

EPFL

Pantographe Parallele Balanced-IsoSpring- Oscillator

Groupe 33

Etudiants:

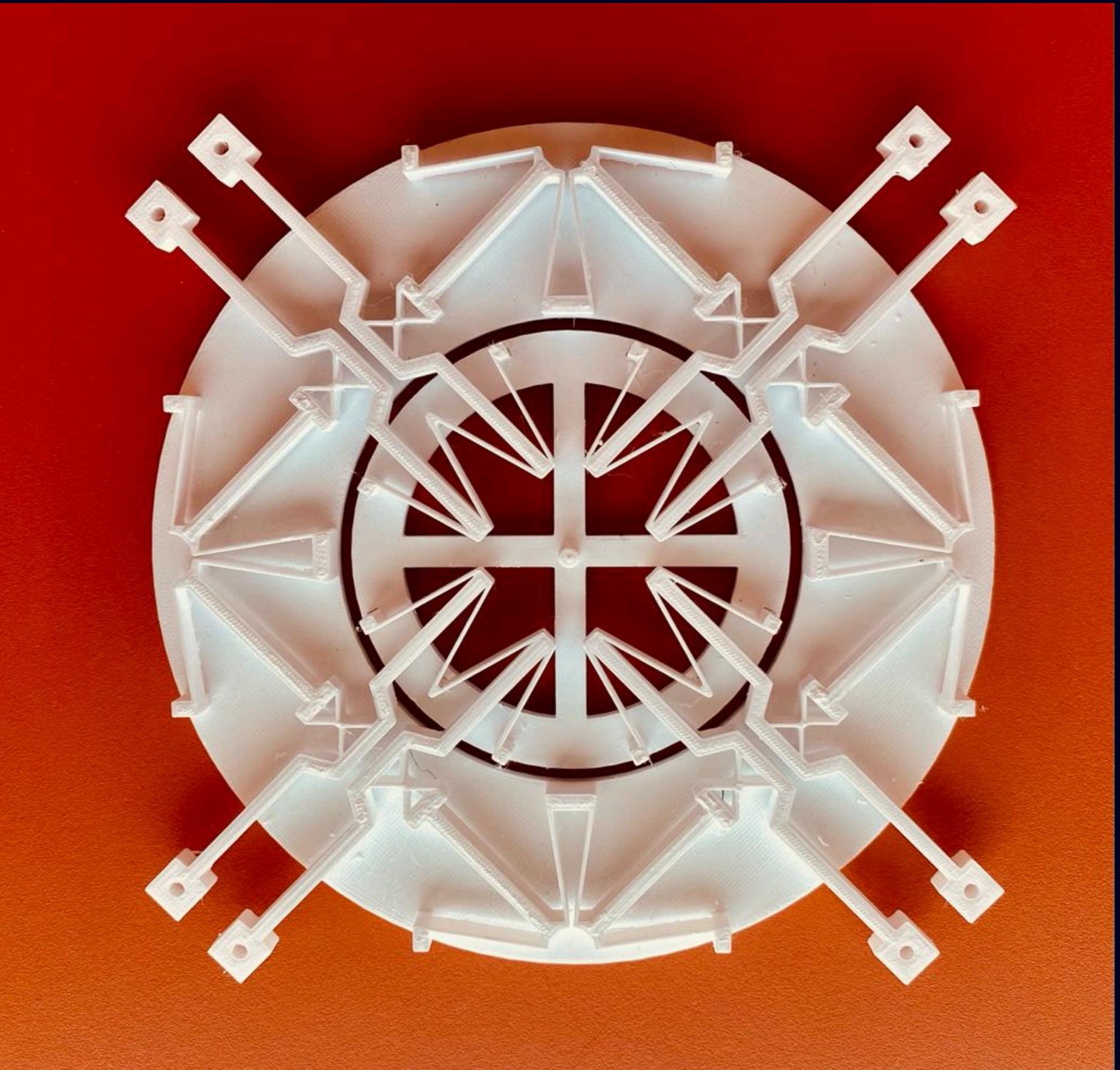
Ben Abda Mohamed Habib

Elmaleh Daniel Abraham

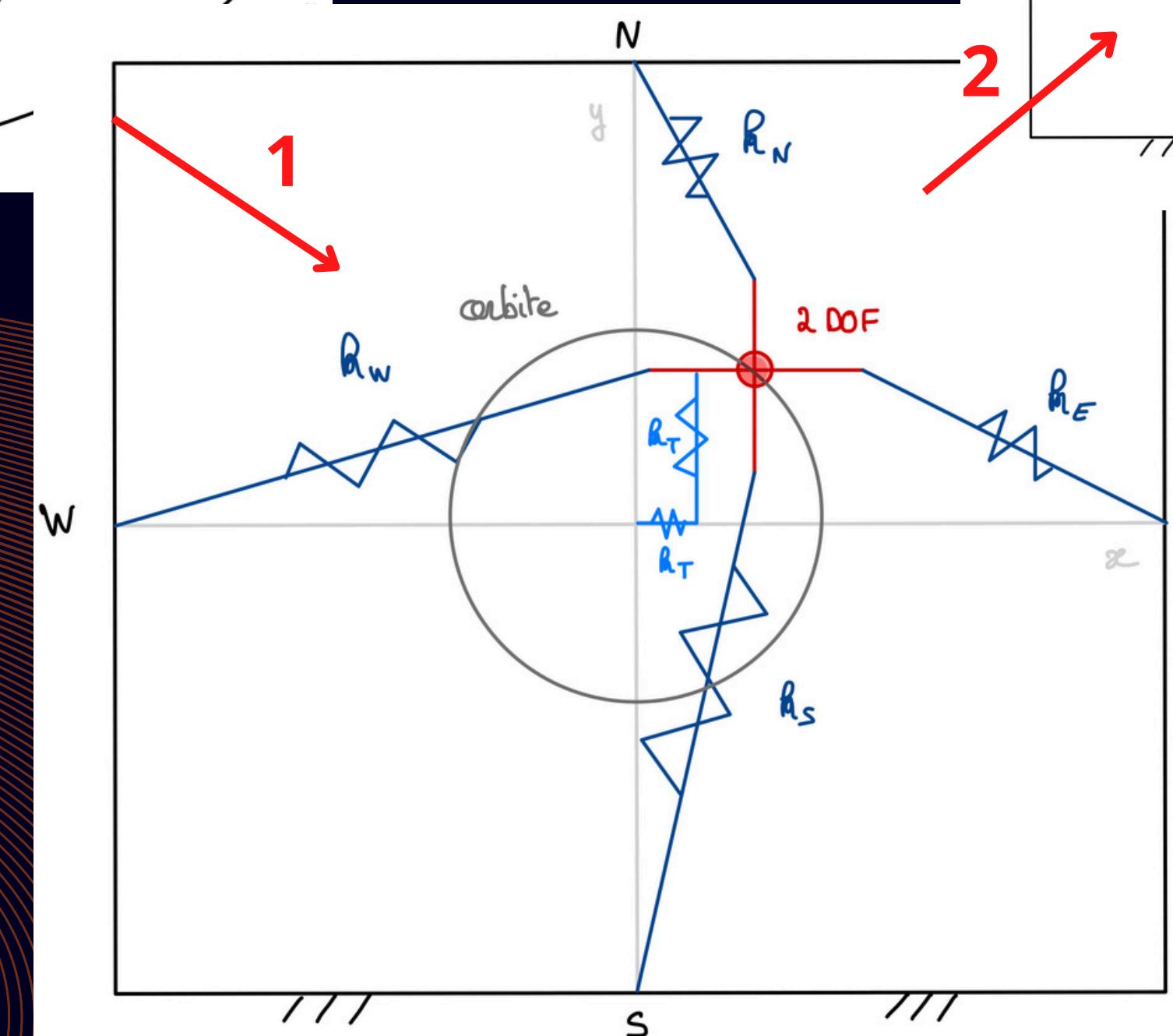
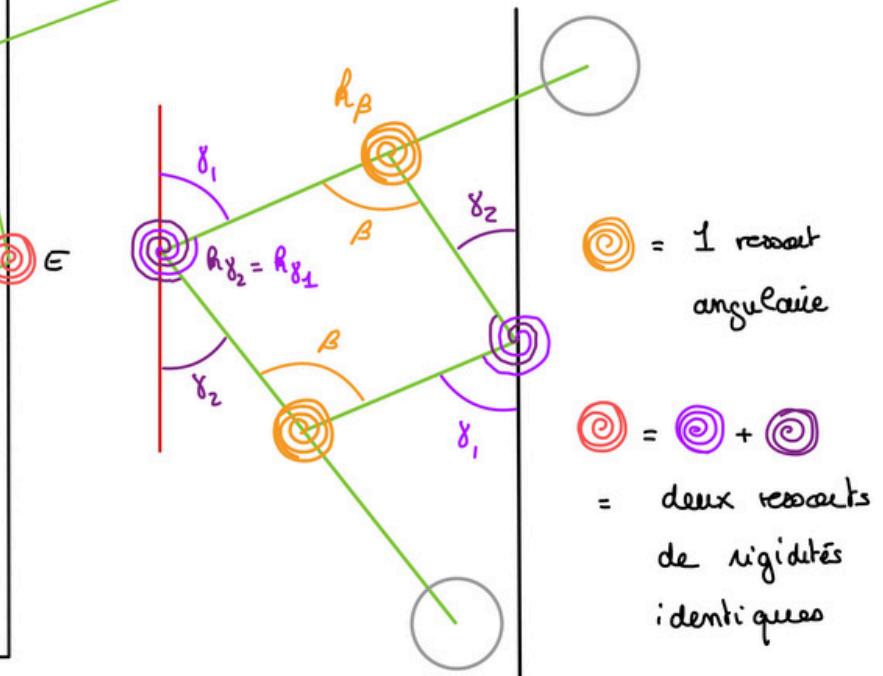
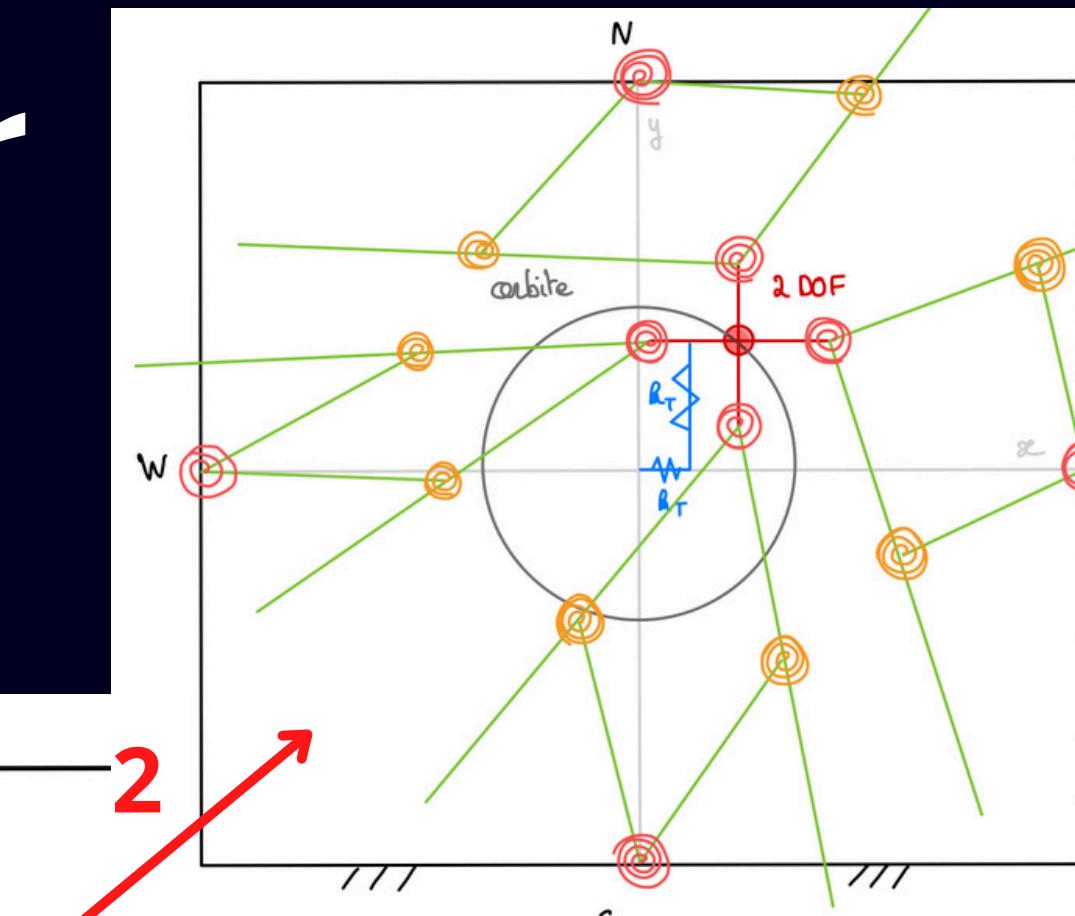
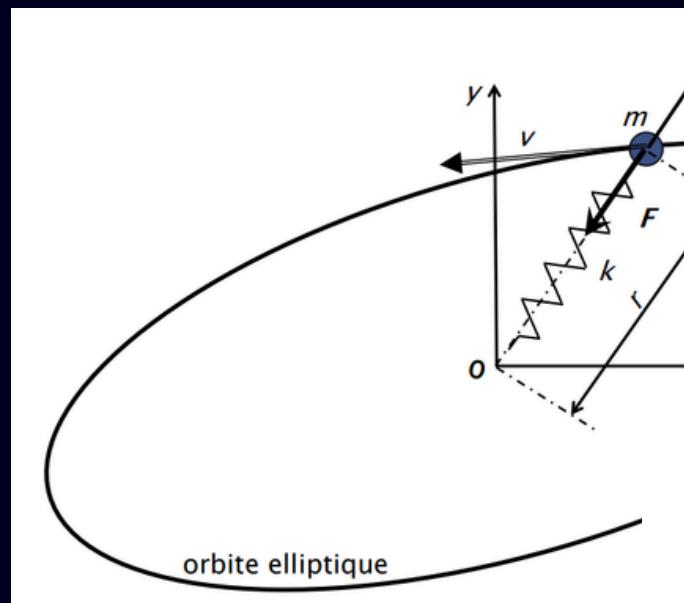
Lanfermann Paul

