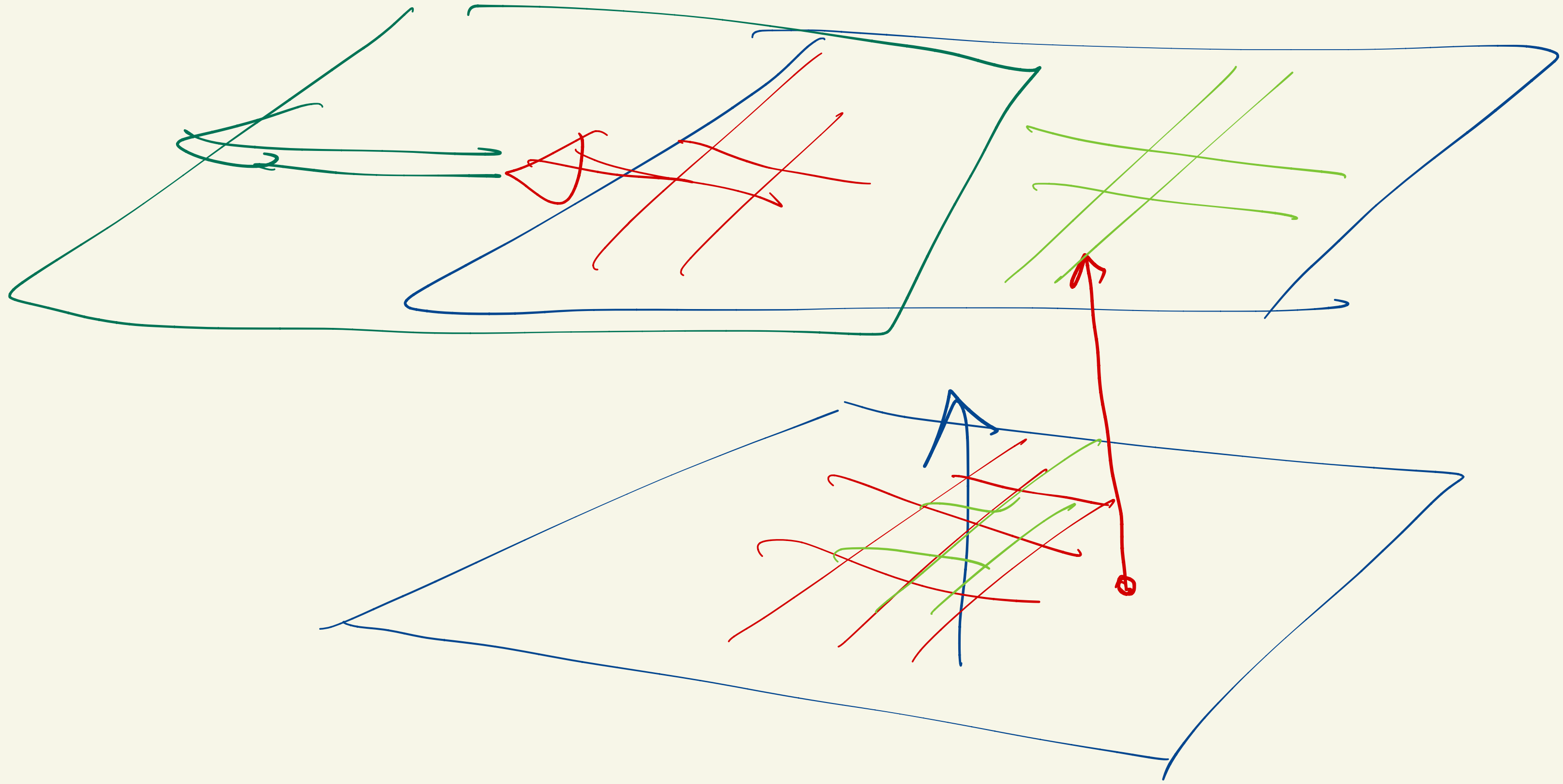
$$\rho = \text{cost} + \text{R-H} \Longrightarrow [p] = 0 \qquad [v_n] \neq 0$$

