Physique

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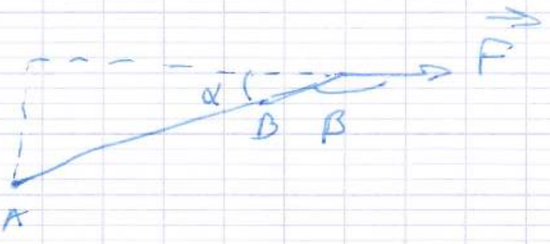
$$\vec{F}_{B/A} = \vec{F}_{A/B} = G \cdot \frac{m_A \times m_B}{d^2} \vec{u}$$ $\vec{u}$ = vect unitaire



$\overline{M}_{/A} = AB \cdot F \times \sin(\beta)$

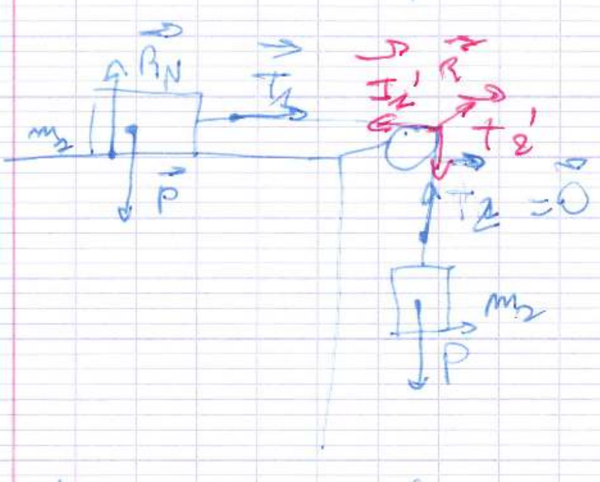
$\sin(\alpha) = \sin(\beta)$

or $\sin(\alpha) = \frac{D3}{D1}$

$$\overline{M}_{/A}(\vec{F}) = -D_1 \cdot F \cdot \frac{D_3}{D_1}$$

5ème Série

Ex 1 : 1)° Donner le bilan des forces exterieures appliqués sur tout le sys



$\vec{R} + \vec{P} = \vec{0}$

$\Sigma \vec{F}_{ext} = \vec{0}$

Quand il y a pas de frottemente $\vec{R} \perp$ Plan de contact.

2°) Exprimer l'accelerat° du sys.

En presence des frottements la react° totale $\vec{R}_N + \vec{f}$
↳ react° tang

Systeme m_1 : $\vec{P}_1$, $\vec{R}_N$, $\vec{T}_1$

Systeme poulie : $\vec{T}_1'$, $\vec{R}$, $\vec{T}_2'$

Systeme m_2 : $\vec{P}_2$, $\vec{T}_2$

I) $\sum \vec{F}_{ext} = m_1 \vec{a}$
$\sum \vec{F}_{ext} = m_2 \vec{a}$

$\vec{T_1} + \vec{P_1} + \vec{R_N} = m_1 \vec{a}$

Projection Ox :

$T_1 + 0 + 0 = m_1 a$

$\boxed{T_1 = m_1 a}$ (1)

$\vec{P_2} + \vec{T_2} = m_2 \vec{a}$

Projection Oy :

$P_2 - T_2 = m_2 a$

$T_2 = -m_2 a + P_2$

$\boxed{T_2 = -m_2 a + m_2 g}$ (2)

$T_1 = T_2$ car masse poulie negligeable et inexistant

$-m_2 a + m_2 g = m_1 a$

$-m_2 a - m_1 a = -m_2 g$

$a(-m_2 - m_1) = -m_2 g$

$a(m_2 + m_1) = m_2 \cdot g$

$a = \frac{m2}{m_1 + m_2} g$

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Ex 2 : $\sum \vec{F}_{ext} = m\vec{a}$

Dans la base de Frenet $(\vec{u}_T, \vec{u}_N)$

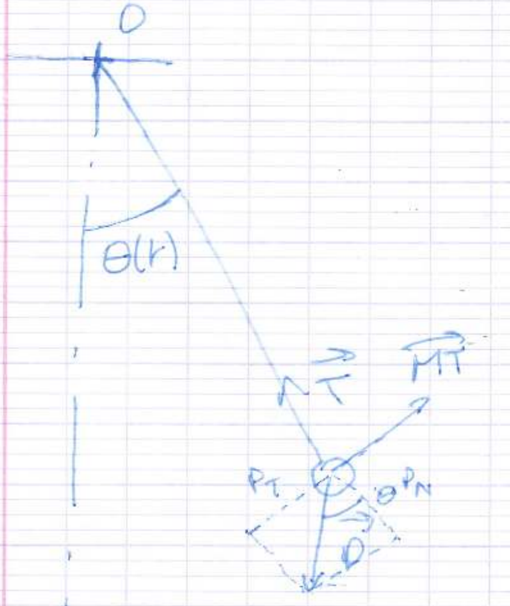
a_T ? a_N ?