Mouillet Jeremie

Wybaillie Alexis



Principe de l'oscillateur



1. Décomposition de la rigidité sur 2 axes
2. Implémentation réelle

Schéma cinématique en articulations idéales



Plateforme à 2 DOF

Bâti

Masses (8x)

Glissières

Double Pivots

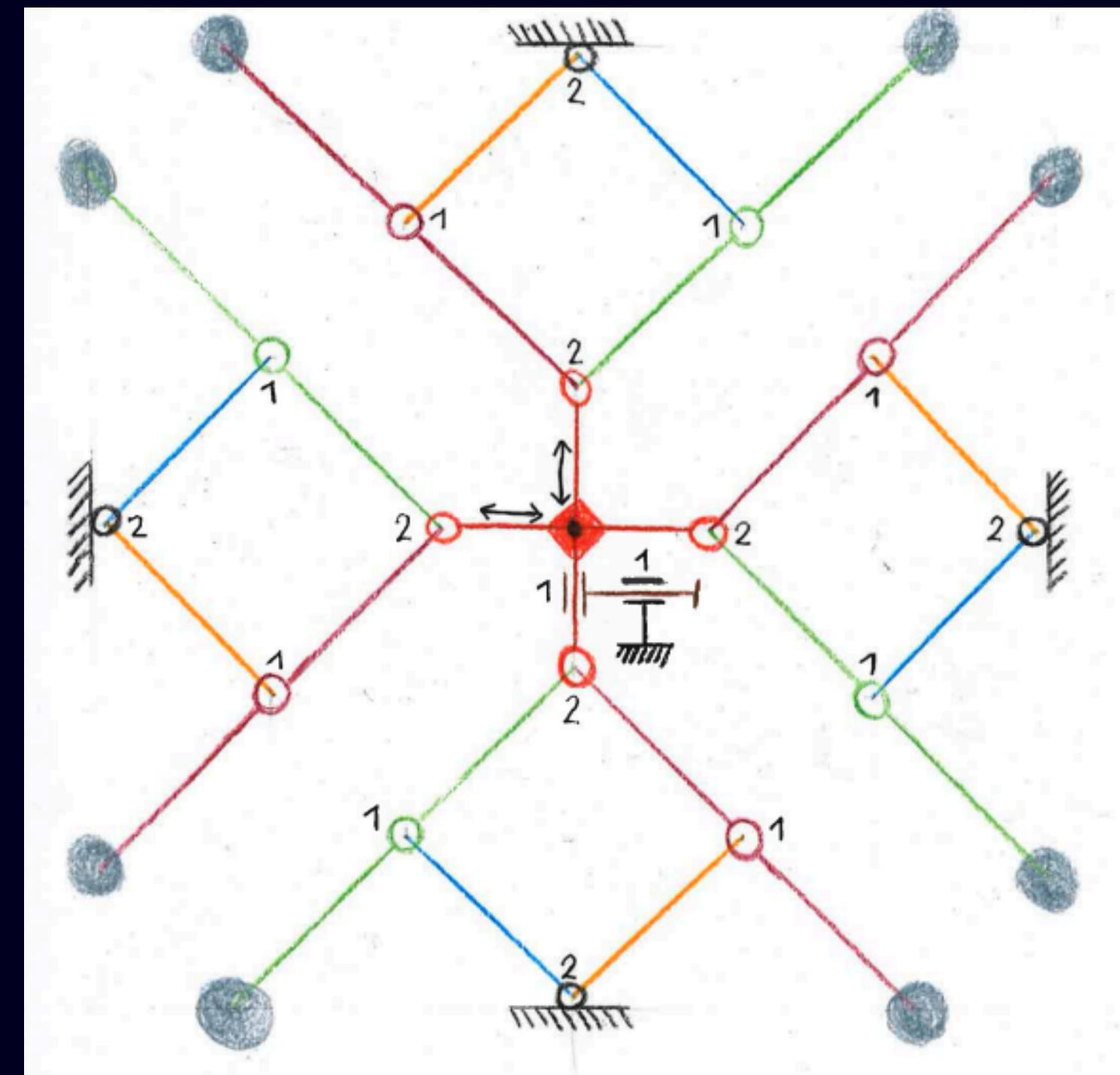
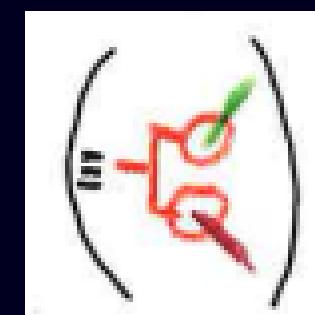