$$p^+ + \tfrac{1}{2}\rho_0 U^{+2} = p^- + \tfrac{1}{2}\rho_0 U^{-2}$$

$$-[p] = \tfrac{1}{2}\rho_0 [U^2] = 0 \qquad \tfrac{1}{2}\left(U^{+2} - U^{-2}\right) = 0$$

$$\frac{U^+ + U^-}{2} \cdot \left(U^+_\pi - U^-_\pi\right) = 0 \qquad w := \frac{U^+ + U^-}{2}$$

$$w = \begin{cases} w_n = U_n = U_n^+ = U_n^- \; (= 0) \\ w_\pi \Longleftarrow \text{si può definire in modo arbitrario.} \end{cases}$$



$$\frac{U^+ + U^-}{2} \cdot \left(U^+_\pi - U^-_\pi\right) = w \cdot [U] = 0 \qquad [U] = [\bar{V}]$$

$$r = n \times [U] \qquad r \parallel w$$

$$[p] = 0 \quad \rightarrow \quad \boxed{w \parallel r = n \times [U] = n \times [U]}$$

$$\zeta = \nabla \times U \qquad \nabla \cdot \zeta = \nabla \cdot (\nabla \times U) \equiv 0$$

$$\nabla = \hat{n}\frac{\partial}{\partial n} + \nabla_\pi \qquad \zeta = \zeta_\pi + \hat{n}\zeta_n$$

$$\nabla\cdot\zeta = \frac{\partial \zeta_n}{\partial n} + \nabla_\pi\cdot\zeta_\pi$$

$$0 \equiv \int_{-\delta_w}^{\delta_w} \nabla\cdot\zeta \, dn = \int_{-\delta_w}^{\delta_w} \frac{\partial \zeta_n}{\partial n}\, dn + \nabla_\pi\cdot\int_{-\delta_w}^{\delta_w} \zeta_\pi \, dn =$$

$$= [\zeta_n] + \nabla_\pi\cdot\int_{-\delta_w}^{\delta_w} \zeta_\pi \, dn = 0$$

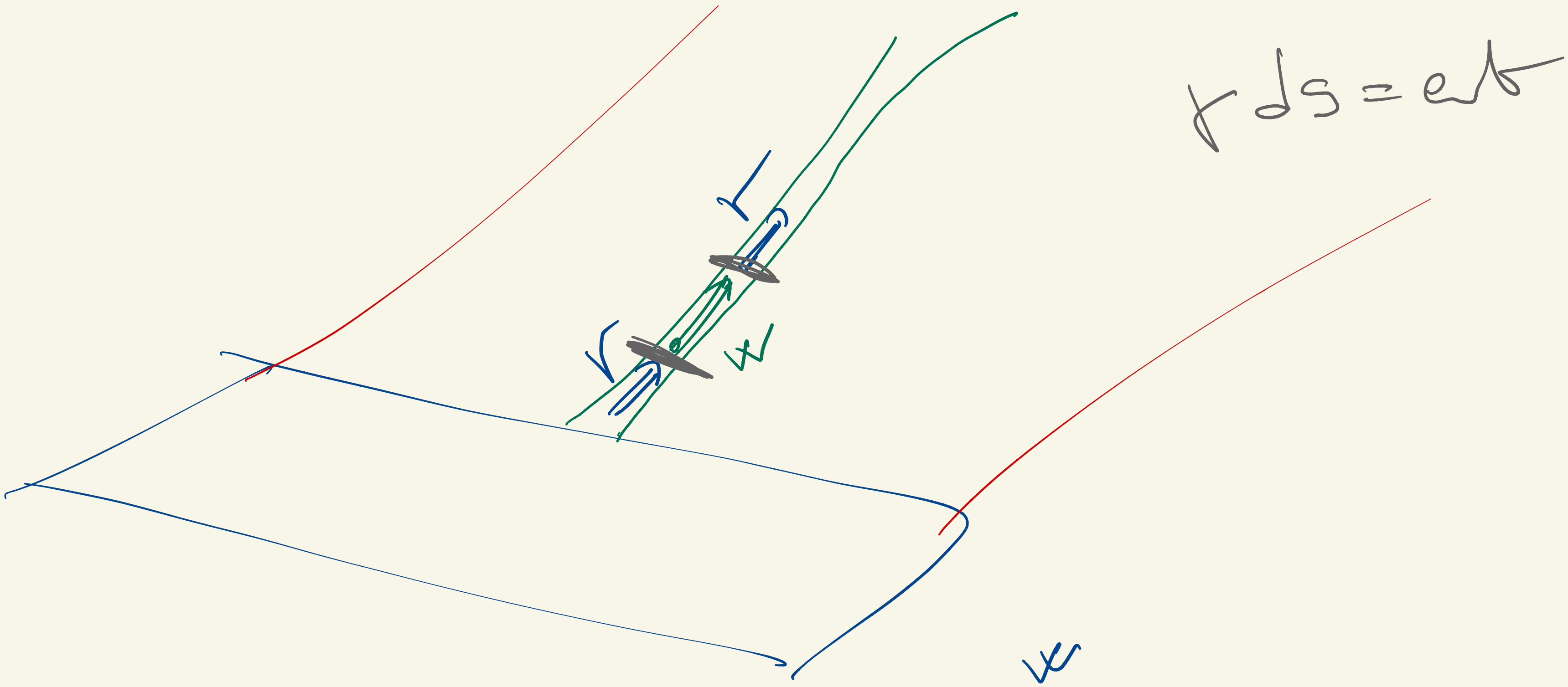
$$\cancel{[\zeta_n]} + \nabla_\pi\cdot\underbrace{(n\times[U])}_{\Gamma} = 0 \Rightarrow \nabla_\pi\cdot\Gamma = 0$$

