Lecture notes

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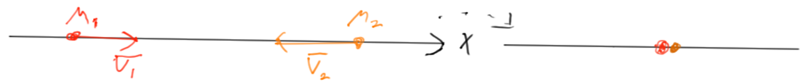
Fortsättning på föregående föreläsning.

Kollisioner

Inelastiska kollisioner



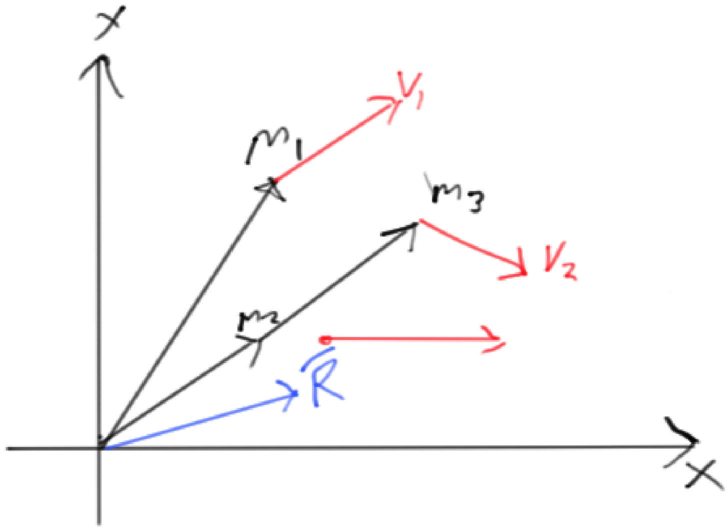
Endast totala frörelse mängden bevaras.

$$\bar{P}_i = m_1\bar{v}_1 + m_2\bar{v}_2$$

$$\bar{P}_f = (m_1 + m_2)\bar{v}$$

$$\bar{P}_i = \bar{P}_f \rightarrow \bar{v} = \frac{m_1\bar{v}_1 + m_2\bar{v}_2}{m_1 + m_2}$$

Tyngdpunkt

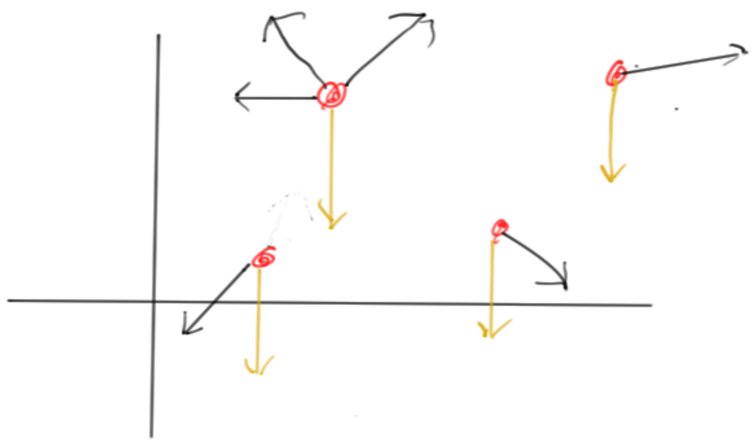


$$\bar{P} = \sum_i m_i \bar{v}_i = \sum_i \frac{d}{dt}(m_i \bar{r}_i)$$

Definera tyngdpunktens läge $\bar{R}$ enligt

$$\bar{R} = \frac{\sum_i m_i \bar{r}_i}{\sum_i m_i} = \frac{\sum_i m_i \bar{r}_i}{M}$$

$$\frac{d\bar{P}}{dt} = \frac{d^2(M\bar{R})}{dt^2} = M\frac{d^2\bar{R}}{dt^2} = M\bar{a_{cm}}$$