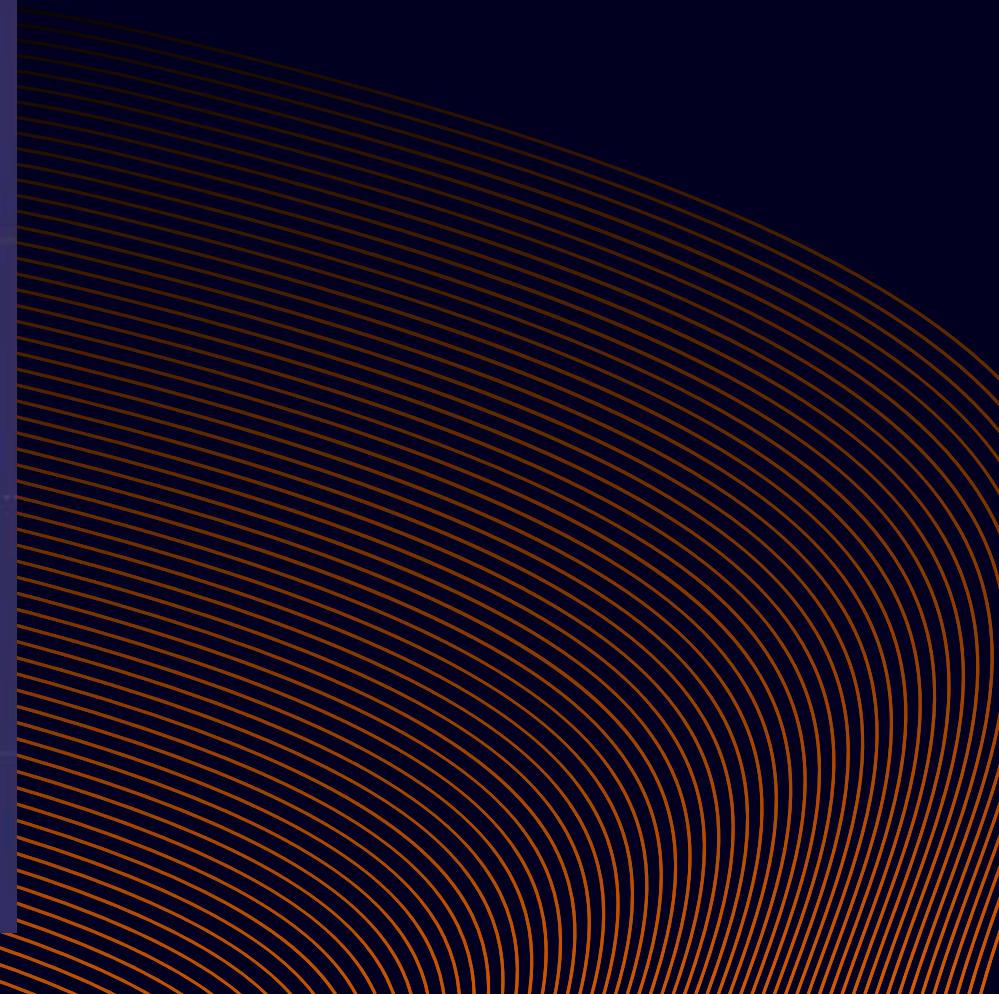
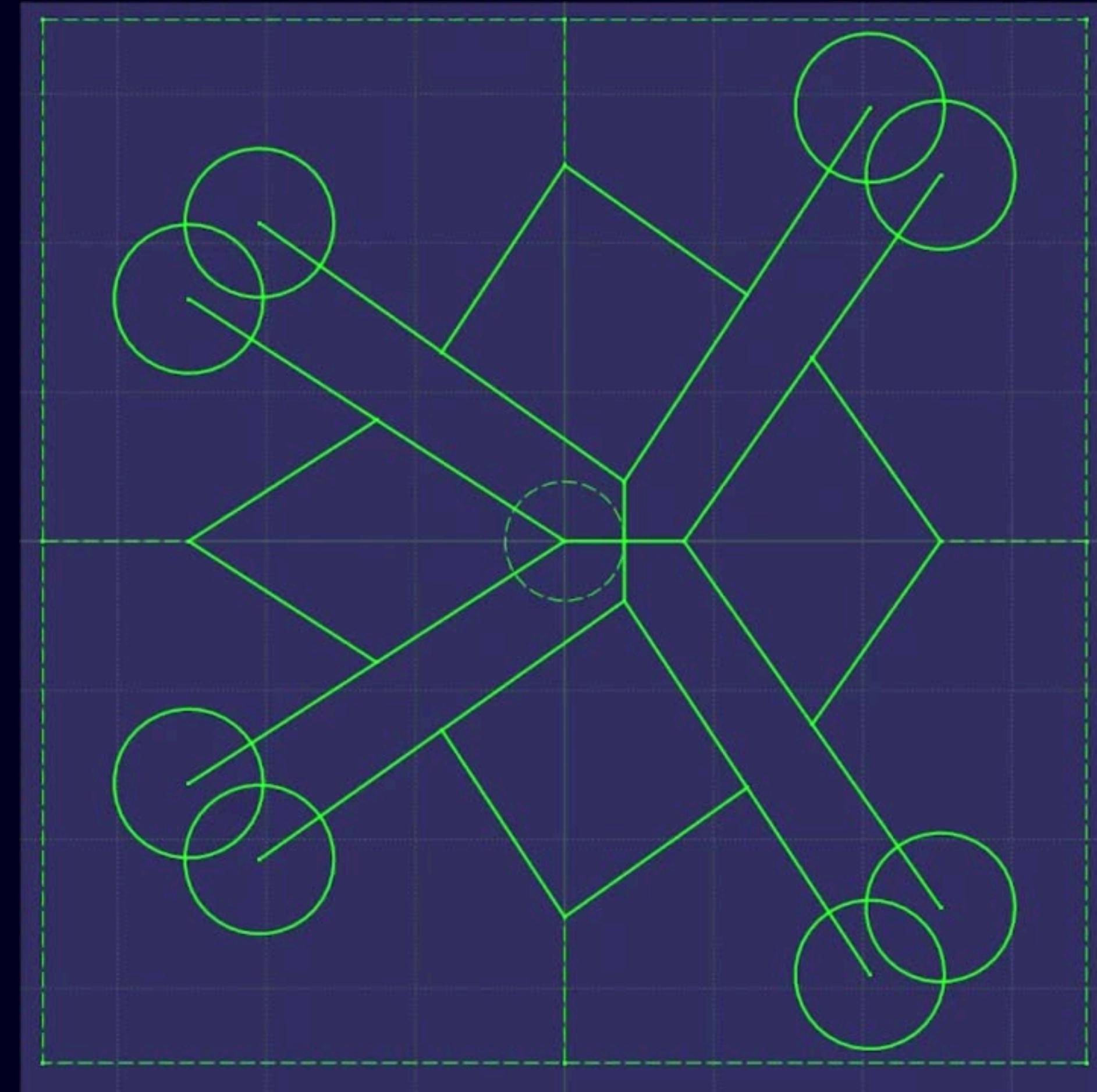
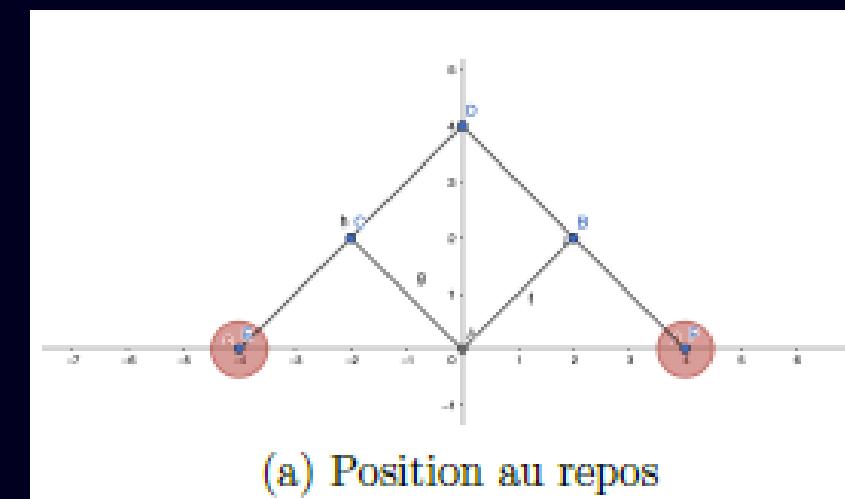
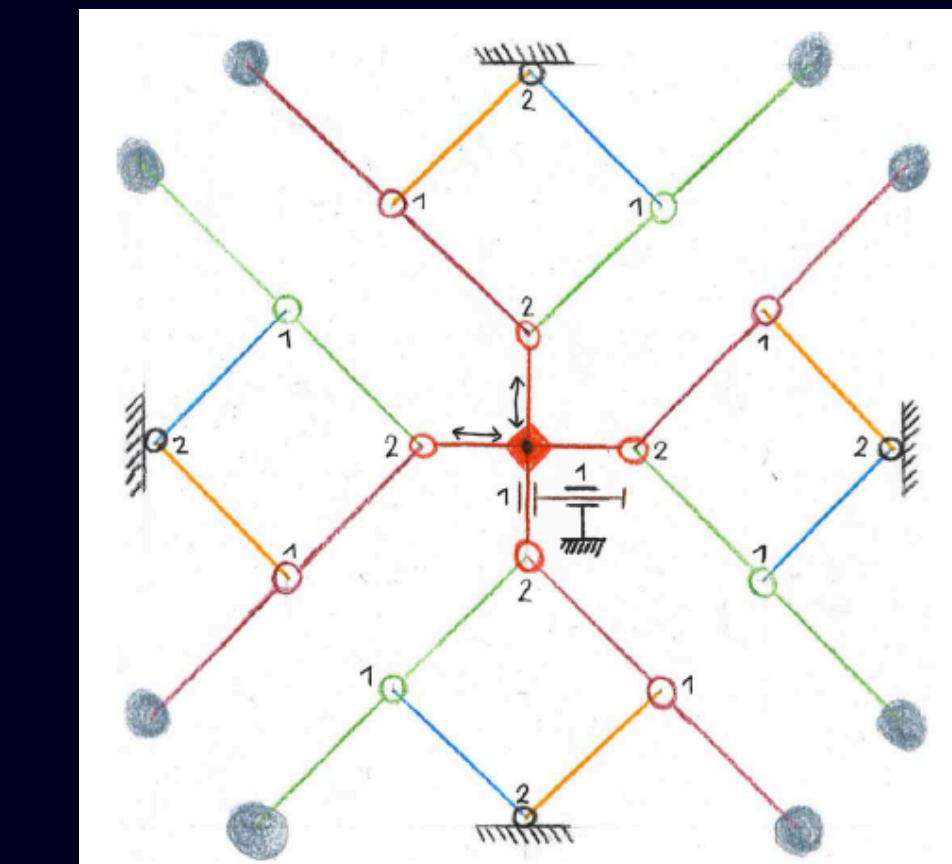
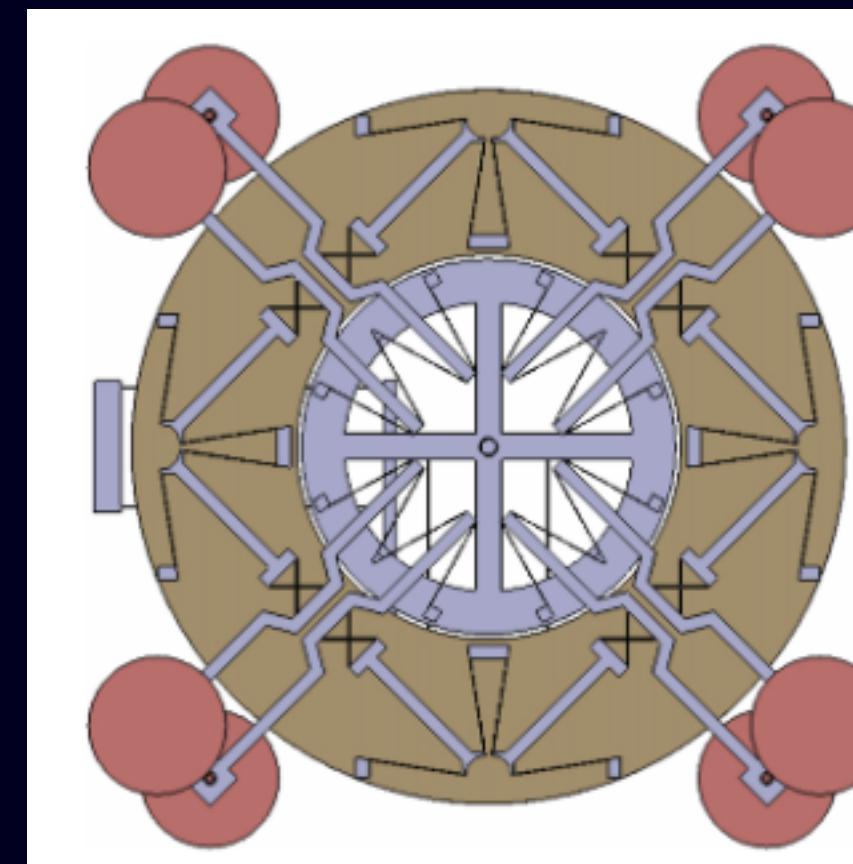


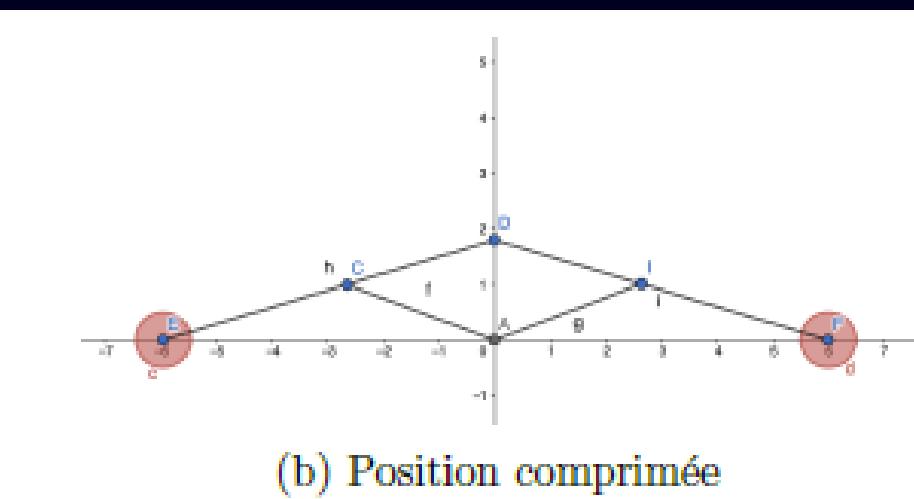
Schéma cinématique en articulations idéales