$$\nabla_\pi \cdot \gamma = 0$$

$$\gamma \,/\!/\, w \qquad w = 1/2\,(U^+ + U^-) \qquad U = v + U_\infty$$

$$V_x = -\nabla_x \oint_{\partial B} U_\infty \cdot n\, g\, dS - \nabla_x \times \oint_{\partial B} n \times v\, g\, dS$$

$$- \nabla_x \int_{S_w} \gamma\, g\, dS$$

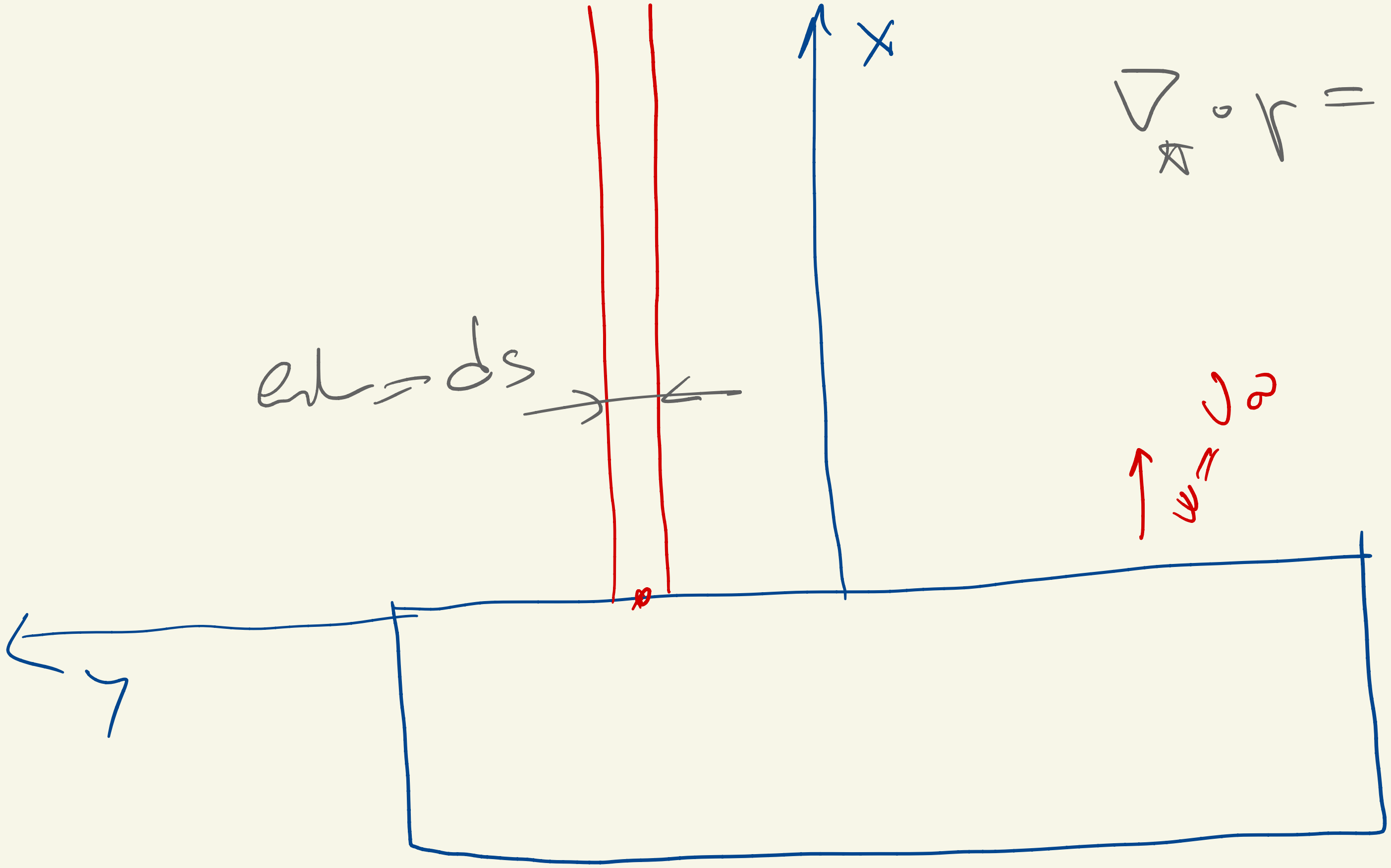


w

Corpo sottile: $\quad |V| \ll U_\infty \qquad \frac{u^+ + u^-}{2} \cdot [u^+ - u^-] = 0$

$$u^+ = U_\infty + v^+ \qquad u^- = U^\infty + v^- \qquad \frac{u^+ + u^-}{2} = U_\infty$$

$$U_\infty \cdot [u] = 0 \quad \rightarrow \quad U_\infty \parallel \gamma$$



$$\nabla_\pi \cdot \gamma = 0 \rightarrow \frac{\partial \gamma_x}{\partial x} = 0$$

