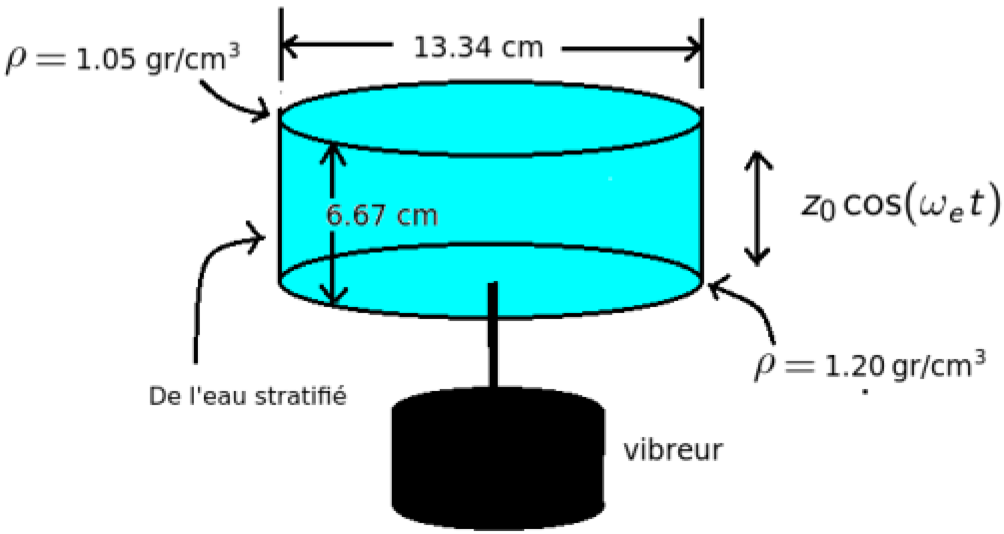
Une simulation numérique de la formation des ondes internes dans un système stratifié dans une géométrie cylindrique.

Sergio Hernández-Zapata, Gerardo Ruiz-Chavarría
Facultad de Ciencias, Universidad Nacional Autónoma de México, Mexique



L'équation de continuité

$$\frac{1}{r}\frac{\partial (r u_r)}{\partial r} + \frac{1}{r}\frac{\partial u_\theta}{\partial \theta} + \frac{\partial u_z}{\partial z} = 0$$

L'équation de diffusion

$$\frac{\partial \rho_s}{\partial t} + \frac{1}{r}\frac{\partial (r \rho_s u_r)}{\partial r} + \frac{1}{r}\frac{\partial (\rho_s u_\theta)}{\partial \theta} + \frac{\partial (\rho_s u_z)}{\partial z} = \frac{D_s}{\omega_e z_0^2}\left(\frac{\partial^2 \rho_s}{\partial r^2} + \frac{1}{r}\frac{\partial \rho_s}{\partial r} + \frac{1}{r^2}\frac{\partial^2 \rho_s}{\partial \theta^2} + \frac{\partial^2 \rho_s}{\partial z^2}\right)$$

