$$E_{cin} = \sum_{\alpha} \frac{1}{2} m_\alpha \vec{v}_\alpha^{\,2}$$

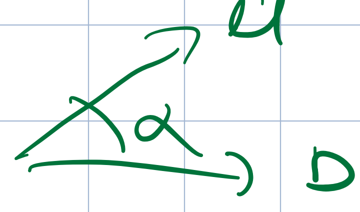
$$= \frac{1}{2} \sum_{\alpha} m_\alpha \left(\vec{v}_A + \vec{\omega} \wedge \vec{AP_\alpha}\right)^2$$

car solide indéf

$$= \frac{1}{2} M \left(\vec{v}_A\right)^2 + \sum_{\alpha} m_\alpha \left(\vec{v}_A \cdot \left(\vec{\omega} \wedge \vec{AP_\alpha}\right)\right)$$

$$+ \frac{1}{2} \sum_{\alpha} m_\alpha \left(\vec{\omega} \wedge \vec{AP_\alpha}\right)^2$$

$$= M \vec{v}_A \cdot \left(\vec{\omega} \wedge \vec{AG}\right)$$



$$\left(\vec{a} \wedge \vec{b}\right) = a^2 b^2 \sin^2 \alpha$$

$$\left(\vec{a} \cdot \vec{b}\right) = a^2 b^2 \cos^2 \alpha$$

$$\Rightarrow \left(\vec{a} \wedge \vec{b}\right)^2 + \left(\vec{a} \cdot \vec{b}\right)^2 = a^2 b^2$$

or $\frac{1}{2}\sum_\alpha m_\alpha \left(\vec{\omega} \wedge \vec{AP_\alpha}\right)^2$

$$= \frac{1}{2}\sum_\alpha m_\alpha \left(\vec{\omega}^2 \left(\vec{AP_\alpha}\right)^2 - \left(\vec{\omega}\cdot\vec{AP_\alpha}\right)^2\right)$$

(on aura $\omega_1^2+\omega_2^2+\omega_3^2$)

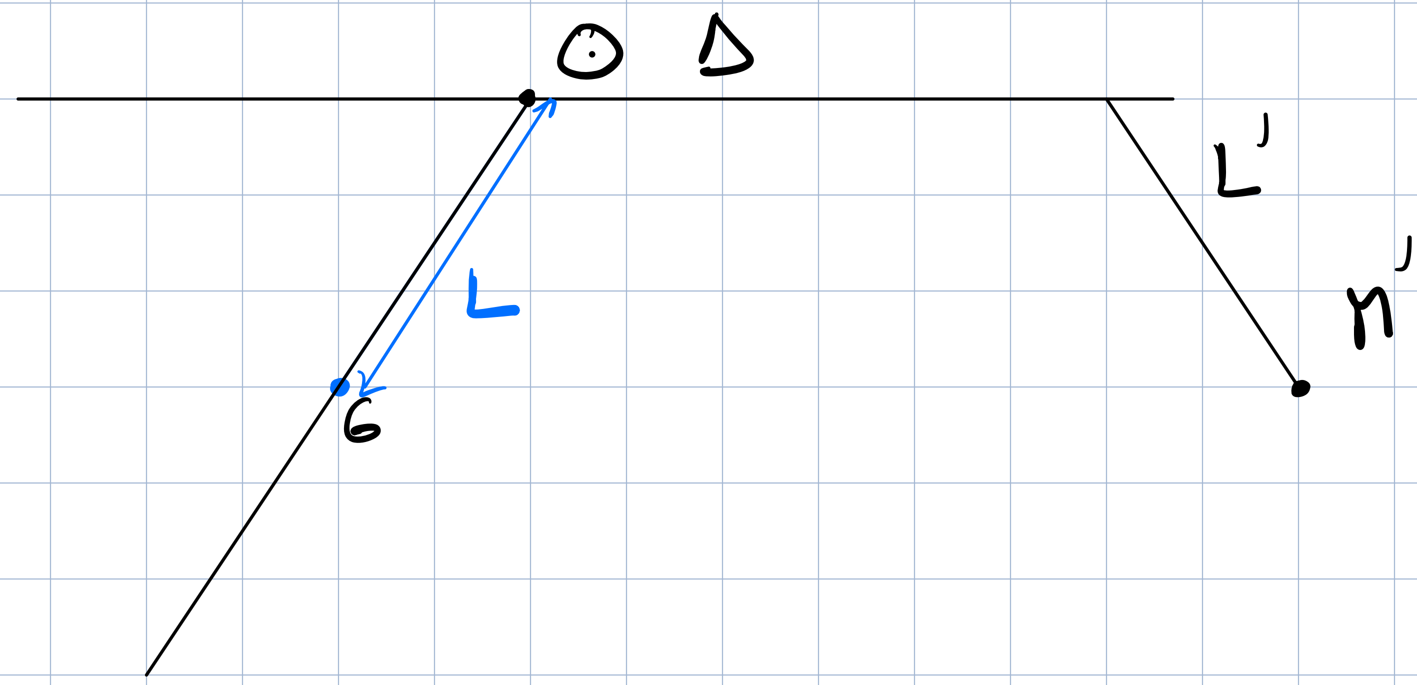
$$= \frac{1}{2}\sum_\alpha m_\alpha \left(\sum_{ij} \omega_i \omega_j \delta_{ij} \left(\vec{AP_\alpha}\right)^2 + \sum_{ij} \omega_i \left(\vec{AP_\alpha}\right)_i \omega_j \left(\vec{AP_\alpha}\right)_j \right)$$

$$= \frac{1}{2}\sum_{ij} \omega_i \omega_j \sum_\alpha m_\alpha \left(\left(\vec{AP_\alpha}\right)^2 \delta_{ij} - \left(\vec{AP_\alpha}\right)_j \left(\vec{AP_\alpha}\right)_i \right)$$

$$= \frac{1}{2}\sum_{ij} \omega_i \omega_j \left(\tilde{I}_A\right)_{ij}$$

$$= \frac{1}{2}\vec{\omega}\cdot\left(\tilde{I}_A \vec{\omega}\right)$$

$$\Rightarrow E_{cin} = \frac{1}{2} M \vec{V_A}^2 + M \vec{V_A}\left(\vec{\omega_A} \wedge \vec{AG}\right) + \frac{1}{2}\vec{\omega}\left(\tilde{I}_A \vec{\omega}\right)$$



$$I_{O,\Delta} = \frac{1}{12} M (2L)^2$$

Que doit valoir L' pour que les périodes soient égales.

$$T = T'$$

$$\Leftrightarrow \omega = \omega'$$

$$\Leftrightarrow \omega^2 = (\omega')^2$$

$$\left.\begin{array}{l} \omega^2 = \dfrac{LMg}{I_D} \\[2em] (\omega')^2 = \dfrac{g}{L'} \end{array}\right\} \Rightarrow \frac{LMg}{I_{G,\Delta} + ML^2} = \frac{g}{L'}$$

$$\Rightarrow \frac{LMg}{\underbrace{\frac{1}{12} M 4L^2 + ML^2}_{\frac{4}{3} ML^2}} = \frac{g}{L'}$$

$$\Rightarrow \frac{LM}{4/3\, ML^2} = \frac{1}{L'}$$

$$\Rightarrow L' = \frac{4}{3} L$$