$$\gamma_x = eh$$

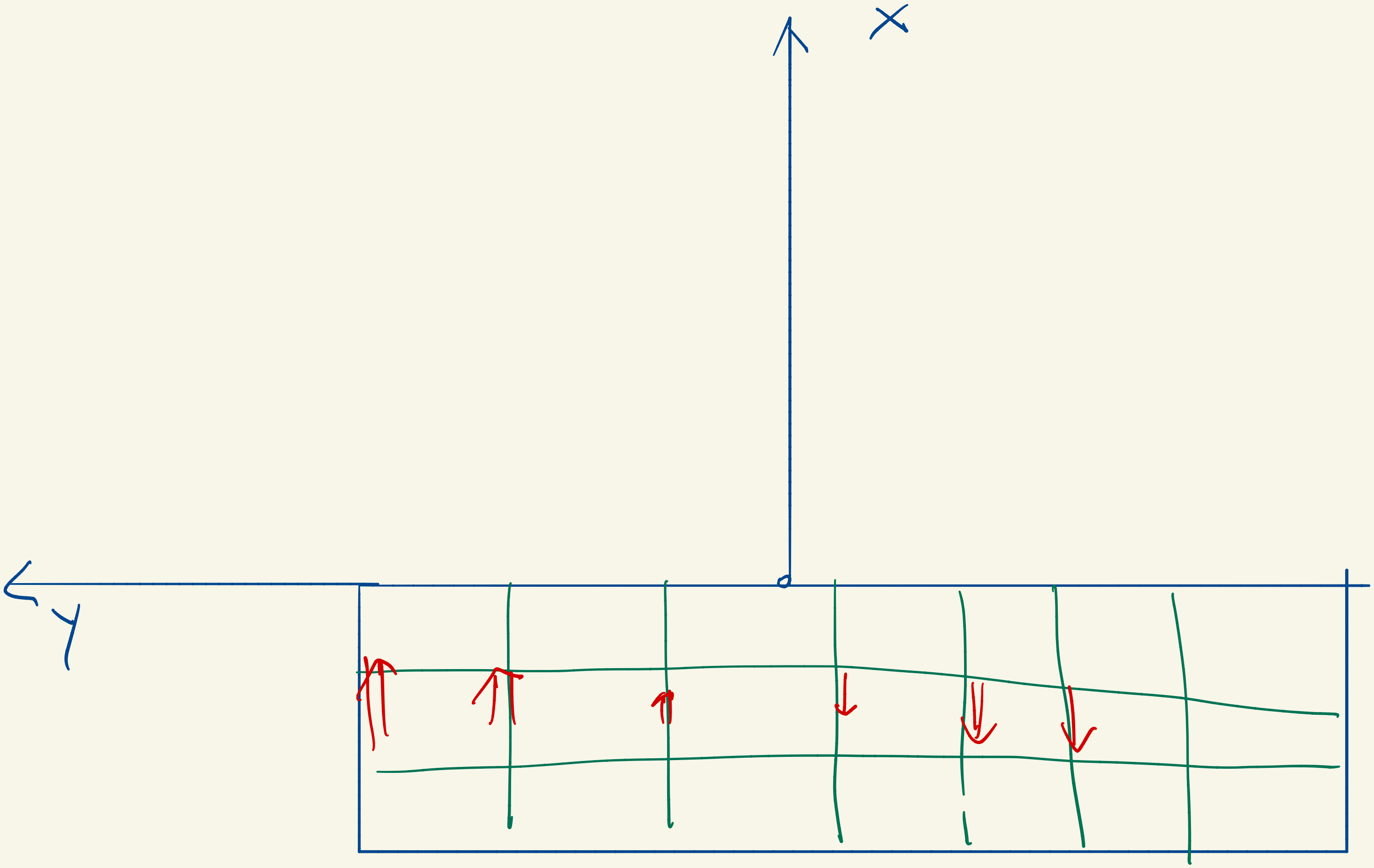
$$\gamma_x = \gamma_\infty(y)$$

$$\gamma_w = V_w [n \times [v]_R]$$

$$\gamma_K = n \times [V]_{TE}$$

$$\uparrow U_\infty$$