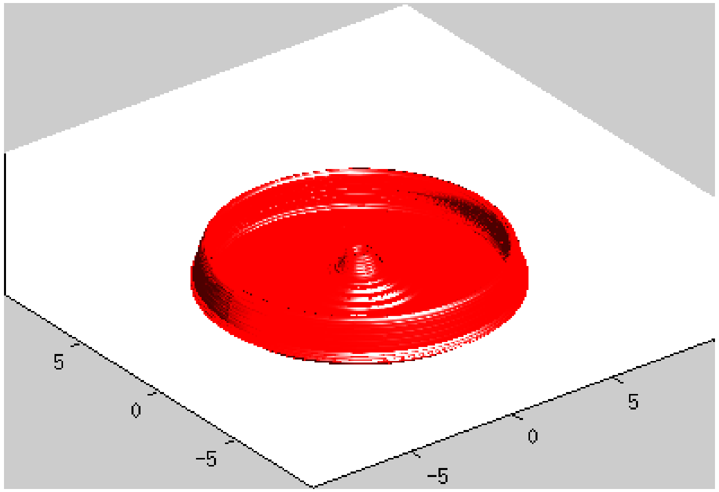
Les équations de Navier-Stokes

$$\frac{\partial u_r}{\partial t} + u_r\frac{\partial u_r}{\partial r} + \frac{u_\theta}{r}\frac{\partial u_r}{\partial \theta} + u_z\frac{\partial u_r}{\partial z} - \frac{u_\theta^2}{r} = -\frac{\partial p}{\partial r} + \frac{\nu}{\omega_e z_0^2}\left(\frac{\partial^2 u_r}{\partial r^2} + \frac{1}{r}\frac{\partial u_r}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u_r}{\partial \theta^2} - \frac{2}{r^2}\frac{\partial u_\theta}{\partial \theta} - \frac{u_r}{r^2} + \frac{\partial^2 u_r}{\partial z^2}\right)$$

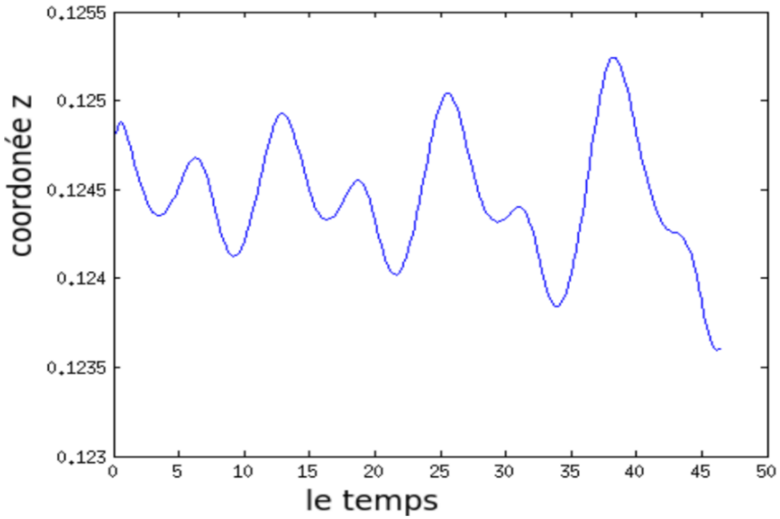
$$\frac{\partial u_\theta}{\partial t} + u_r\frac{\partial u_\theta}{\partial r} + \frac{u_\theta u_r}{r} + \frac{u_\theta}{r}\frac{\partial u_\theta}{\partial \theta} + u_z\frac{\partial u_\theta}{\partial z} = -\frac{1}{r}\frac{\partial p}{\partial \theta} + \frac{\nu}{\omega_e z_0^2}\left(\frac{\partial^2 u_\theta}{\partial r^2} + \frac{1}{r}\frac{\partial u_\theta}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u_\theta}{\partial \theta^2} + \frac{2}{r^2}\frac{\partial u_r}{\partial \theta} - \frac{u_\theta}{r^2} + \frac{\partial^2 u_\theta}{\partial z^2}\right)$$

$$\frac{\partial u_z}{\partial t} + u_r\frac{\partial u_z}{\partial r} + \frac{u_\theta}{r}\frac{\partial u_z}{\partial \theta} + u_z\frac{\partial u_z}{\partial z} = -\frac{\partial p}{\partial z} + \frac{\nu}{\omega_e z_0^2}\left(\frac{\partial^2 u_z}{\partial r^2} + \frac{1}{r}\frac{\partial u_z}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u_z}{\partial \theta^2} + \frac{\partial^2 u_z}{\partial z^2}\right) + \left(-\frac{g}{\omega_e^2 z_0} + \cos(t)\right)(1 + \rho_s)$$

