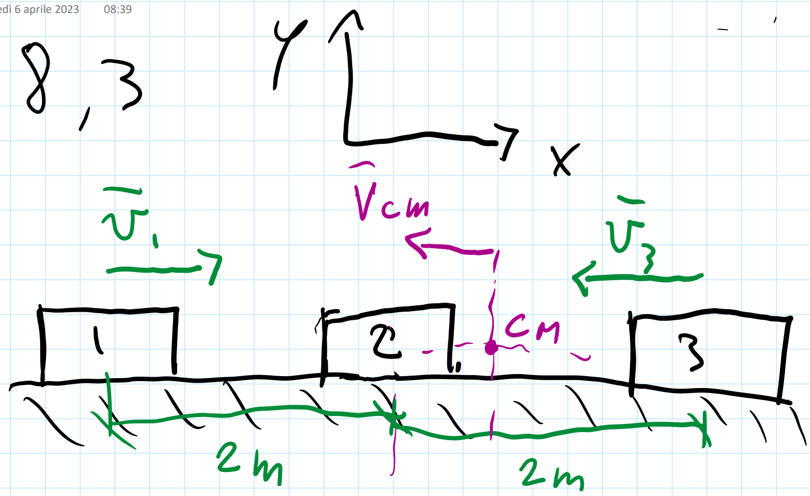
Tutorato06

giovedì 6 aprile 2023 08:39

8,3



$m_1 = 1\ kg$

$m_2 = 4\ kg$

$m_3 = 3\ kg$

$v_1 = 2\ m/s$

$v_3 = -1\ m/s$

$v_2 = 0\ m/s$

$P = m_{TOT} \cdot v_{CM} = (cost)$

in assenza $\bar{F}$ esterne

$v_{CM} = ?$ (v_{sist})

$$\bar{P} = \sum_i m_i \bar{v}_i = m_1 \bar{v}_1 + \cancel{m_2 \bar{v}_2} + m_3 \bar{v}_3$$

$$P = 1 \cdot 2 + 3 \cdot (-1) = -1\ Ns$$

$$M_{TOT} \cdot v_{CM} = -1 \quad (=P)$$

$$v_{CM} = \frac{P}{M_{TOT}} = \frac{-1}{1+4+3} = -\frac{1}{8}\ m/s = -0,125\ m/s$$

(ip: <u>urto anelastico</u>)

ΔP_1 PUNTO 1

$$\Delta P_1 = m_1 (\Delta v_1) \underset{1}{=} m_1 (v_{fin} - v_{in})$$

$$\Delta p_1 = m_1(\Delta v_1) = m_1(v_{fin} - v_{in})$$
$$= 1(-0{,}125 - 2)$$
$$= (-)2{,}125 \ Ns$$

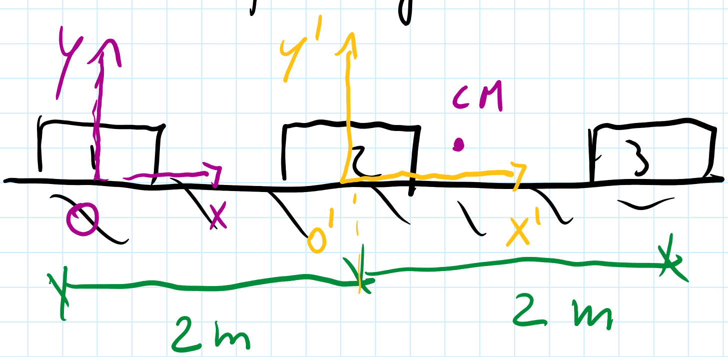
$$\cancel{\Delta E_{K_3} = \frac{1}{2} m_3 (\Delta v_3)^2} \rightsquigarrow \text{NO}$$

$$(-0{,}125 - 1)^2 \rightsquigarrow (-1{,}125)^2$$

$$\Delta E_{K_3} = \frac{1}{2} m_3 (v_{CM})^2 - \frac{1}{2} m_3 (v_3)^2$$
$$= \frac{1}{2} \cdot 3 (-0{,}125)^2 - \frac{1}{2} \cdot 3 (-1)^2$$
$$= (-)1{,}477 \ J$$

(en cinetica 3 è diminuita)

Ora corpi fermi $\rightsquigarrow X_{CM}$?