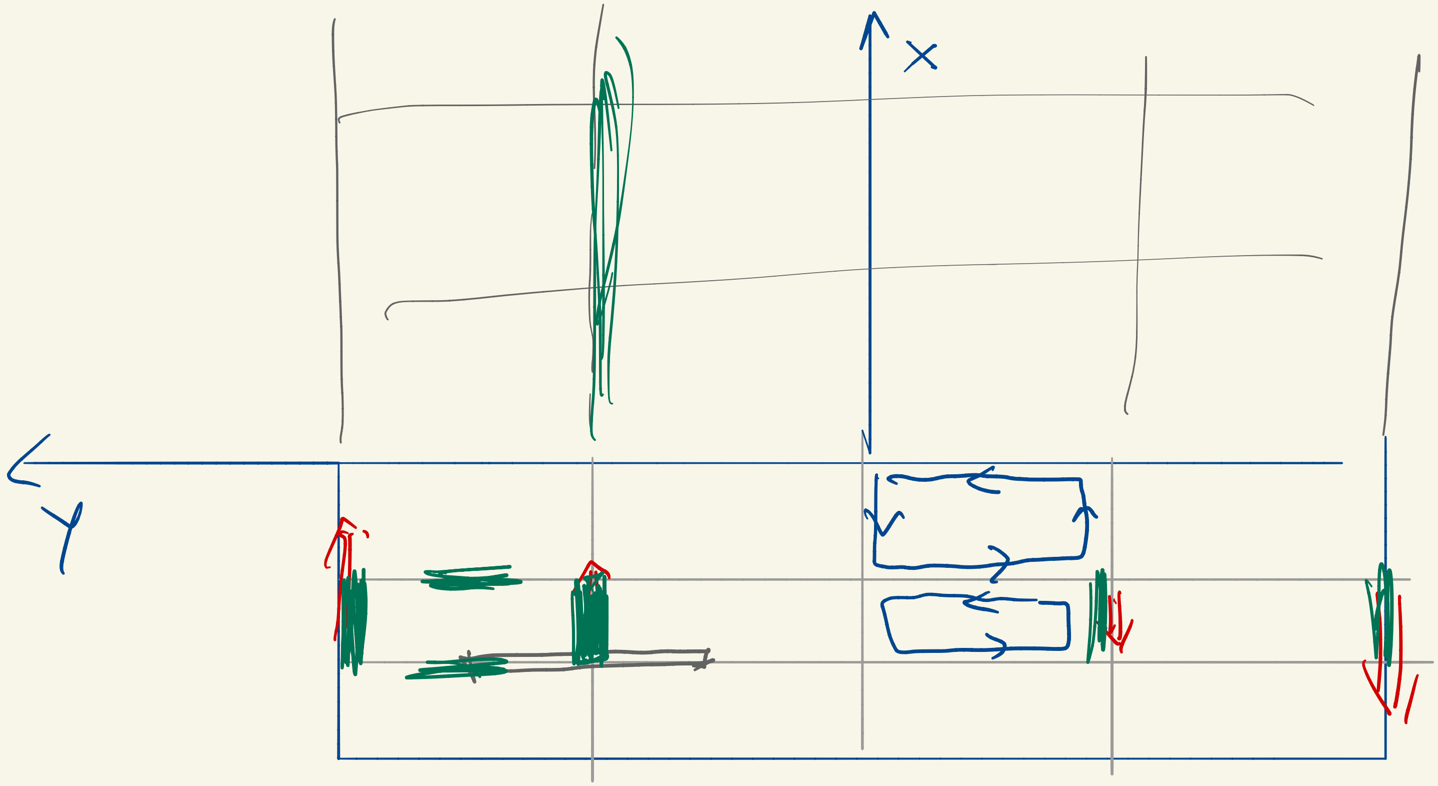
$$\nabla_\pi \cdot \gamma = 0 \longleftrightarrow \frac{\partial \gamma_x}{\partial x} + \cancel{\frac{\partial \gamma_y}{\partial y}} = 0$$



