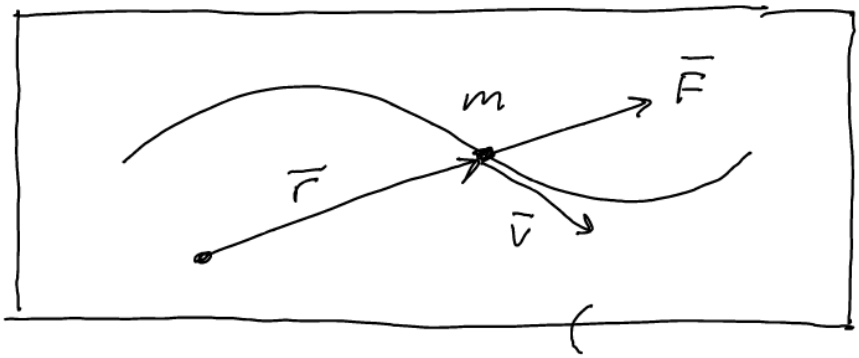
Föreläsning 3, mekanik del 1.

Kinetik.



inertialram (fix).

Partikelns rörelsemängd, $\bar{p}$:

$$\bar{p} = m\bar{v} = m\dot{\bar{r}}.$$

Massa m konstant.

Newton II (kraftlagen)

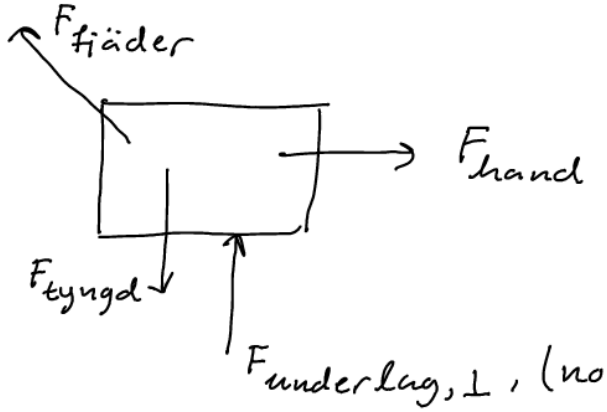
$$\bar{F} = \dot{\bar{p}} = m\bar{a} = m\ddot{\bar{r}}$$

$\bar{F}$: totala kraften på partikeln.

För partikel i jämvikt (vila): $\bar{F} = \bar{0}$

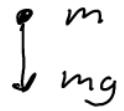
Friläggning

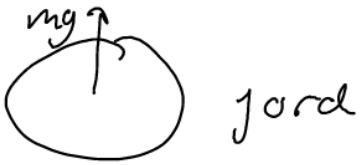
Frilägger partikeln:



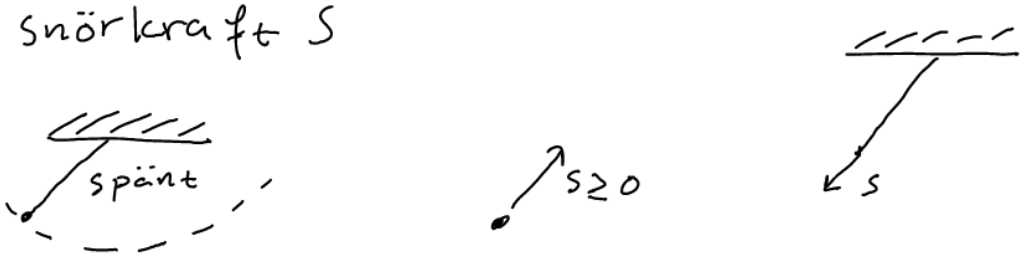
Tyngdkraft; mg

$0 < mg$

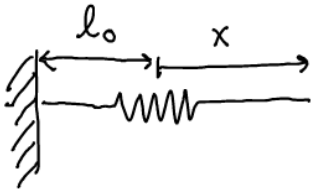




Snörkraft S

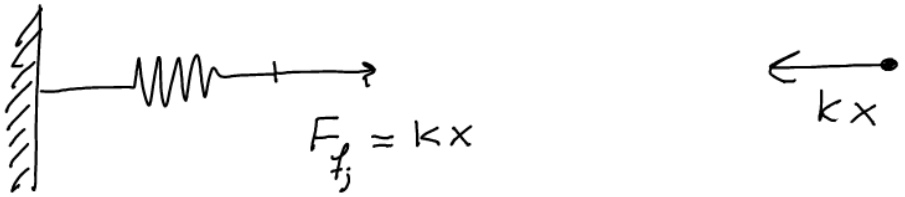


Fjäderkraft, F_{fj} (linjär fjäder)

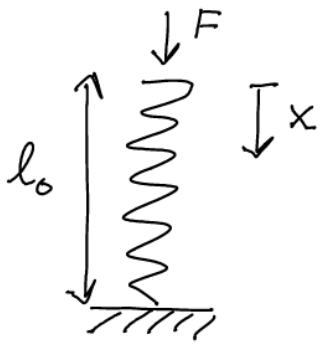


l_0, ospänd längd

k, fjäderkonstant.

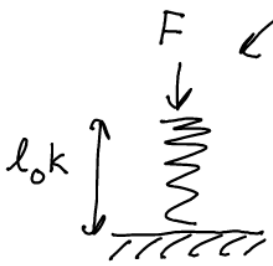


$(x < 0)$ ←

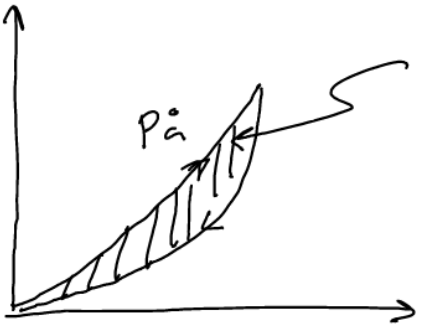


$$k = \frac{F}{x}$$

klipt fjäder, (hälften så lång.)

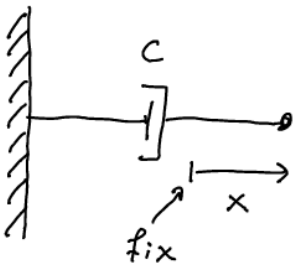


$$k^* = \frac{F}{x/2} = 2k$$

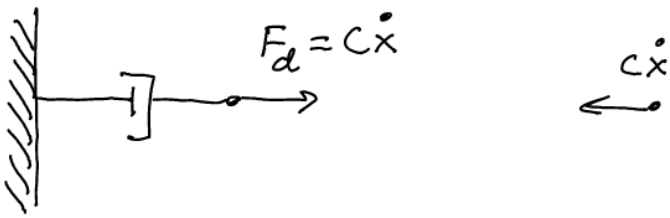


arean svarar mot energi förlust (icke linjär, progressiv fjäder)

Dämparkraft, F_d (linjära dämpare)



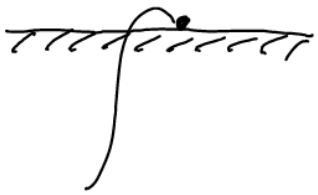
C- dämpningskonstant.



