Física

Cinemática

MRU

$\Delta x = x_f - x_0$ | $v = \dfrac{\Delta x}{\Delta t} = \dfrac{x_f - x_0}{t_f - t_0}$ | $x = x_0 + v(t - t_0)$

Encuentro $x_A = x_B$ para $t = t_e$

MRUV $a = \dfrac{\Delta v}{\Delta t} = \dfrac{v - v_0}{t - t_0}$ | $v = v_0 + a(t - t_0)$ | $x = x_0 + v_0 t + \frac{1}{2} a t^2$

Dinámica

$F = ma$ | $P = mg$ | $f_{roz} = \mu_k N$ | $f_{roz} \leq \mu_s N$ | $F_{resorte} = \Delta x\, k$

Movimiento circular

$f_{cp} = m a_{cp} = m \omega^2 R = \dfrac{m v_T^2}{R}$ | $a = \dfrac{v^2}{R}$

$r\theta = v \Delta t$ | $v = R\dot{\theta} = R\dfrac{\theta}{\Delta t}$ | $\omega = \dfrac{v}{R} = \dfrac{\theta}{\Delta t}$

MCUA $a_{cp} = R\omega^2 = \dfrac{v^2}{R}$ | $a_T = R\ddot{\theta}$

Movimiento relativo

$\vec{r}_{real} = \vec{r}_{\text{sist referencia}} + \vec{r}\,'_{\text{con respecto al SR}}$

$\vec{v}_{real} = \vec{v}_{SR} + \vec{v}_{\text{con respecto al SR}}$

TRABAJO Y ENERGÍA

$T = F \cdot d \cos\alpha$

$W_{AB} = \int_A^B F\, d\vec{r} = \int_A^B |\vec{F}| \cos\theta \, dx$

$K = \frac{1}{2} m v^2$

$W_{TOTAL} = \Delta K$

$E_{pg} = mgh$

$E_{pe} = \frac{1}{2} k \Delta x^2$

$\Delta U = -W_{FC}$

$P = F \cdot v$

$W = \int_0^{t_f} P\, dt = \int_0^{t_f} F v\, dt$

$\Delta E_{mec} = W_{FNC}$

$E_{mec} = K + E_{pg} + E_{pe}$

Impulso $J = F \Delta t$

Cantidad de movimiento $P = m v$

$J = P_f - P_0$

$F_{ext} = 0 \rightarrow P_f = P_0$

Sistemas de partículas:

$r_{cm} = \frac{1}{M_{TOTAL}} \sum_i^n \vec{r}_i m_i$

$v_{cm} = \frac{1}{M_{TOTAL}} \sum^n m_i v_i$

$a_{cm} = \frac{1}{M_{TOTAL}} \sum^n m_i a_i$

$P_i = m_i v_i$

$\vec{P}_{sist} = \sum P_i = M_T v_{cm}$

$E_T = \sum E_i$

$\sum F_{ext} = M a_{cm}$

$M_T \vec{a}_{cm} = \dot{\vec{P}}_{TOT} = \sum \vec{F}_{ext}$

$K_{cm} = \frac{1}{2} M v_{cm}^2$

Colisiones $\Delta P = 0$

Elásticas $K_i = K_f$

Inelásticos $K_i \neq K_f$

$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_{1i} + \left(\frac{2 m_2}{m_1 + m_2}\right) v_{2i}$

$v_{2f} = \left(\frac{2 m_1}{m_1 + m_2}\right) v_{1i} + \left(\frac{m_2 - m_1}{m_1 + m_2}\right) v_{2i}$

$v_f = \left(\frac{m_1}{m_1 + m_2}\right) v_{1i} + \left(\frac{m_2}{m_1 + m_2}\right) v_{2i}$

ROTACIÓN

- CINEMÁTICA

$\alpha = \frac{d\omega}{dt}$	$\omega = \frac{d\theta}{dt}$	$\theta = \int \omega\, dt$	$\omega = \int \alpha\, dt$	$a_R = \frac{v^2}{R} = \omega^2 R$
$x = R\theta$	$v_T = R\omega$	$a_T = R\alpha$		

- DINÁMICA

Inercia $\boxed{I = \sum m_i r_i^2}$

$\boxed{I_{\text{eje arbitrario}} = I_{cm} + Mh^2}$

h = dist entre eje arbitrario y eje en cm

Energía cinética $\boxed{k = \frac{1}{2} I \omega^2}$

Torque $\boxed{\tau = R \wedge F}$ $\boxed{|\tau| = |R||F| \operatorname{sen}\theta}$

