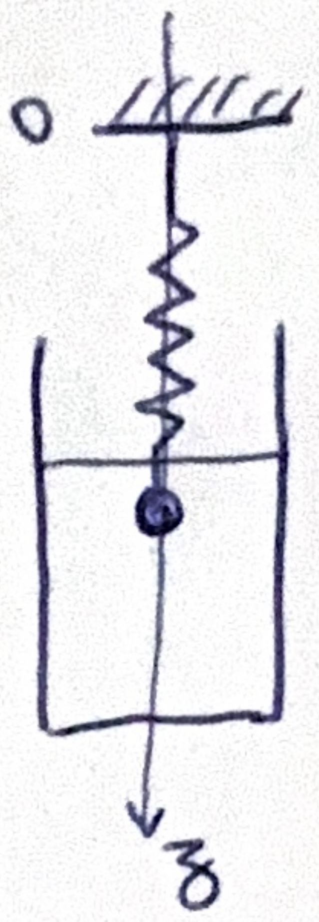
Pseudo - oscillat°

1) <u>syst</u> $\{M\,(m)\}$ étudié ds <u>R_T terrestre galiléen</u>



Bdf : $\vec{P} = mg\,\vec{u_z}$

$\vec{\pi} = -\rho V g\,\vec{u_z}$ $\quad V = \frac{4}{3}\pi r^3$

$\vec{f_{el}} = -k(z - l_0)\,\vec{u_z}$

$\vec{f} = -6\pi\eta r\,\dot{z}\,\vec{u_z}$

r faible $\rightarrow \|\vec{\pi}\| \ll \|\vec{P}\|$.

<u>PFD</u> $\quad m\vec{a} = \vec{P} + \vec{f_{el}} + \vec{f}$.

selon (Oz) : $m\ddot{z} = mg - k(z - l_0) - 6\pi\eta r\dot{z}$

$$\ddot{z} + \underbrace{\frac{6\pi\eta r}{m}}_{\frac{\omega_0}{Q}}\dot{z} + \underbrace{\frac{k}{m}}_{\omega_0^2} z = g + \frac{k}{m} l_0 .$$

$\rightarrow$ $\omega_0 = \sqrt{\frac{k}{m}}$

$Q = \frac{\omega_0 m}{6\pi\eta r} = \frac{\sqrt{km}}{6\pi\eta r}$

$z = z_h + z_p$ $\qquad z_p$ tq $0 + 0 + \omega_0^2 z_p = g + \omega_0^2 l_0$

$z_p = l_0 + \frac{g}{\omega_0^2} > l_0$ ok.

$z_h \rightarrow$ oscillat° pseudo-périodiques

$\Delta = \left(\frac{\omega_0}{Q}\right)^2 - 4\omega_0^2 < 0$.

$$r_{12} = \frac{-\omega_0/Q \pm i\sqrt{4\omega_0^2 - \omega_0^2/Q^2}}{2} = -\frac{\omega_0}{2Q} \pm i\,\boxed{\underbrace{\omega_0\sqrt{1 - \frac{1}{4Q^2}}}_{\omega_p}}$$

$$\boxed{z_h = e^{-\frac{\omega_0}{2Q}t}\left(A\cos(\omega_p t) + B\sin(\omega_p t)\right)}.$$

$$T_p = \frac{2\pi}{\omega_p} = \frac{2\pi}{\omega_0\sqrt{1 - \frac{1}{4Q^2}}} = \frac{T_0}{\sqrt{1 - \frac{1}{4Q^2}}} = \frac{T_0}{\sqrt{1 - \frac{(6\pi\eta r)^2}{4km}}}$$

on élimine k : $k = m\omega_0^2 = m\frac{4\pi^2}{T_0^2} \Rightarrow km = \left(\frac{2\pi m}{T_0}\right)^2$

$$\boxed{T_p = \frac{T_0}{\sqrt{1 - \left(\frac{6\pi\eta r\,T_0}{4\pi m}\right)^2}} = \frac{T_0}{\sqrt{1 - \left(\frac{3\eta r T_0}{2m}\right)^2}}}$$

2) appl° : on mesure T_0, r, m et T_p

<u>on en déduit η</u>