$$X_{CM} = \frac{\overset{(v_1 m_1)}{x_1 m_1} + x_2 m_2 + x_3 m_3}{m_1 + m_2 + m_3}$$

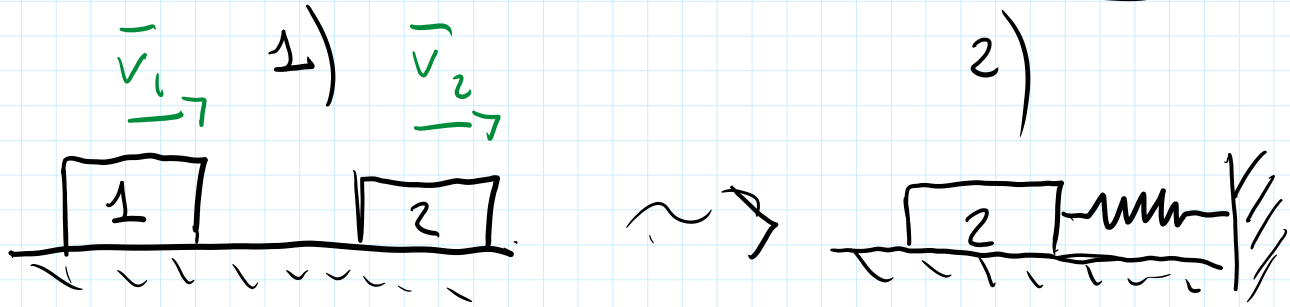
(Oxy)

$$\overline{}$$
$$m_1 + m_2 + m_3$$

$$= \frac{0 \cdot 1 + 2 \cdot 4 + 4 \cdot 3}{8} = 2,5\ m$$

$(O'x'y)$

$$X_{CM} = \frac{-2 \cdot 1 + 0 \cdot 4 + 2 \cdot 3}{8} = 0,5\ m$$



$m_1 = m_2 = 0,5\ kg$ $\qquad V_1 = 10\ m/s$

$\mu = 0$ $\qquad V_2 = 5\ m/s$

URTO ELASTICO $\rightarrow \left(\begin{array}{l} \bar{P}_{TOT} = cost \\ E_{K_{TOT}} = cost \end{array} \right)$

$$\begin{cases} m_1 v_1 + m_2 v_2 = m_1 \cdot v_1' + m_2 \cdot v_2' = (m_1 + m_2) \cdot V_{CM} \\ \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_1 (v_1')^2 + \frac{1}{2} m_2 (v_2')^2 = \left(\frac{1}{2} M_{TOT} (v_{CM})^2 \right) \end{cases}$$

$(v' = v_{fin})$

$(v' = v_{fin})$

$$\begin{cases} 0{,}5\,(10+5) = 0{,}5\,(v_1' + v_2') \\ \parallel \end{cases}$$

$$\begin{cases} 15 = v_1' + v_2' \rightsquigarrow v_1' = 15 - v_2' \\ \cancel{\frac{1}{2}} \cdot \cancel{0{,}5} \cdot 100 + \cancel{\frac{1}{2}} \cdot \cancel{0{,}5} \cdot 25 = \cancel{\frac{1}{2}} \cdot \cancel{0{,}5}\,(15 - v_2')^2 + \cancel{\frac{1}{2}} \cdot \cancel{0{,}5} \cdot (v_2')^2 \end{cases}$$

$$\begin{cases} \parallel \\ 125 = (v_2')^2 - 30(v_2') + 225 + (v_2')^2 \end{cases}$$

$$\begin{cases} \\ 2(v_2')^2 - 30v_2' + 100 = 0 \end{cases}$$

$$(v_2')^2 - 15v_2' + 50 = 0$$

$$(v_2' - 10)(v_2' - 5) = 0$$

$\nearrow v_2' = 10\ m/s$ I)

$\searrow v_2' = 5\ m/s$ II)

II)

$$\left.\begin{aligned} v_2' &= 5\,m/s \\ v_1' &= 10\,m/s \end{aligned}\right\}$$

CASO SISTEMA IN CUI 2 MASSE NON SI TOCCANO, OVVERO SONO IN

MOTO STAZIONARIO

I) $\left.\begin{aligned} v_2' &= 10\ m/s \\ v_1' &= 5\ m/s \end{aligned}\right\}$ SOLUZIONE CERCATA URTO ELASTICO