$\boxed{\sum \tau_{ext} = I\alpha}$

Trabajo $\boxed{W = \int \tau\, d\theta}$ $\boxed{dW = \tau\, d\theta}$

$\boxed{W = \Delta k}$ $\boxed{dW_{neto} = \sum \tau_{ext}\, \omega\, dt}$

Potencia $\boxed{P = \tau \omega}$ $\boxed{P = \frac{dW}{dt}}$

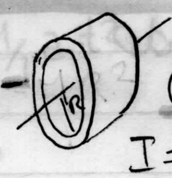
Ímpetu angular

Partícula $\boxed{l = r \wedge p = r.p.\operatorname{sen}\theta}$

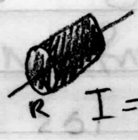
$\boxed{\sum \tau = \frac{dl}{dt}}$ $\boxed{l_z = \underbrace{mr^2}_{I} \omega}$

Inercia de Rotación

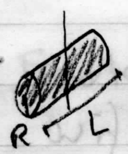
- Aro $I = MR^2$



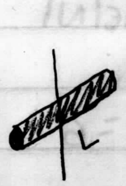
- Cilindro $I = \frac{M}{2}(R_1^2 + R_2^2)$



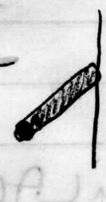
- Cilindro $I = \frac{MR^2}{2}$



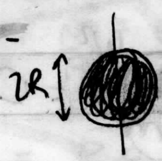
- Cilindro $I = \frac{MR^2}{4} + \frac{ML^2}{12}$



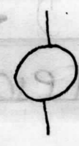
- Varilla $I = \frac{ML^2}{12}$



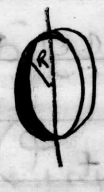
- Varilla $I = \frac{ML^2}{3}$



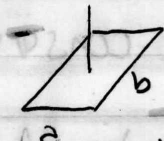
- Esfera $I = \frac{2MR^2}{5}$



- Cascarón $I = \frac{2MR^2}{3}$



- Aro $I = \frac{MR^2}{2}$



- Placa Rectangular $I = \frac{M(a^2 + b^2)}{12}$

- Partícula $I = Mr^2$

r = distancia al eje

Sistemas:

$\boxed{\sum \tau_{ext} = \frac{dL}{dt}}$

L y W $\boxed{L = I\omega}$

$\boxed{I_i \omega_i = I_f \omega_f}$ $\boxed{\text{constante}}$

Producto vectorial

$\vec{v} = a\hat{i} + b\hat{j} + c\hat{k}$
$\vec{w} = a'\hat{i} + b'\hat{j} + c'\hat{k}$ $\Rightarrow$ $\vec{v} \wedge \vec{w} = |\vec{v}||\vec{w}|\sin\theta = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a & b & c \\ a' & b' & c' \end{vmatrix}$

EQUILIBRIO

Si un sist está en equilibrio, entonces para cada rígido:

$\sum_i F = 0 \rightarrow$ i)
$\rightarrow$ j)

$\sum_i \tau_P = 0$ (Respecto a cualquier punto)

Verifico
- Todas las $N \geq 0$
- $|F_R| \leq M_E |N|$
- $T \geq 0$

OSCILACIONES

- En resorte $\ddot{x} + \left(\frac{k}{m}\right) x = 0$ (w_0^2)

$E = \frac{1}{2} k x^2 + \frac{1}{2} m \dot{x}^2$

- Se conserva la energía

General: $\ddot{x} + w_0^2 x = 0$

$x(t) = A\cos(w_0 t + \varphi)$
$\dot{x}(t) = -w_0 A \sin(w_0 t + \varphi)$
$\ddot{x}(t) = w_0^2 A \cos(w_0 t + \varphi)$

Condiciones iniciales
$x(0) = x_0 \Rightarrow x_0 = A\cos\varphi$
$\dot{x}(0) = v_0 \Rightarrow v_0 = -A w_0 \sin\varphi$
$\Rightarrow$ despejo A y φ

Periodo $T = 2\pi / w_0$ (seg)
Frecuencia $= 1/T$ (Hz)
Frecuencia angular $= w_0$
Amplitud $= A$

Oscilaciones pequeñas si $\theta \approx 0$ $\Rightarrow$ $\sin\theta \approx \theta$, $\cos\theta \approx 1$