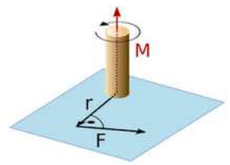
SCIENCES DE L'INGENIEUR

Formulaire – Modélisation des efforts



MODELISATION DES EFFORTS

RESSORT

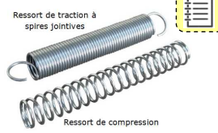
Force (N) — **Raideur** (N.mm^{-1}) — Allongement (mm)

$$F = k \cdot x$$

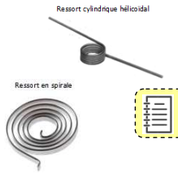
Couple (N.m) — **Raideur** (N.m.rad^{-1})

$$C = k \cdot \alpha$$

Angle de déformation (rad)



Ch9 F8 — Traction / Compression



Ch9 F8 — Torsion

ACTIONNEURS

- Moteur électrique
  - A courant continu — Ch4 F9

$$C = K \cdot I$$

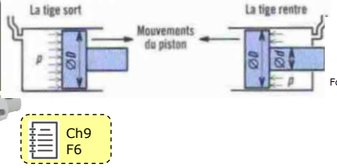
Intensité (A) — Constante de couple (N.m.A^{-1}) — Couple (N.m)

  - Pas à pas

  - Servomoteur

Voir catalogues constructeur

- Vérin — Ch9 F6



$$F = p \cdot S$$

Force (N) — Surface (m²) — Pression (Pa)

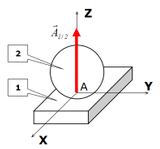
Unité légale : $N \cdot m^{-2}$, Pa avec $1\,Pa = 1\,N \cdot m^{-2}$

Unité pratique : MPa, bar avec $1\,bar = 10^5\,Pa$

DE CONTACT

GLISSEUR

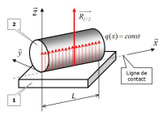
- Charge ponctuelle — Ch9 F4



$$\overrightarrow{A_{1/2}} \begin{vmatrix} 0 \\ 0 \\ Z_{A12} \end{vmatrix}$$

Unité légale : N

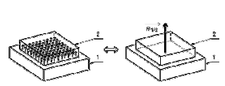
- Charge linéique — Ch9 F5



$$\overrightarrow{R_{1/2}} = \int_{x=0}^{x=L} q(x)\,dx\,\vec{z}$$

Unité légale : $N \cdot m^{-1}$

- Charge surfacique — Ch9 F6



$$\overrightarrow{R_{1/2}} = \int_S p(M) \cdot \overrightarrow{ds}$$

Si la pression est uniforme, on a :

$$F = p \cdot S$$

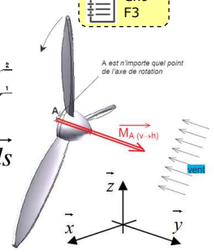
Force (N) — Surface (m²) — Pression (Pa)

Unité légale : $N \cdot m^{-2}$, Pa avec $1\,Pa = 1\,N \cdot m^{-2}$

Unité pratique : MPa, bar avec $1\,bar = 10^5\,Pa$

COUPLE

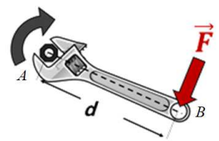
- Pur — Ch9 F3



$$\overrightarrow{M_{A(V \to h)}} \begin{vmatrix} 0 \\ 8 \\ 0 \end{vmatrix}$$

$$\{M_{A(V \to h)}\} = \begin{Bmatrix} 0 & 0 \\ 0 & 8 \\ 0 & 0 \end{Bmatrix}_A$$

- Moment d'une force — Ch9 F9



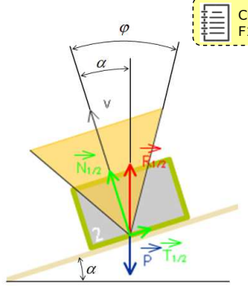
$$M_A(\vec{F}) = \pm F \times d$$

$$\overrightarrow{M_A(\vec{F})} = \overrightarrow{M_B(\vec{F})} + \overrightarrow{AB} \wedge \vec{F}$$

FROTTEMENT

SOLIDE

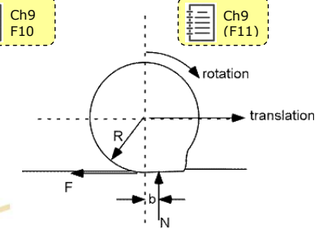
- De glissement (modèle de Coulomb) — Ch9 F10



$$T = N \cdot f$$

Coefficient frottement (-) — Composante normale (N) — Composante tangentielle (N)

- De roulement — Ch9 (F11)



$$C_R = b \cdot N$$

Force (N) — Distance (m) — Couple résistant (N.m)

FLUIDE (hydrodynamique)

- Régime laminaire — Ch13 F8

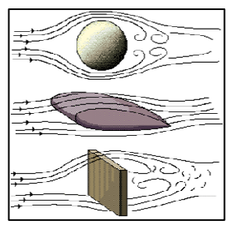
$m \cdot s^{-1}$, $Pa \cdot s$, m, N

$$F_t = k \cdot \eta \cdot v$$

- Régime turbulent — Ch13 F8

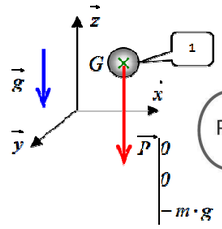
$m \cdot s^{-1}$, m^2, $kg \cdot m^{-3}$, N

$$F_t = \frac{1}{2} \rho \cdot S \cdot C_x \cdot v^2$$



A DISTANCE

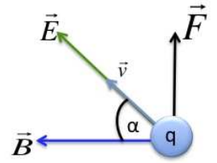
- Poids propre — Ch9 F7



$$\vec{P} = m \cdot \vec{g}$$

$$\{P\} = \begin{Bmatrix} \vec{P} \\ \vec{0} \end{Bmatrix}_G$$

- Force électromagnétique



$$\vec{F} = q \cdot \vec{E} + q \cdot \vec{v} \wedge \vec{B}$$