Équilibrage en force et en moment

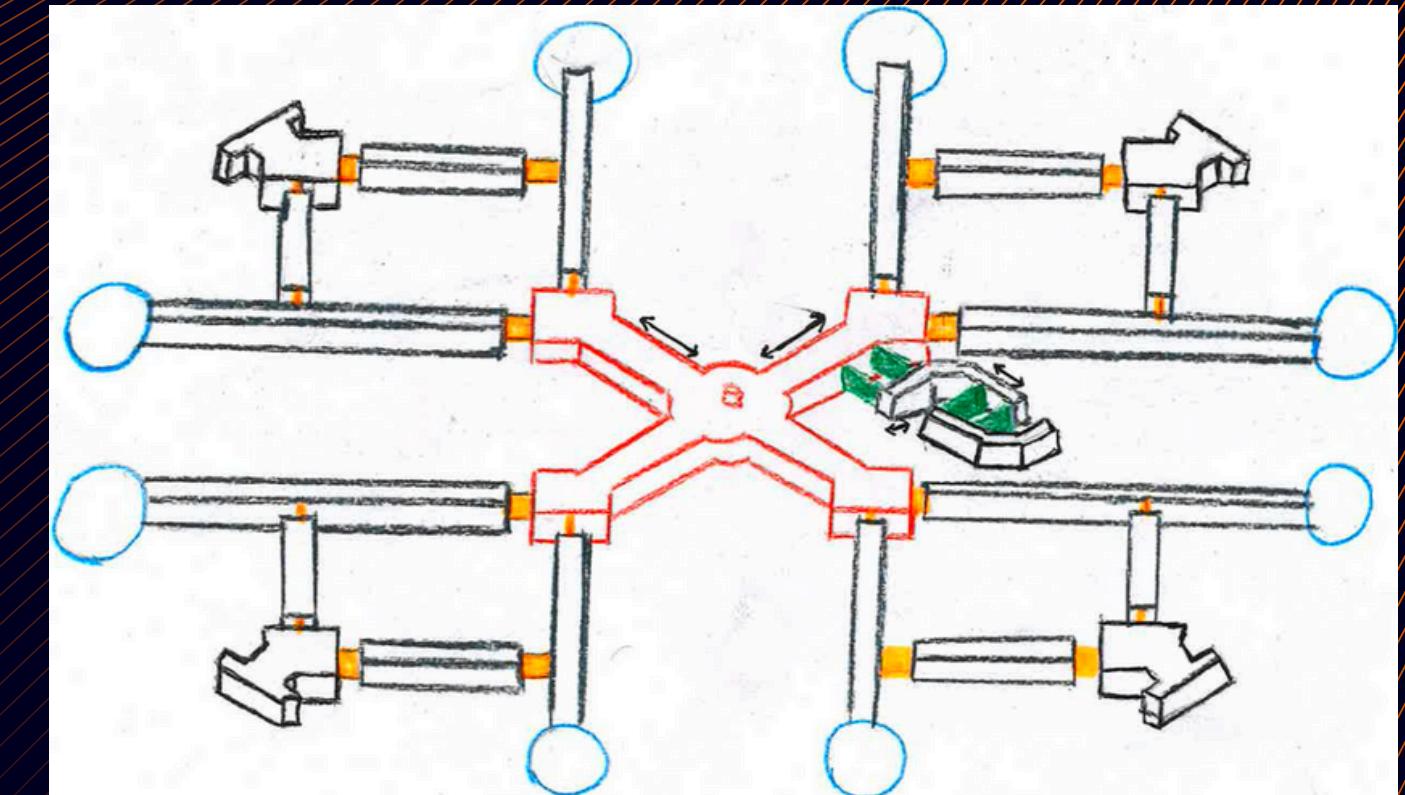


(a) Position au repos

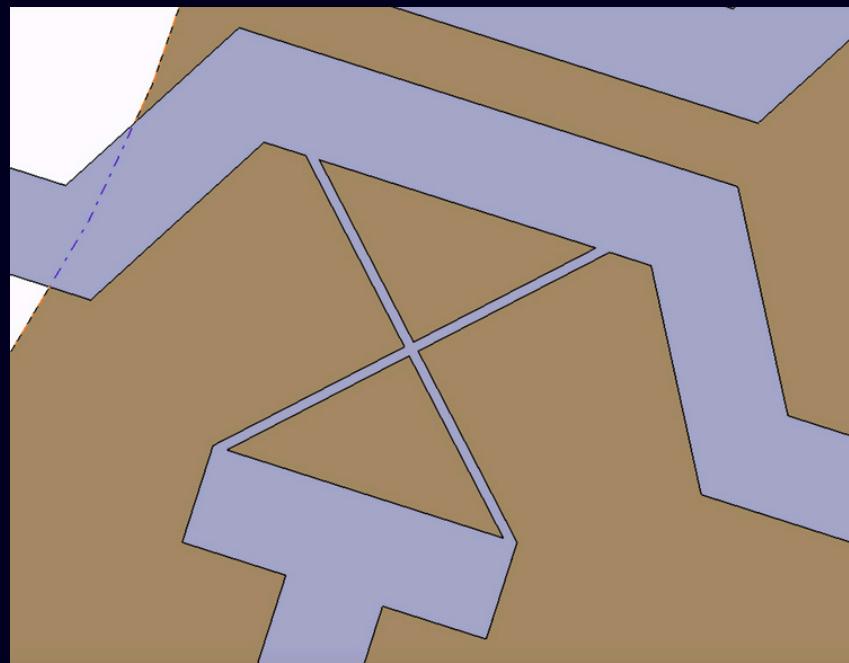


(b) Position compressée

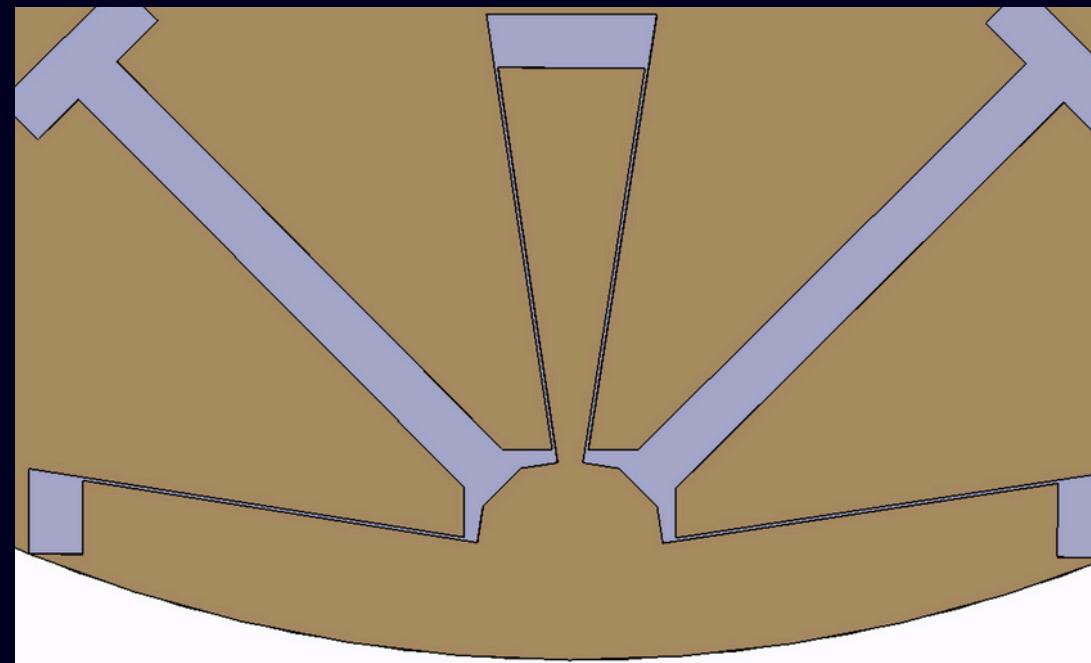
Implementation en guidage flexible



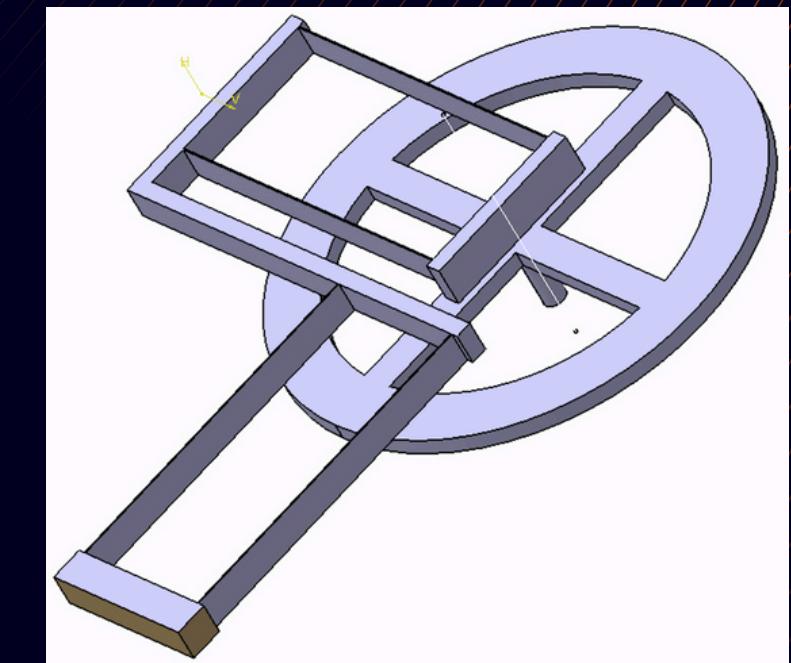
1ere itération de l'implementation en guidage flexible