$$\bar{P} = \bar{P}_1 + \bar{P}_2 + \dots$$

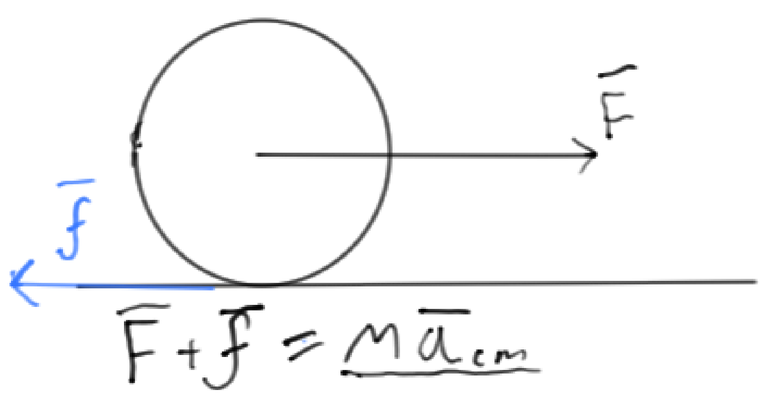
$$\frac{d\bar{P}}{dt} = +\frac{d\bar{P}_1}{dt} + \frac{d\bar{P}_2}{dt} + \dots =$$

$$= (\text{vita pilar} + 1) + \sum \text{gula pilar} = \sum \bar{F}_i$$

$$\sum \bar{F}_i\text{ext} = M\frac{d^2\bar{R}}{dt^2} = Ma_{\bar{C}M}$$

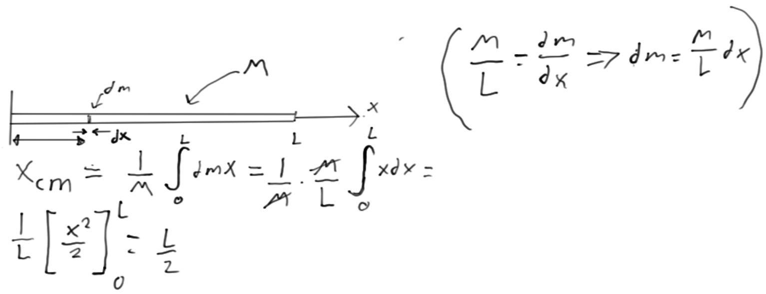
Summa av alla externa krafterna ger oss tyngdpunktes acceleration!

Exempel 1



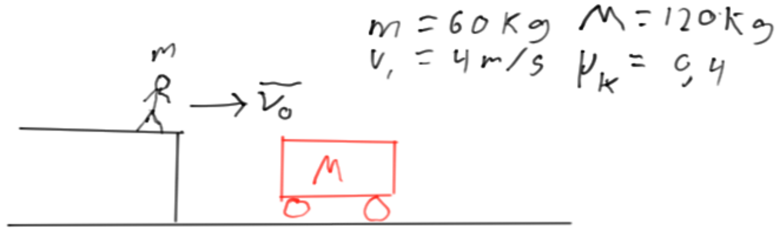
Exempel, tyngdpunkt

Exempel 2



Exempel 3

Tyndpunktens läge



1. Sluthastighet

$$mv_0 = (m+M)v \rightarrow v = \frac{m}{m+M}v_0 =$$
$$\frac{60 * 4}{120 + 60}$$

2. Friktionkraft

$$f = \mu_k N = \mu_k mg = 0,4 * 60 * 9.82 = 235N$$

3. Gliddid

$$a = \frac{f}{m} = \mu_k g$$
$$\Delta v = -at = (1.33 - 4.00) = 0.400 * 9.81 * t => t = 0.685$$

4. ΔP_m ΔP_M

$$\Delta P_m = P_f - P_i = 60(1.33 - 4.00) = -160 kgm/s$$
$$\Delta P_M = P_f - P_i = 190(1.33 - 0) = +160 kgm/s$$

5. Δx under glidning

$$v_f^2 - v_i^2 = 2a\Delta x$$
$$1.33^2 - 4.00^2 = 2(-\mu_k g) * \Delta x => \Delta = 1.81m$$

6. Förflyttning av vagnen under gldningsfasen $\Delta x'$

$$f = \mu_k mg, a = \frac{\mu_k mg}{M}$$
$$1.33^2 - 0^2 = 2\frac{\mu_k mg}{M}\Delta x'$$
$$= 0.45m$$

7. ΔK_m (Föränding av rörelse energi)

$$\Delta K_m = \frac{1}{2}60(1.33^2 - 4.00^2) =$$
$$= -426.7J$$

8. Δ_M

$$\Delta K_M = \frac{1}{2}120 * 1.33^2 = 106.7J$$

Fattas $320J$!

9. Skillnad

$$235 * 1.36 = 320$$
$$1.36 = 1.81 - 0.45$$