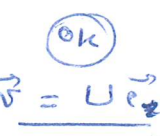


MF314 - Écoulement autour d'un cylindre.

1 - Écoulement irrotationnel $\rightarrow \text{rot } \vec{v} = \vec{0} \Rightarrow \exists \phi \setminus \vec{v} = \text{grad } \phi$

— incompressible $\rightarrow \text{div } \vec{v} = 0 \Rightarrow \Delta \phi = 0$

2 - a - $\vec{v} = U \vec{e}_x = \text{grad } \phi_0 = \frac{d\phi_0}{dx} \vec{e}_x \rightarrow \phi_0 = Ux$

b - $\phi = \phi_u + \phi_{\text{dipole}} = Ux + \frac{K \cos \theta}{2\pi r} \xrightarrow{r \rightarrow \infty} \phi_0$ 

c - C.L. : vitesse normale au cylindre, nulle.

$x = r \cos \theta \rightarrow \phi = U r \cos \theta + \frac{K \cos \theta}{2\pi r}$

$v_n = \frac{\partial \phi}{\partial r} = U \cos \theta - \frac{K \cos \theta}{2\pi r^2}$; $v_n(R) = 0 \Rightarrow K = U 2\pi R^2$

d - $\phi = U \cos \theta \left(1 + \frac{R^2}{r^2} \right)$; $v_n = \frac{\partial \phi}{\partial r} = U \cos \theta \left(1 - \frac{R^2}{r^2} \right)$

$v_\theta = \frac{\partial \phi}{\partial \theta} = -U \sin \theta \left(1 + \frac{R^2}{r^2} \right)$

e - $\vec{v}(A) = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ Point d'arrêt ; $\vec{v}(A') = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$

f - Pour fluides incompressibles : rotonnement des ldc $\Rightarrow v \uparrow$