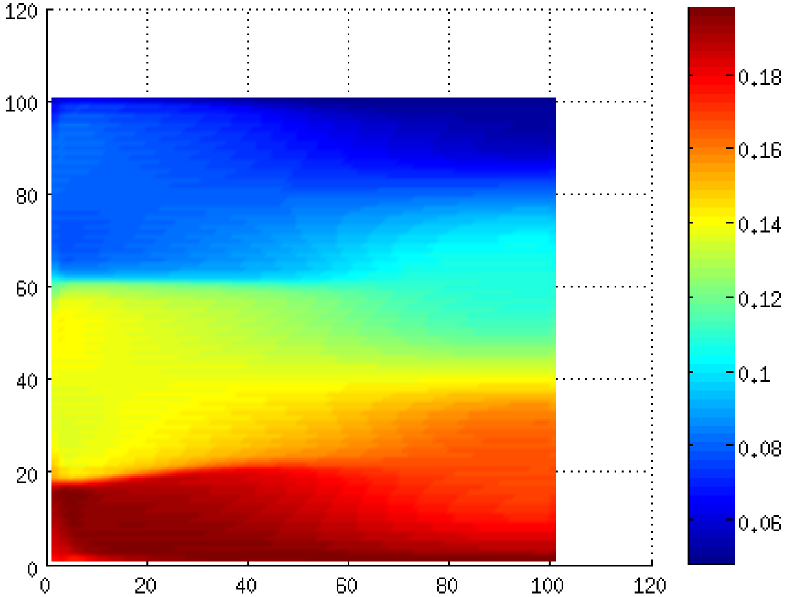
QUE'EST-CE QU'ON PEUT ÉTUDIER AVEC CETTE SIMULATION



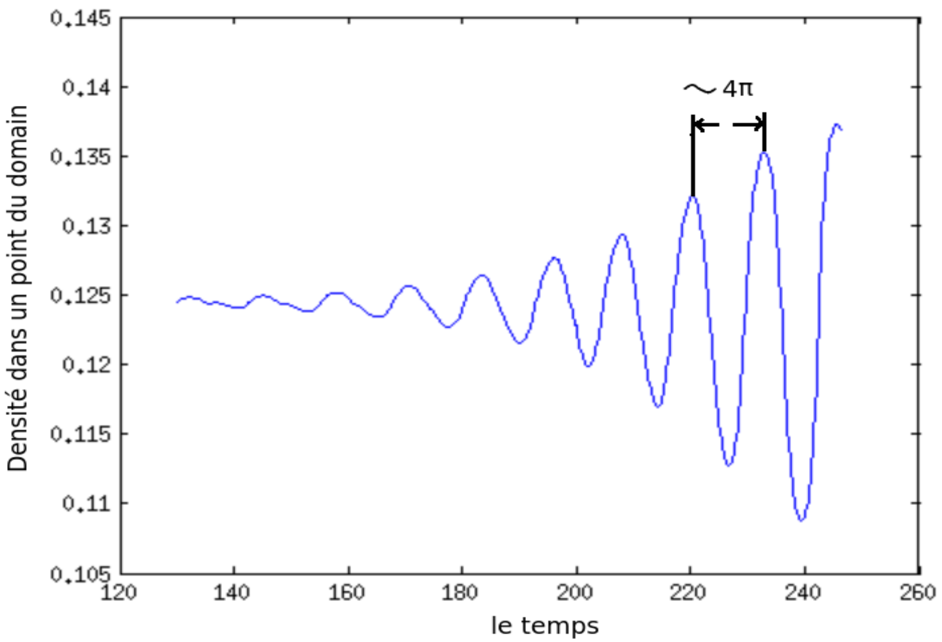
Surfaces d'isodensité



Oscillation vertical d'un point matériel



Profil de densité dans le plan r-z (la valeur de θ est constant)



Densité dans un point fixé du domain