Kontaktkraft

Friktionsfri kontakt - normalkraft N

Friktionskraft F_{fr}



μ_s - statiskt friktionstal

μ_k - kinetiskt friktionstal

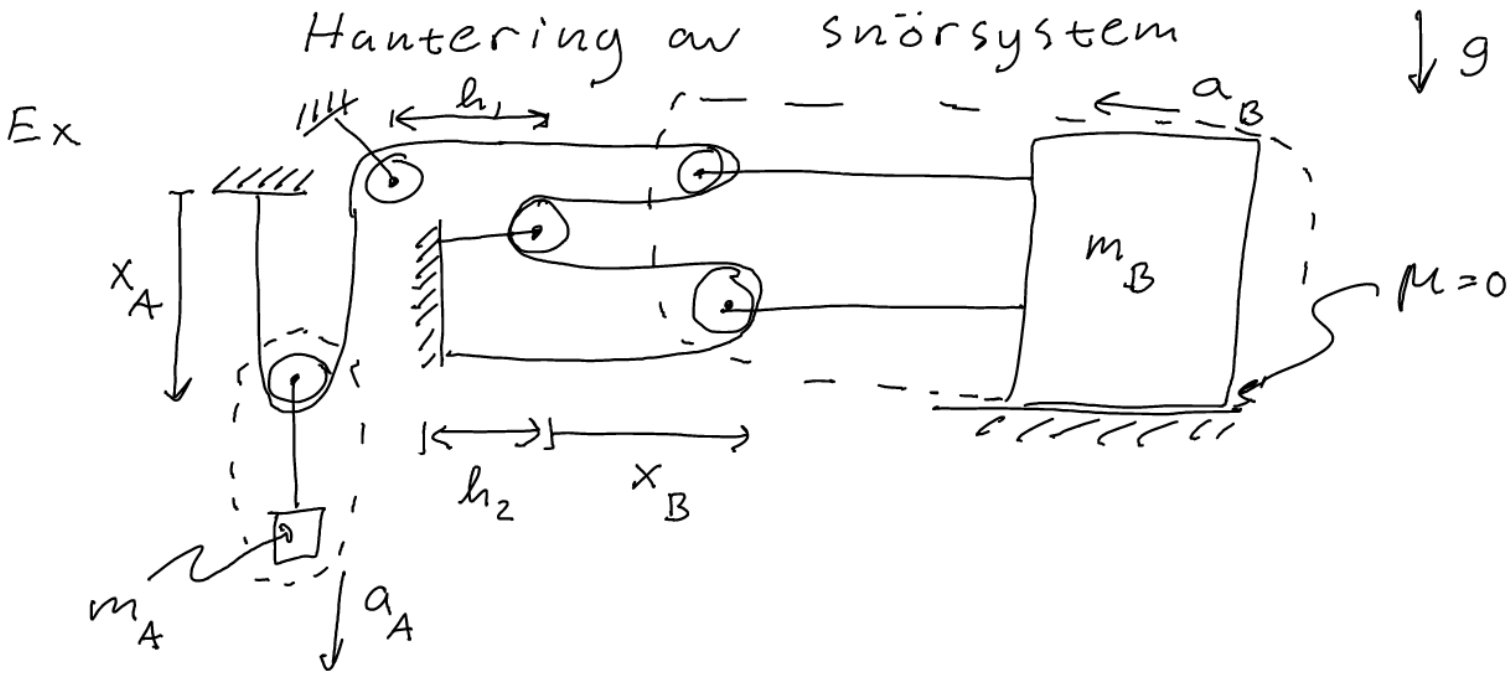
$|F_{fr}| \leq \mu_s N \Rightarrow$ Glider ej.

Vid glidning:

$|F_{fr}| = \mu_k N$

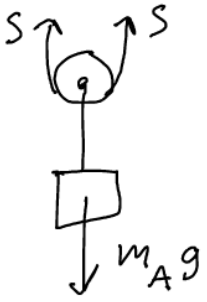
F_{fr} motriktad v

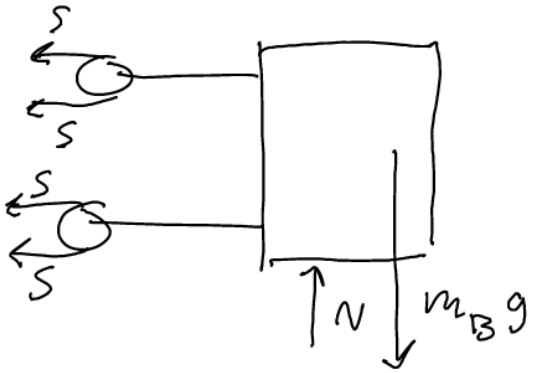
Hantering av snörsystem



a_A ?