$$\int \xi_r \, d\eta = n \times v = \Gamma_B$$

$$\nabla \cdot (n \times v) = 0$$

$$\nabla_x \cdot \Gamma_B = 0$$



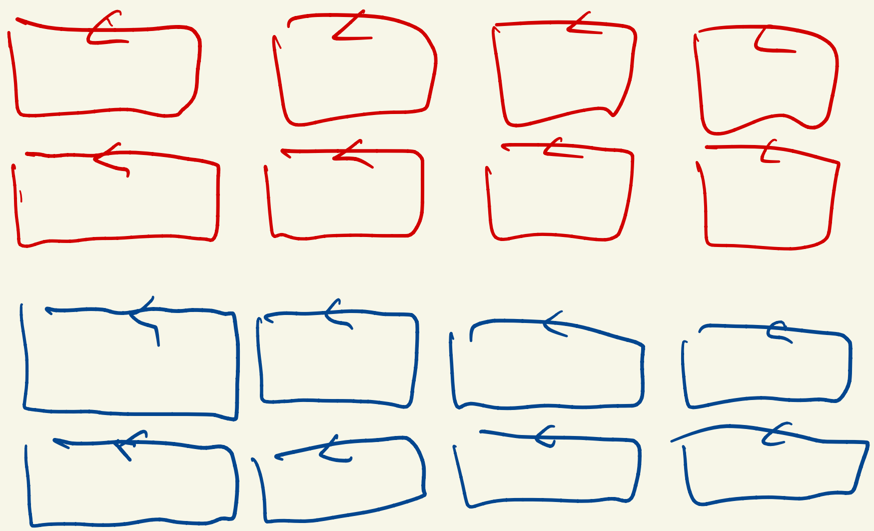
Γ_n