Pivot Croisé

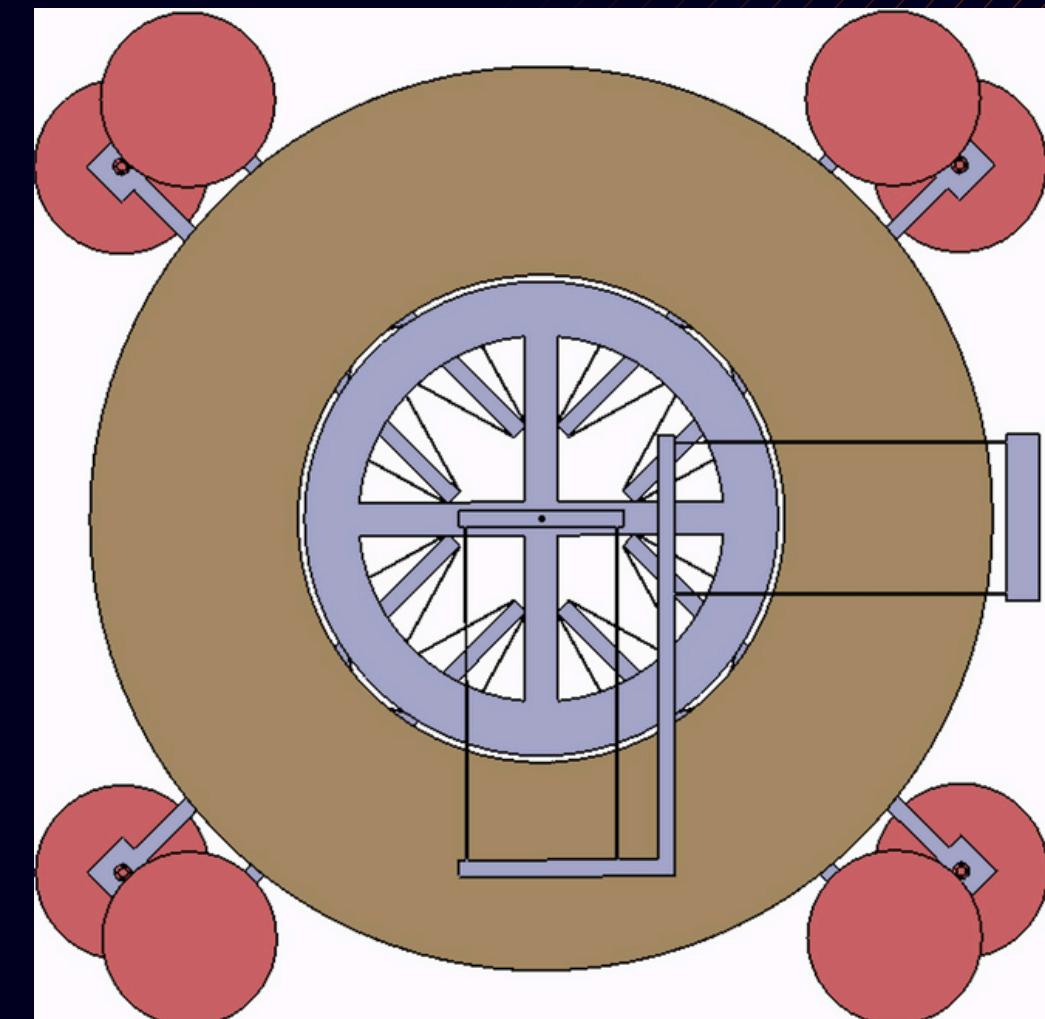
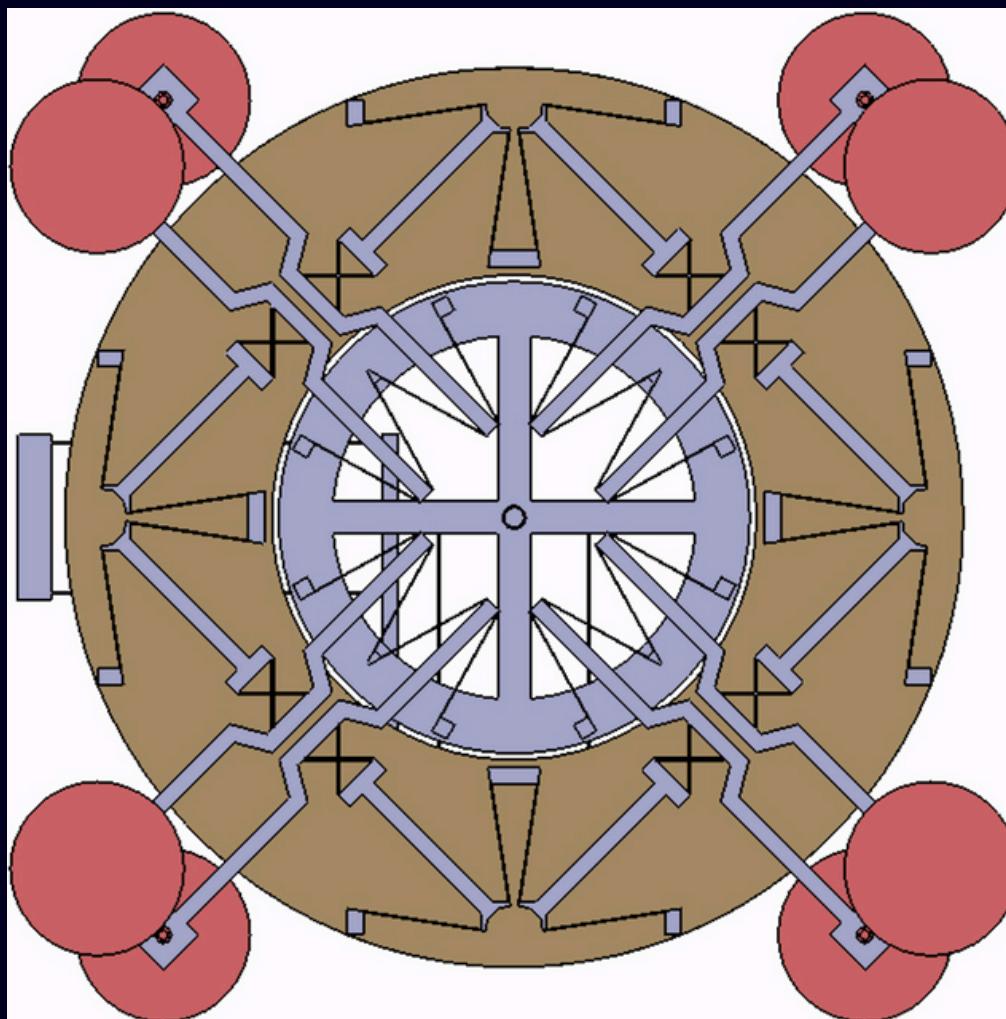


Double Pivot RCC

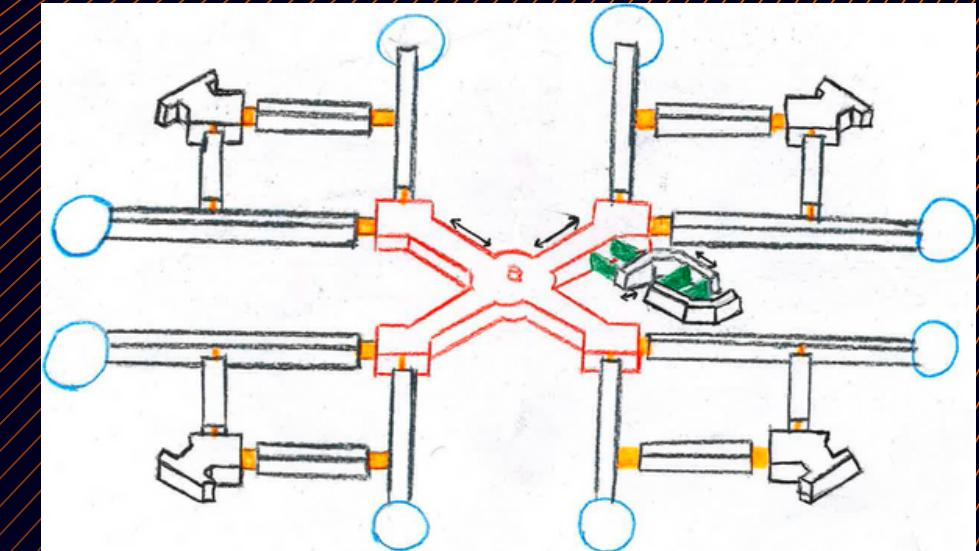


Deux Tables à Lames

Implementation en guidage flexible

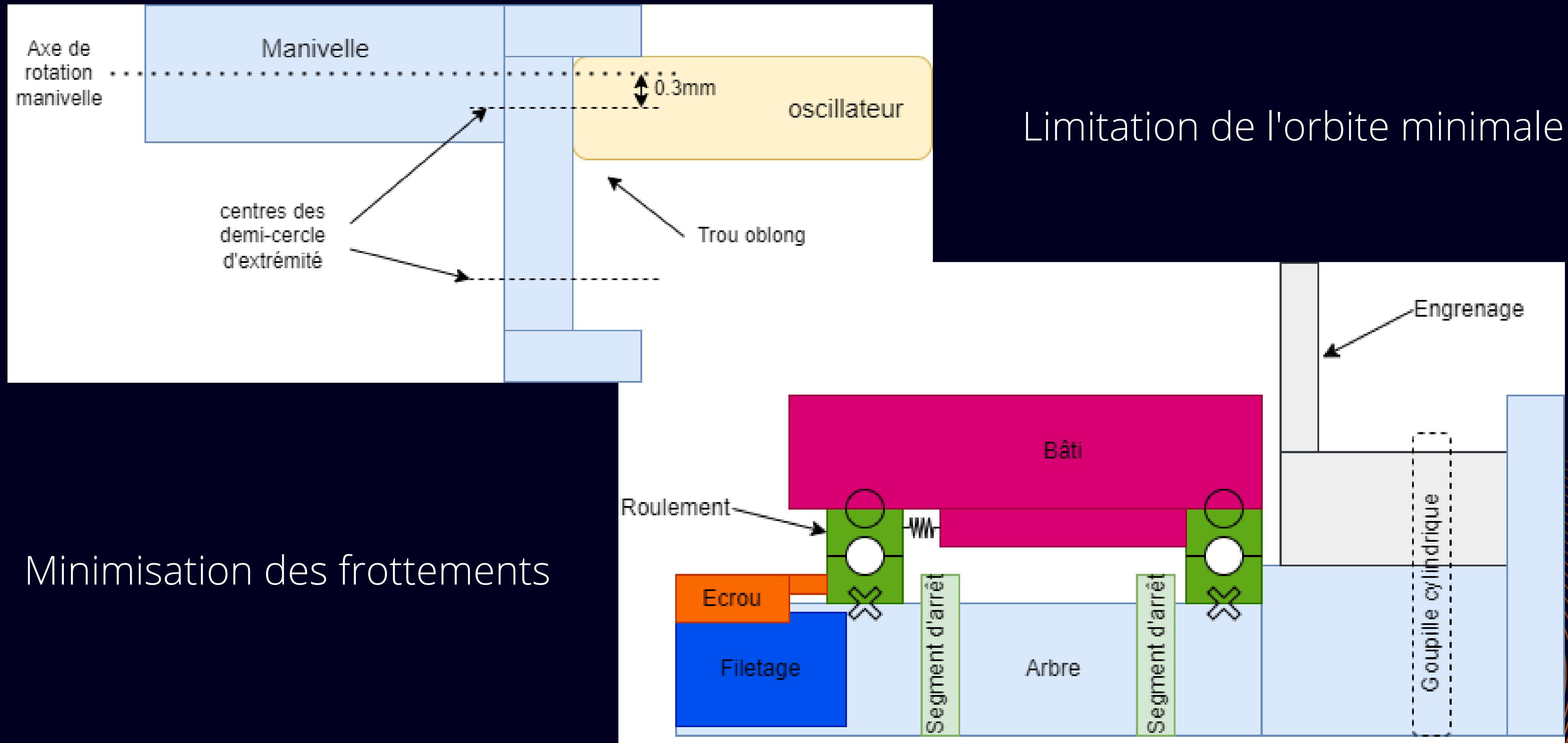


Implementation en guidage flexible (Version améliorée)