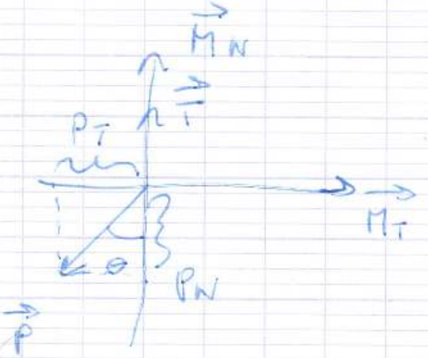
$\begin{cases} a_T = \frac{dv}{dt} \text{ avec } v = R\dot{\theta} \text{ avec } R = L = \text{long. du fil} \\ a_N = \frac{v^2}{R} \end{cases} \Rightarrow \begin{cases} a_T = L\frac{d\dot{\theta}}{dt} = L\ddot{\theta} \\ a_N = \frac{v^2}{L} = \frac{(L\dot{\theta})^2}{L} = L(\dot{\theta})^2 \end{cases}$

$y'' + \frac{g}{L}y = 0 \qquad \Delta = \frac{-4g}{L} \qquad r_2 = -2i\sqrt{\frac{g}{L}} \qquad +2i\sqrt{\frac{g}{L}}$

$K_2\cos\left(2\sqrt{\frac{g}{L}}\right) + k_2\sin\left(2\sqrt{\frac{g}{L}}\right)$ avec $(k_1, k_2) \in \mathbb{R}^2$

$r^2 + \frac{g}{L} = 0$





$\vec{T} = \begin{pmatrix} 0 \\ T \end{pmatrix}_{\vec{u}_T, \vec{u}_N}$

$\vec{P} = \begin{pmatrix} -P\sin(\theta) \\ -P\cos(\theta) \end{pmatrix}_{\vec{u}_T, \vec{u}_N}$

Projection de $\vec{P} + \vec{T} = m\vec{a}$

$\begin{cases} \text{sur } \vec{MT} : \\ -P\sin(\theta) + 0 = ma_T = mL\ddot{\theta} \quad (1) \\ \text{sur } \vec{MN} : \\ -P\cos(\theta) + T = ma_N = mL\dot{\theta}^2 \quad (2) \end{cases}$

$(1) \Rightarrow -mg\sin(\theta) = mL\ddot{\theta}$

$L\ddot{\theta} + g\sin(\theta) = 0$

$\sin(\theta) \simeq \theta \ (\theta \leq 10°)$

$$\ddot{\theta} + \frac{g}{L}\theta = 0$$

L'equation différentielle dont la résolution dans l'equation horaire du mvt $\theta(t)$

$$\omega = 2\pi f = \frac{2\pi}{T}$$

$-\omega^2 \cos(\omega t)$

2) $\theta(t) = \theta_0 \cos(\omega t)$ est sol de l'eqt diff

$\Rightarrow \ddot{\theta_0 \cos(\omega t)} + \frac{g}{L}\theta_0 \cos(\omega t) = 0 \ \forall t$

$-\theta_0 \omega^2 \cos(\omega t) + \frac{g}{L}\theta_0 \cos(\omega t) = 0$

$\theta_0 \cos(\omega t)\left[-\omega^2 + \frac{g}{L}\right] = 0 \ \forall t$

$\text{coef} = 0 \Rightarrow \omega^2 = \frac{g}{L} = \omega = \sqrt{\frac{g}{L}}$

AN: $T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{L}{g}}$

$T = 2\pi\sqrt{\frac{80 \times 10^{-2}}{10}} = 2\pi\, 2\sqrt{2} \cdot 10^{-1} = 4\pi\sqrt{2} \cdot 10^{-1} \simeq 1{,}8\,\text{sec}$

$$\begin{cases} \ddot{x} + \overset{\omega^2}{\left(\frac{k}{m}\right)} x = 0 \\ \ddot{\theta} + \underset{\omega^2}{\left(\frac{g}{L}\right)} \theta = 0 \end{cases}$$