Friläggg:





Newton II $(\bar{F} = m\bar{a})$

A, ↓ : $m_A g - 2S = m_A a_A$ (2)

B ← : $4S = m_B a_B$ (3)

3 obekanta (a_A, a_B, S), 2 ekvationer.

Snörets längd, l:

$l = 2x_A + h_1 + 4x_B + h_2 + \text{konst.} = \text{konst.}$

$\therefore \dot{l} = 2\dot{x}_A + 4\dot{x}_B = 0$

$\ddot{l} = 2\ddot{x}_A + 4\ddot{x}_B = 0$

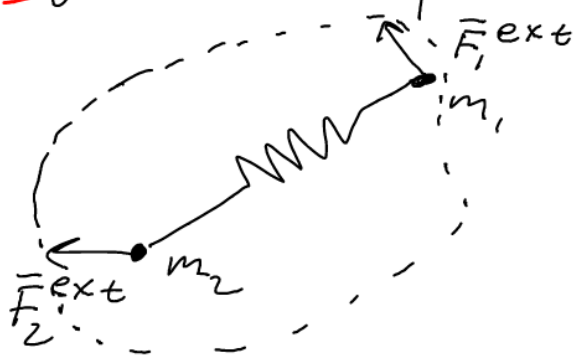
$\ddot{x}_A = a_A$, $\ddot{x}_B = -a_B$

$\Leftrightarrow a_B = \frac{1}{2} a_A$

ins. i (3) $\Rightarrow$ $S = \dfrac{m_B a_A}{8}$

ins i (2) $\Rightarrow$ $m_A g - \dfrac{m_B a_A}{4} = m_A a_A \Leftrightarrow a_A = \dfrac{4 m_A g}{4 m_A + m_B}$, $\downarrow$

System av partiklar

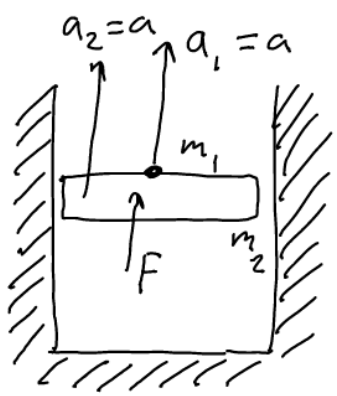


Newton II för system av n st partiklar

$$\bar{F}^{ext} = \sum_{i=1}^{n} m_i \bar{a}_i$$

$\bar{F}^{ext} = \sum_{i=1}^{n} \bar{F}_i$, total extern kraft på systemet.

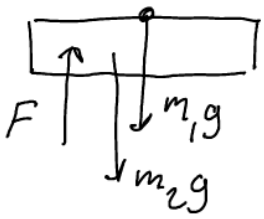
Ex:



$\downarrow g$

$\mu = 0$

Frilägg $m_1 + m_2$:

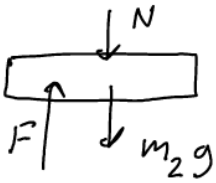


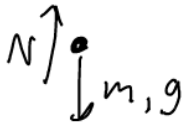
$\uparrow$: $F - m_1 g - m_2 g = (m_1 + m_2) a$

$$a = \frac{F}{m_1 + m_2} - g \uparrow$$

Alt: frilägg m_1 och m_2 för sig

Newton II





1) $\uparrow$: $N - m_1 g = m_1 a$ (4)

2) $\uparrow$: $F - m_2 g - N = m_2 a$ (5)

(4) + (5) $\Rightarrow a = \ldots$