1ere itération de l'implementation en guidage flexible

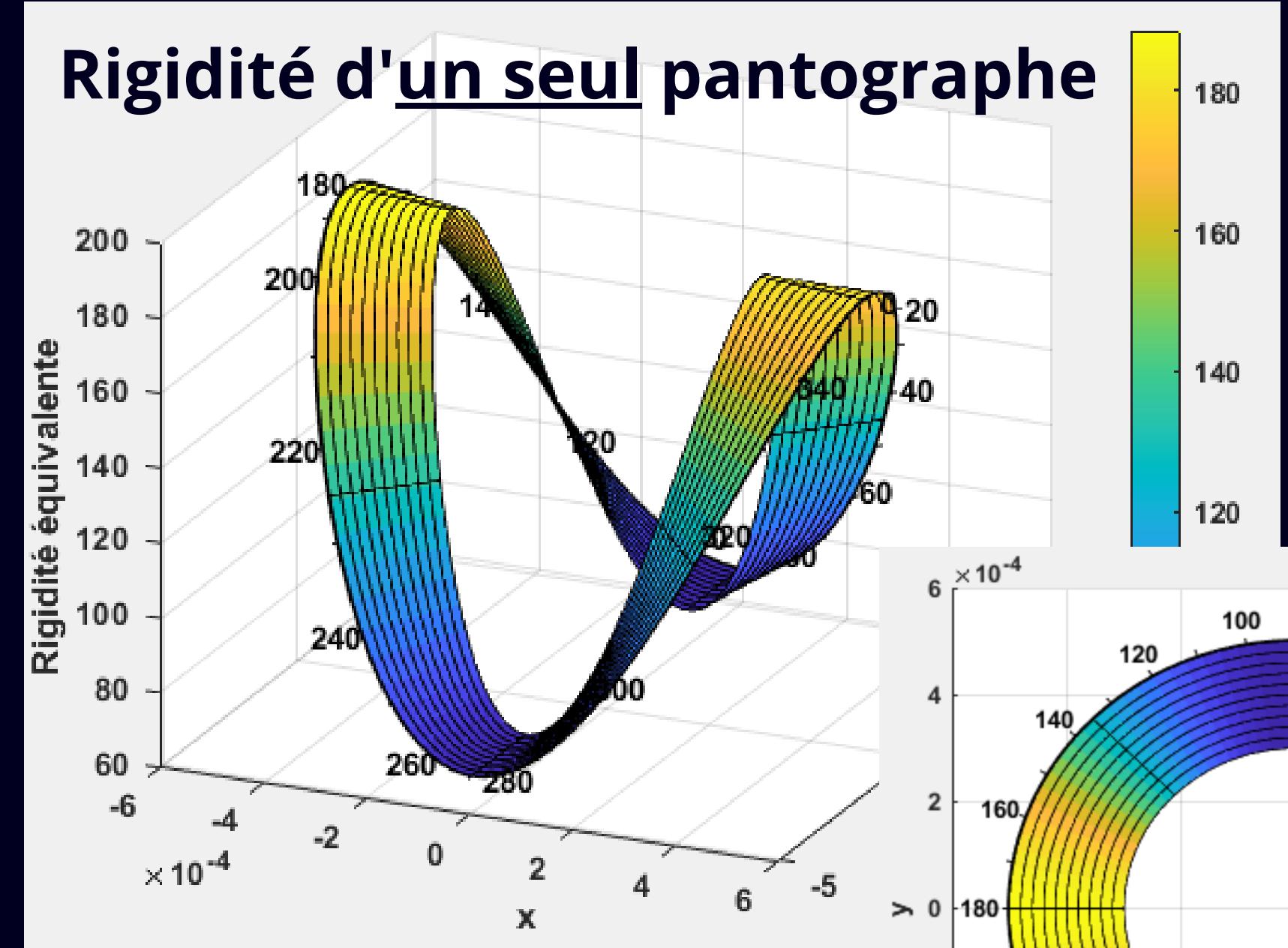
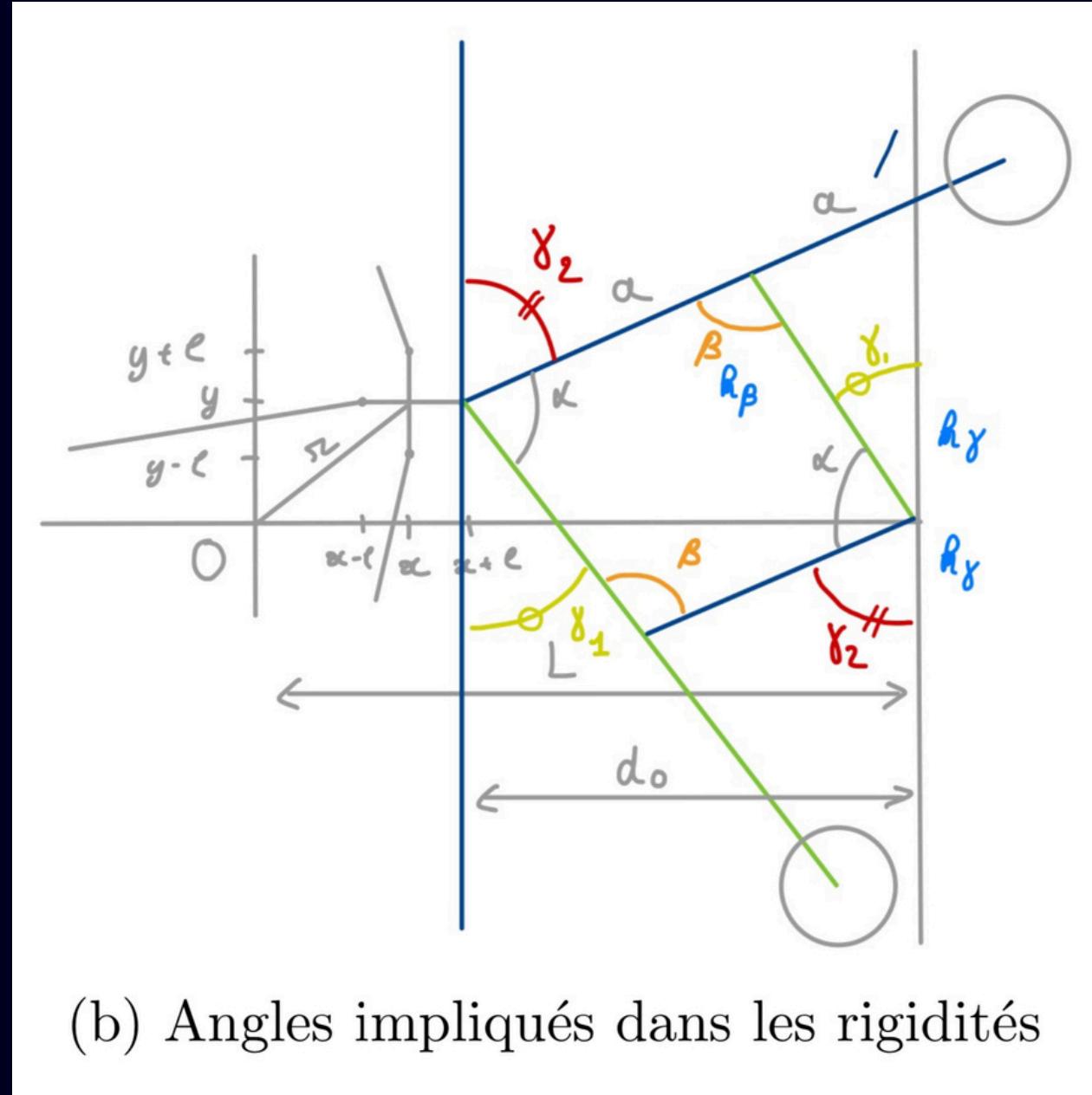
Manivelle



Alexis

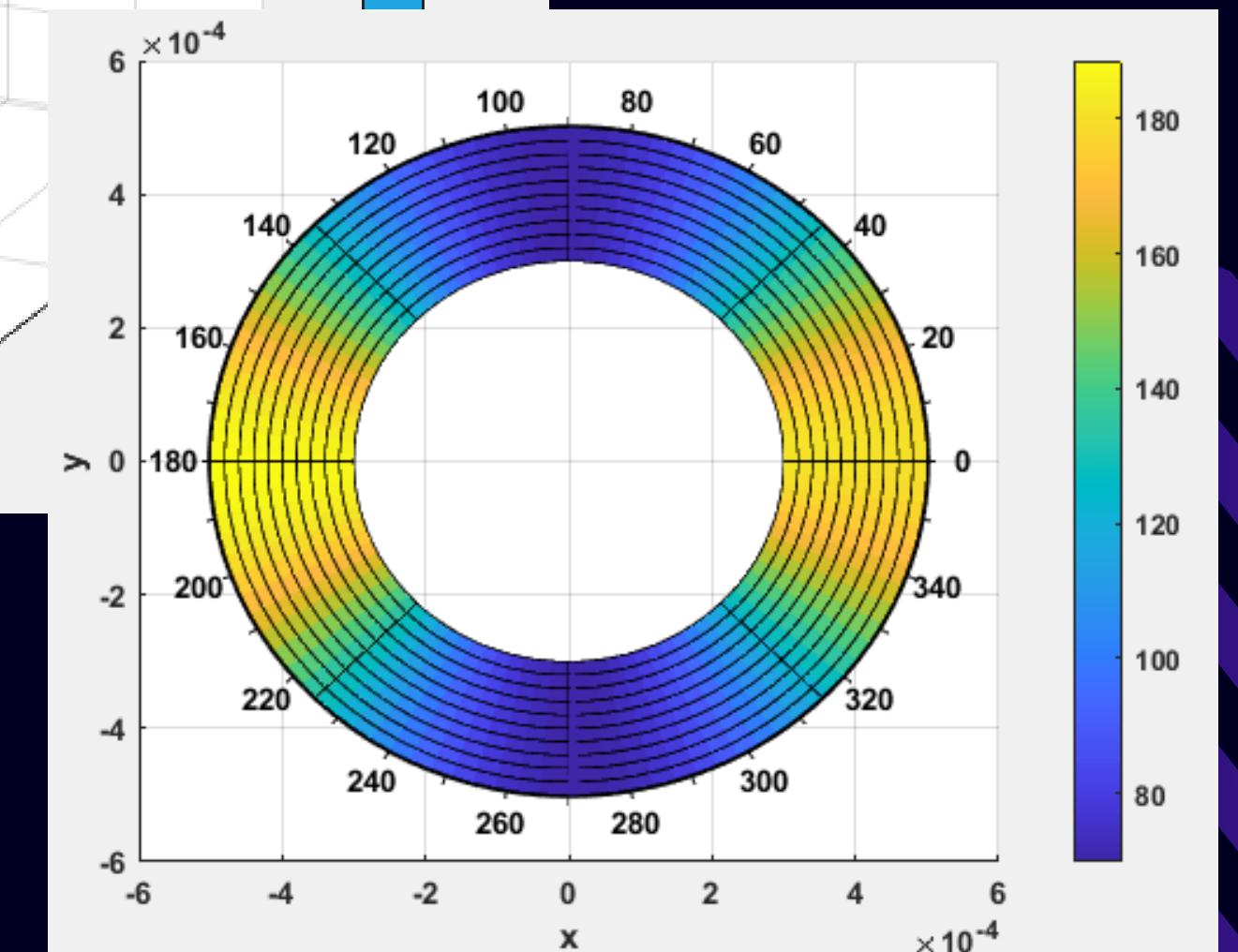
Module de Young	Limite de contrainte	limite d'élasticité	Largeur b	course angulaire maximale pour les pivots C	course maximale pour la table à lames
95 GPa	205 MPa	1800 MPa	2 mm	0,035 rad	0,5 mm
pivots lames croisées		pivots lames RCC		double table à lames	
longueur de lame l	4,25 mm	7,2 mm		20 mm	
épaisseur de lame h ($\geq 60 \mu m$)	60 μm	60 μm		83,3 μm	
rapport l/h (≤ 240)	70,8	120		240	
course angulaire admissible θ	0,076 rad	0,091 rad		3,45 mm	
rigidité k	0,0064 N.m.rad ⁻¹	0,0079 N.m.rad ⁻¹		28 N.m ⁻¹	<input type="button" value="▼"/>
contrainte maximale dans la lame σ	94 MPa	125 MPa		830 MPa	
facteur de sécurité après 50 ans	2,2	14,4		2,2	