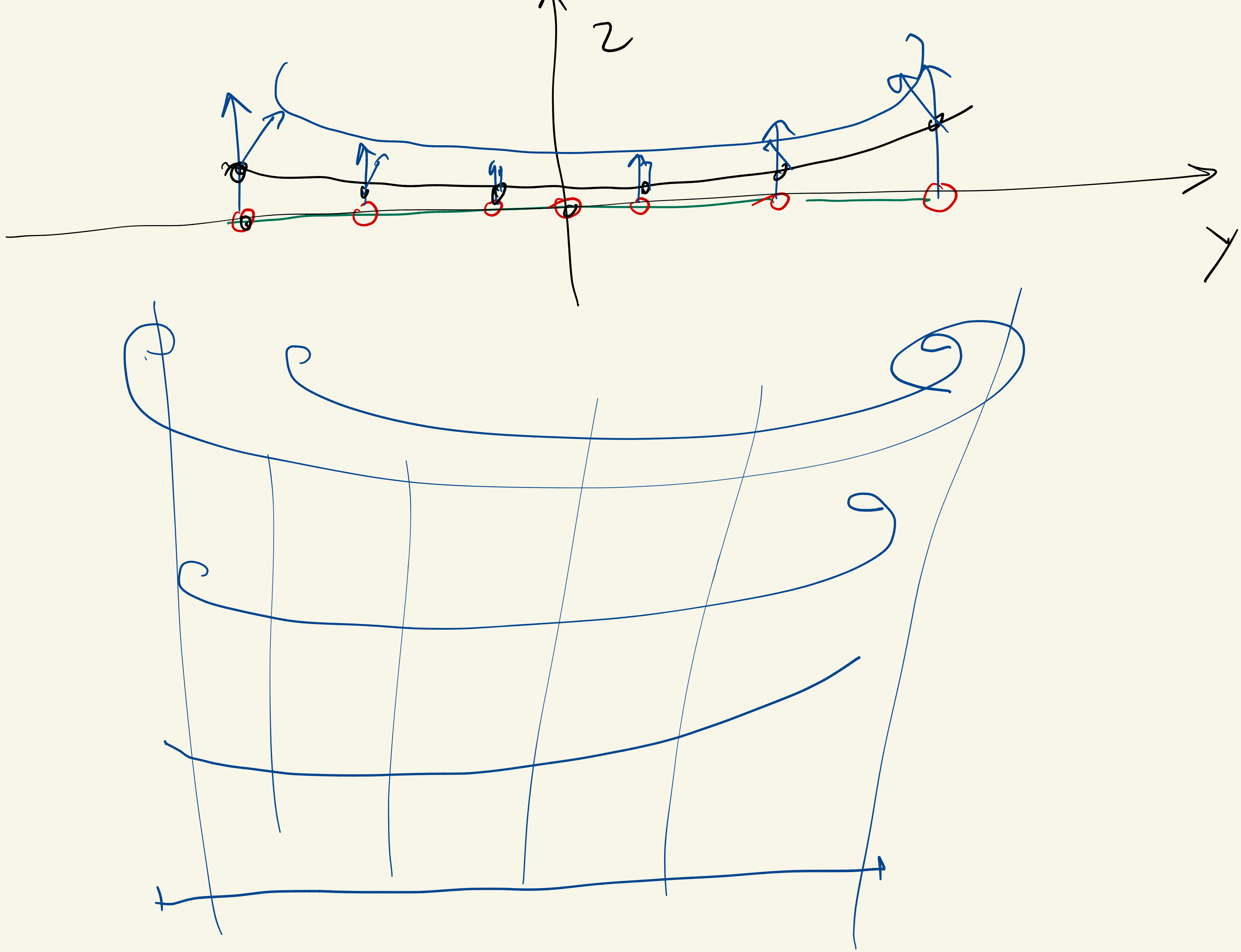
$n = 1, \ldots, N$

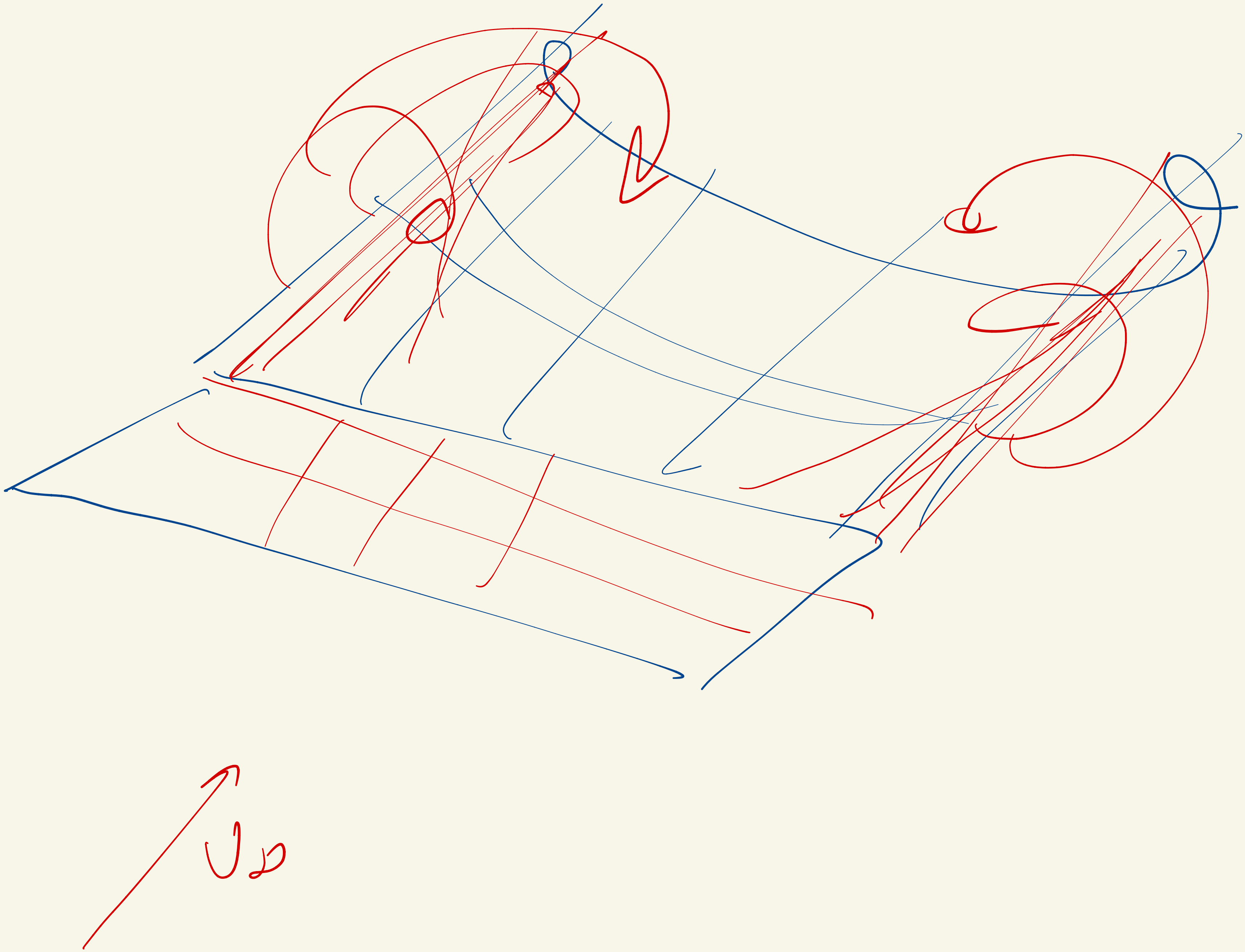
$\Gamma_B = n \times V$

$\nabla \cdot \Gamma_B = 0$

Vortex Lattice Method




z
y


v2