$\bar{V}$ corpo 2 rispetto corpo 1

$\leadsto V'_{2\,REL} = 5\ m/s$

$\left(\underbrace{\bar{V}_{TOT}}_{10\ m/s} = \underbrace{\bar{V}_{\substack{SISTEMA \\ RELATIVO}}}_{5\ m/s} + \bar{V}_{\substack{CORPO \\ RELATIVA}} \right)$

$F = m \cdot a \qquad -K \cdot x = m \dfrac{d^2x}{dt^2}$

BILANCIO FORZE

$\left(\sqrt{\dfrac{m}{K}} = \omega\right) \qquad x = -\omega^2 \dfrac{d^3x}{dt^2}$

BILANCIO ENERGIA

$E_{TOT} = cost$

$\downarrow$

$E_K + E_{elastica} = cost$

$\left(\dfrac{1}{2} m (V_2')^2 = \dfrac{1}{2} K (\Delta x)^2 + cost \right)$

$$\left(\frac{1}{2} m (V_2) = -\frac{1}{2} K (\Delta x) + \text{cost} \right)$$

$\rightsquigarrow$ caso Δx_{MAX} $\rightsquigarrow$ TUTTA CINETICA DIVENTA ELASTICA

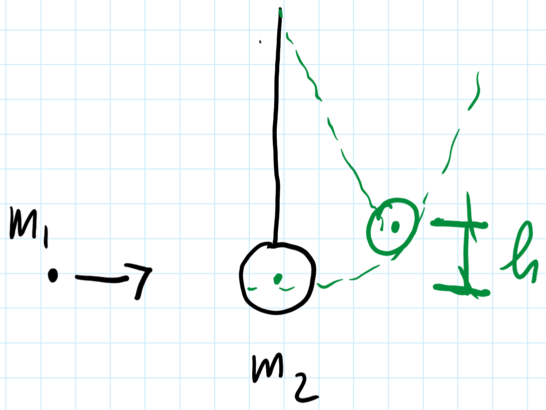
$\Delta x_{MAX} \equiv A$

$$E_K = \frac{1}{2}\, 0{,}5 \cdot 10^2 = 25 \text{ J}$$

$$E_{EL_{MAX}} = \frac{1}{2} K A^2 = E_K$$

$$25 = \frac{1}{2} K \cdot (0{,}38)^2$$

$$K = \frac{50}{(0{,}38)^2} = 346 \text{ N/m}$$



$m_1 = 0{,}1 \text{ kg}$

$m_1 + m_2 = 10 \text{ kg}$

$V_1 = 200 \text{ m/s}$

$\tau = 5 \cdot 10^{-4} \text{ s}$

$$P = \text{cost}$$

$$(m_1+m_2)\cdot V_{CM} = m_1 v_1 + m_2 v_2$$

$$V_{CM} = \frac{m_1 v_1 + m_2 v_2}{m_1+m_2} = \frac{0{,}1\cdot 200 + 9{,}9\cdot 0}{10} = 2\ m/s$$

$$\left(\sum F = m\cdot a\right) \quad X$$

$$E_{TOT} = cost$$

$$\frac{1}{2}(m_1+m_2)V_{CM}^2 = E_K = \frac{1}{2}\cdot 10\cdot 2^2 = 20\ J$$

$E_{GRAV\ MAX}$ → TUTTA CINETICA DIVENTA GRAVITAZIONALE → h MASSIMA

$$E_{GRAV\ MAX} = m\cdot g\cdot h$$

$$20 = 10\cdot 9{,}8\cdot h$$

$$h = \frac{20}{10\cdot 9{,}8} = 0{,}2\ m$$

TEO MEDIA INTEGRALE

$$\Delta P = \int^{t_2} F\, d\tau = F_m\cdot\tau$$

$$\Delta P = \int_{t_1}^{t_2} F \, d\tau \stackrel{\swarrow}{=} F_m \cdot \tau$$

$$J = \int_{t_1}^{t_2} F \, d\tau = F_m \cdot \tau$$

$$\Delta P = (m_1 + m_2) v_2' - \cancel{m_2 v_2}$$

$$= 20 \; Ns$$

$$\Delta P = F_m \cdot \tau \leadsto F_m = \frac{\Delta P}{\tau} = \frac{20}{5 \cdot 10^{-4}} = 40\,000 \; N$$

$$= 40 \; kN$$