Démarche et calcul de la rigidité équivalente

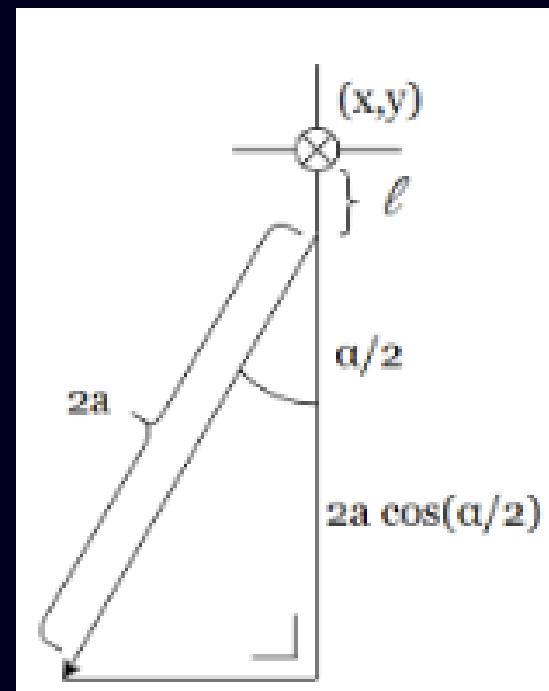
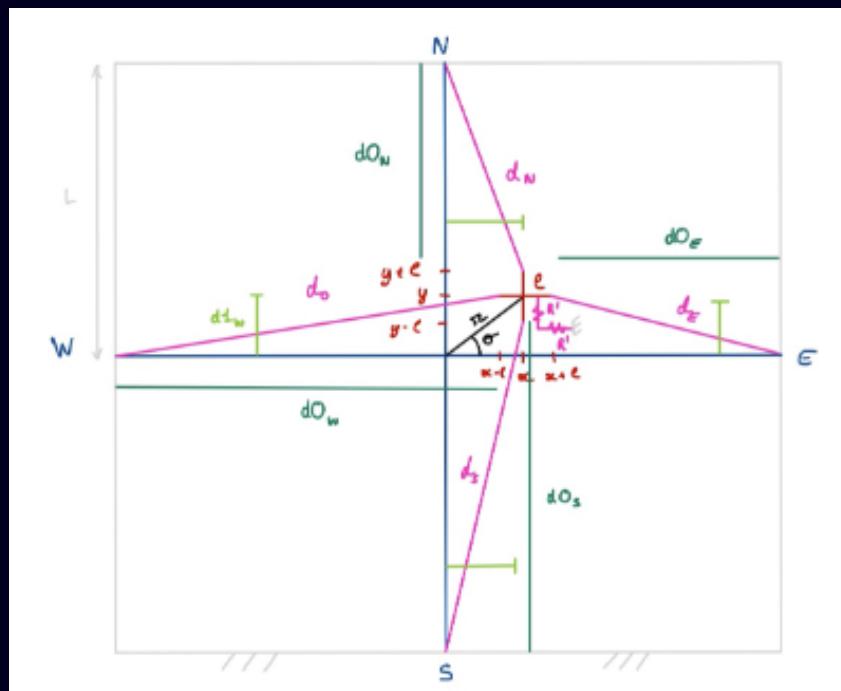


$$E_{pot,P,X} = \frac{1}{2} [2k_\gamma[(\gamma_1 - \gamma_0)^2 + (\gamma_2 - \gamma_0)^2] + 2k_\beta(\beta - \beta_0)^2]$$

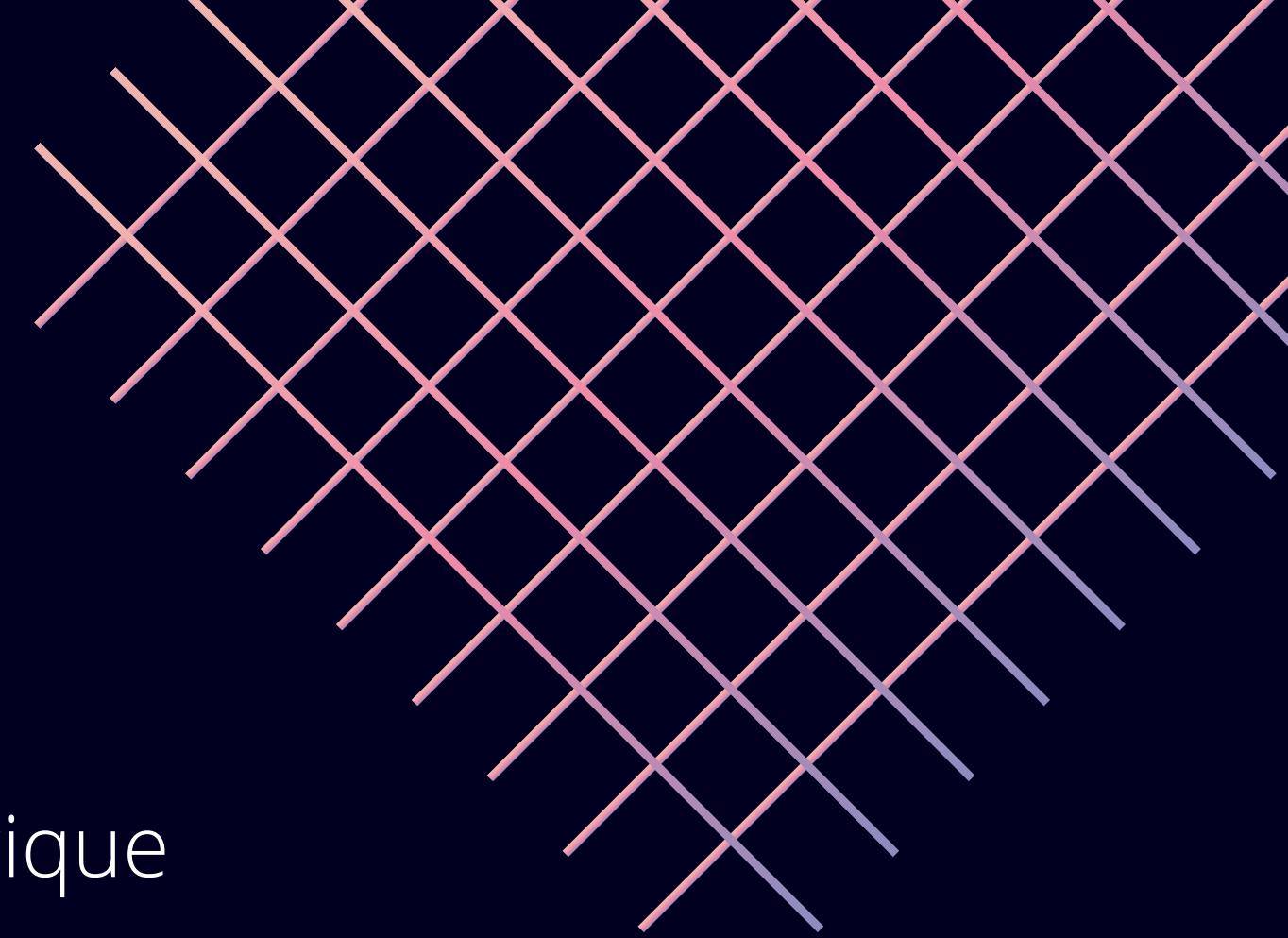
$$\sum_X \frac{1}{r^2} [2k_\gamma[(\gamma_1 - \gamma_0)^2 + (\gamma_2 - \gamma_0)^2] + 2k_\beta(\beta - \beta_0)^2]$$



Calcul de la masse réduite



Interpretation Géométrique



Résultat du calcul

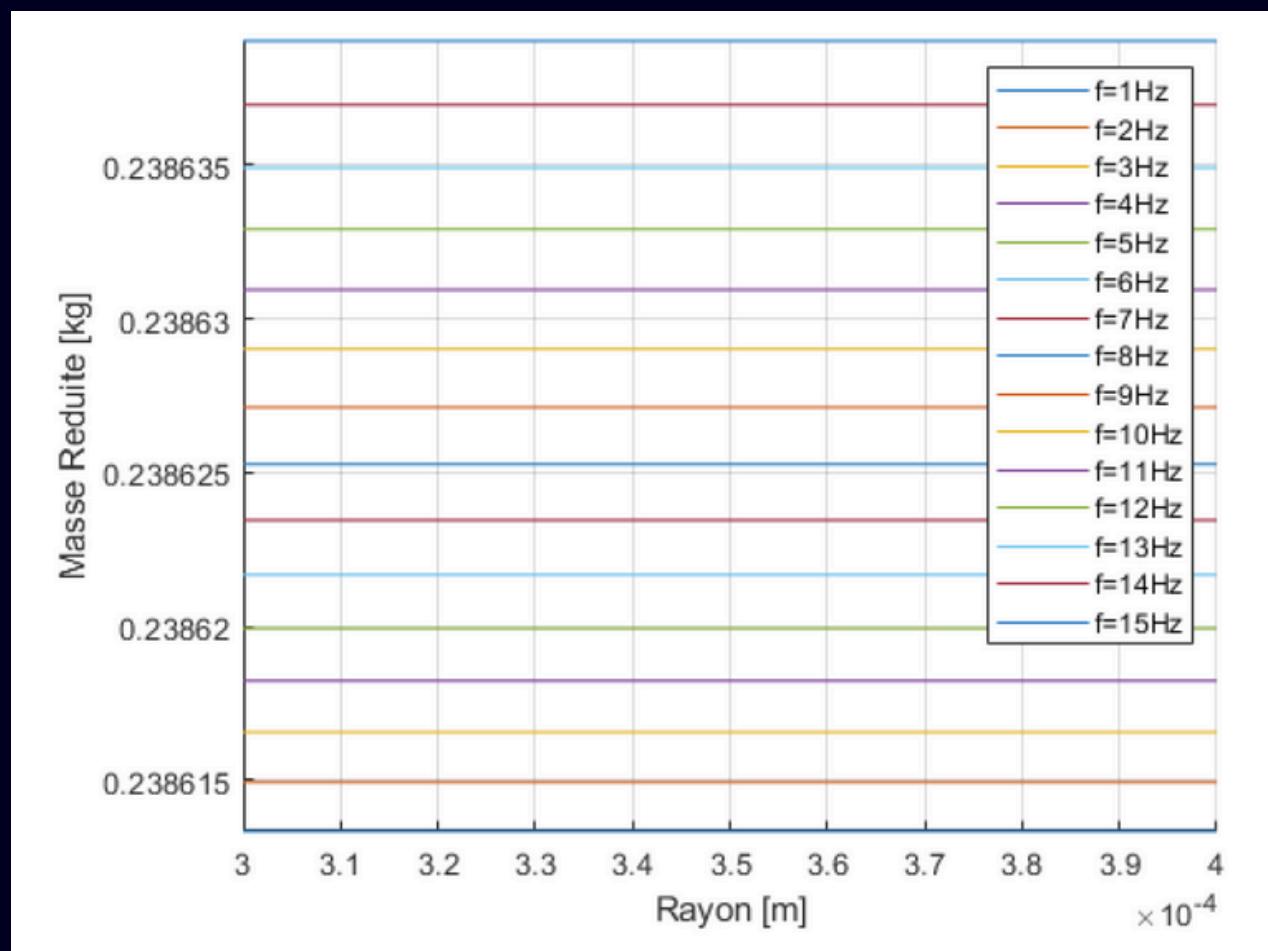
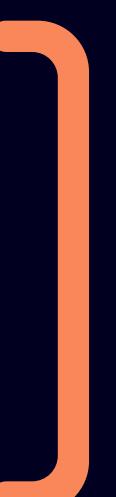


Formulation Mathématique

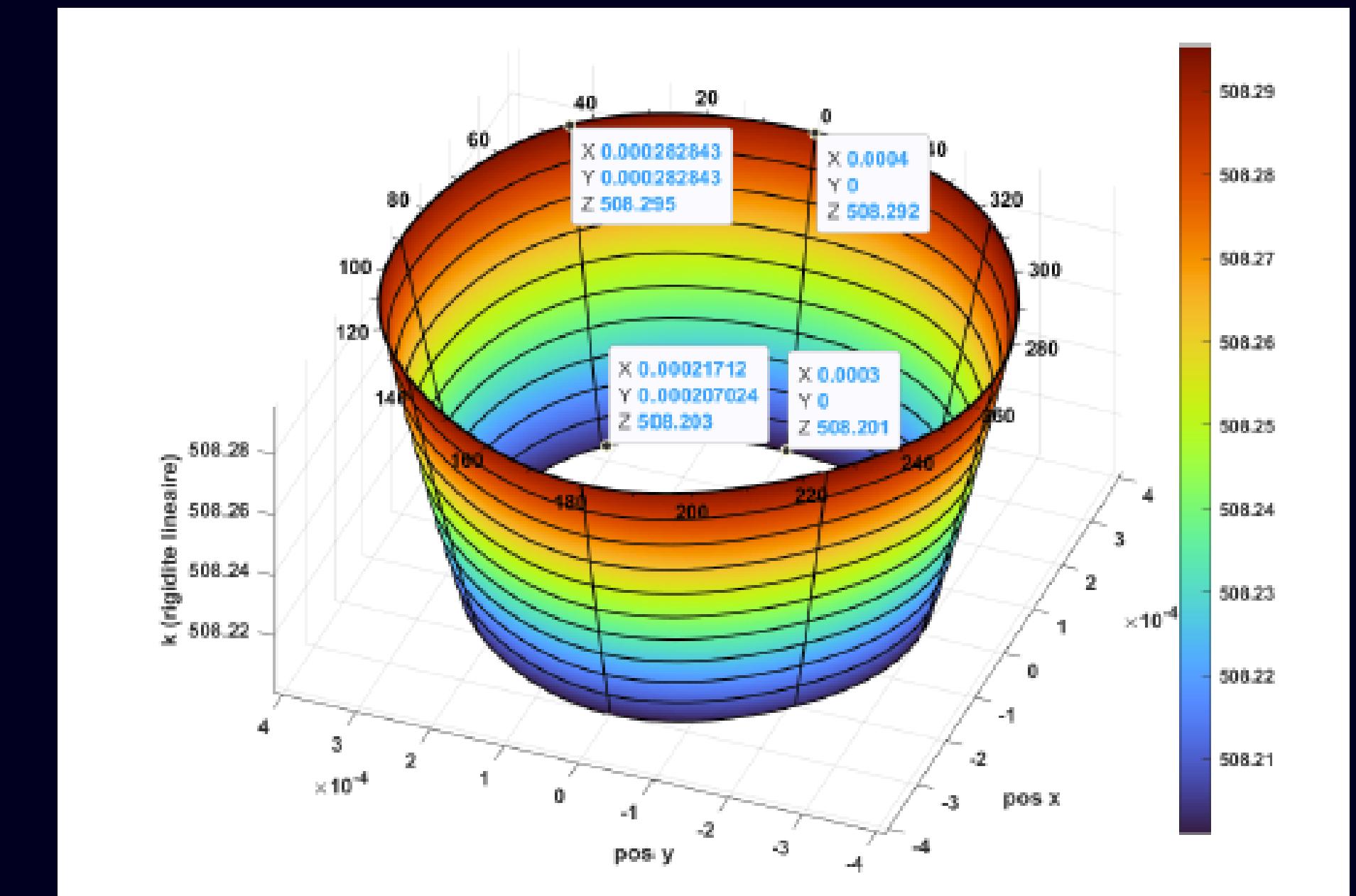
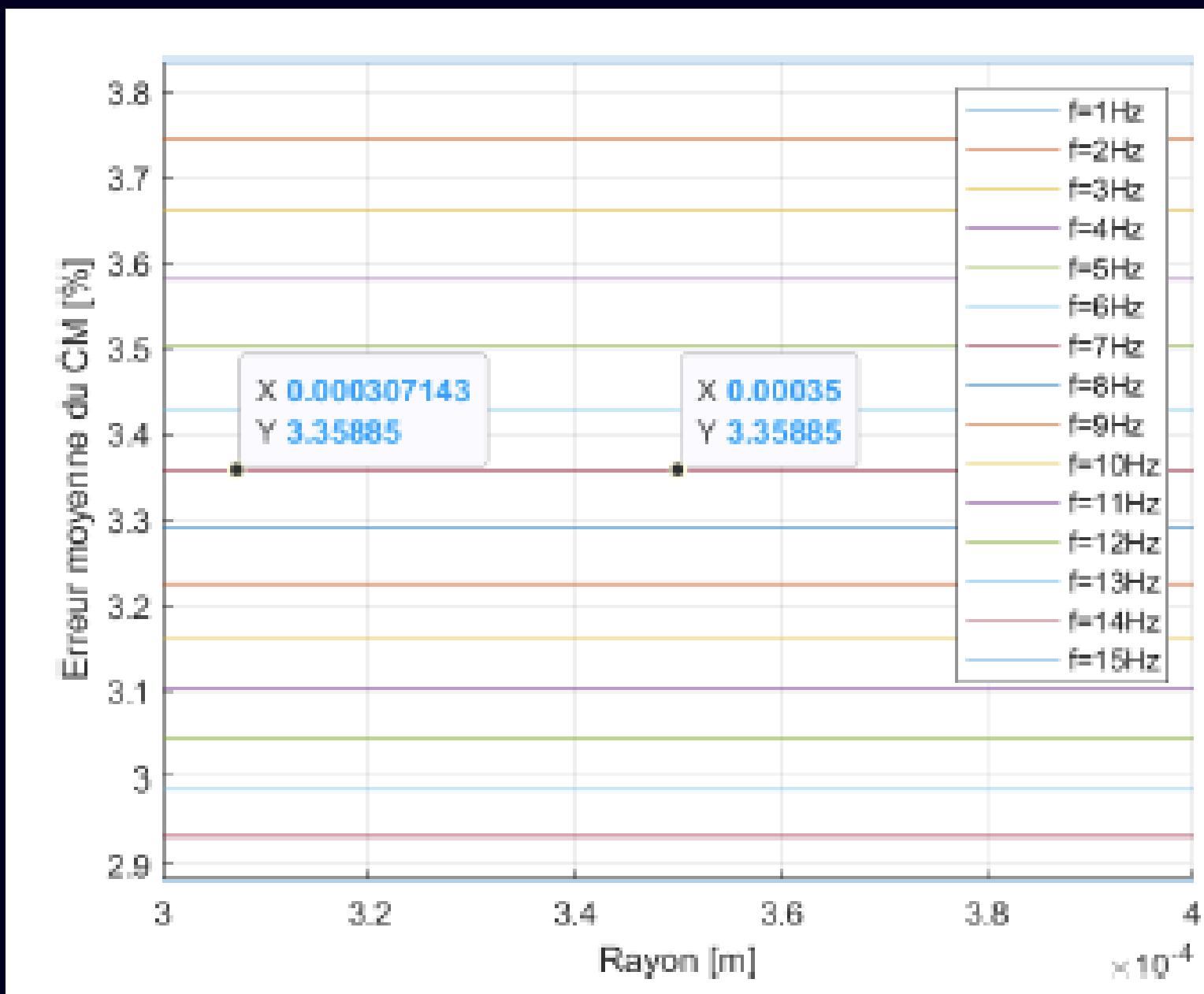
$$\overrightarrow{Pm}_{i,1}(x_0, y_0) = \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} - \begin{bmatrix} 0 \\ l \end{bmatrix} + 2a \begin{bmatrix} -\cos(\alpha/2) \\ -\sin(\alpha/2) \end{bmatrix}$$

$$\overrightarrow{Pm}_{i,2}(x_0, y_0) = \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} - \begin{bmatrix} 0 \\ l \end{bmatrix} + 2a \begin{bmatrix} \cos(\alpha/2) \\ -\sin(\alpha/2) \end{bmatrix}$$

$$\frac{1}{2} J_r \omega^2 = \sum_{i=1}^8 \left[\frac{1}{2} m_i v_i^2 \right]$$



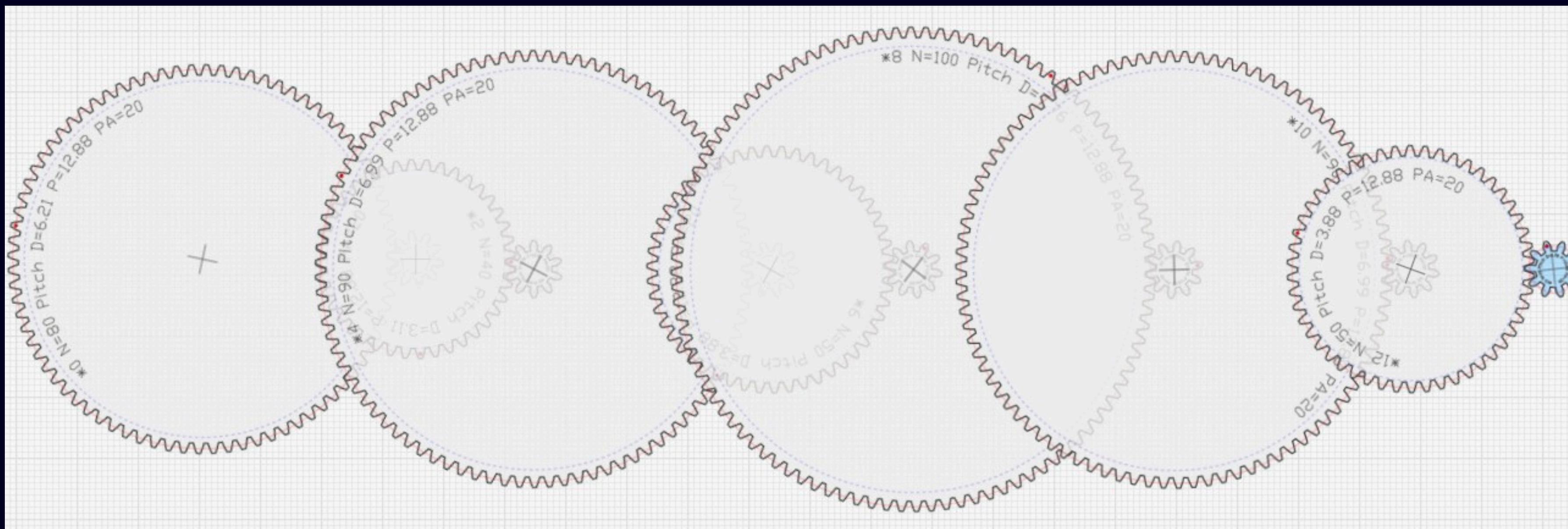
Isotropie de la masse et de rigidité



Transmission

Rapport Total	648 000
Couple max	1,10E-01
Couple min	7,00E-02
Fréquence de l'oscillateur (Hz)	7,5

Rendement manivelle	0,6
Rendement rouage	0,98
Rendement total	0,53



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MERCI !

Q & A