Lecture notes

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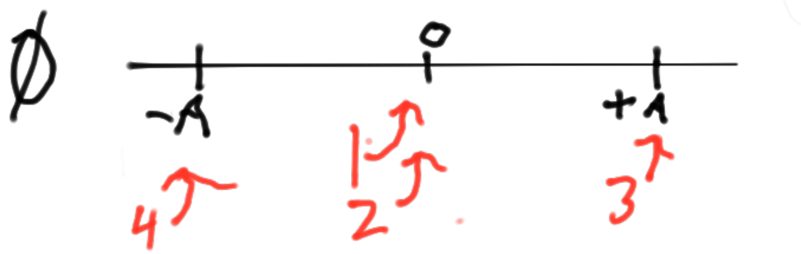
Svängningar



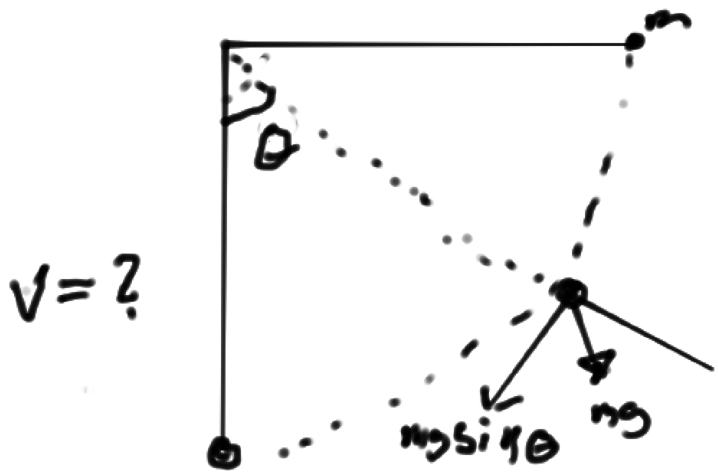
$$x(t) = A\sin(\omega t + \phi), \omega = \sqrt{\frac{k}{m}} \tag{1}$$

$$x(t) = -A\sin(\omega t) \tag{2}$$

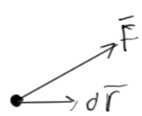
$$x(t) = A\cos(\omega t) \tag{3}$$

$$x(t) = -A\cos(\omega t) \tag{4}$$

Arbete - Energi



Arbete

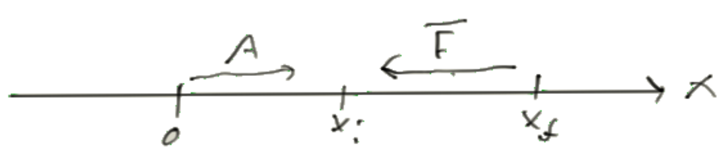


Enhet : $J = Nm$

$$W_{i\to f} = \int_i^f \bar{F} d\bar{r}$$

$$dW = (F\cos\theta)dr = F(dr \cdot cos\theta)$$

$$\bar{F} = -k\bar{x} = -kx\hat{i}$$

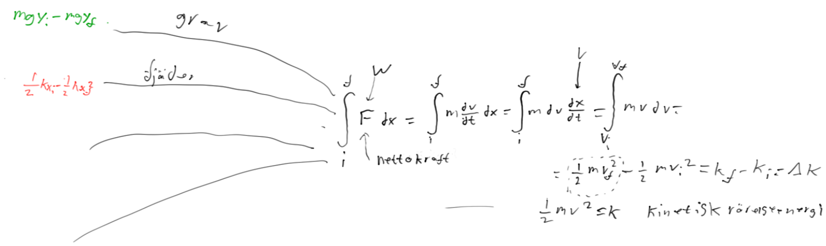


Figur 1: Arbetet som uträttas av en fjäder

$$W_{i\to r} = \int_i^f \bar{F} \cdot d\bar{x} = \int_i^f (-kx\hat{i}) \cdot (dx\hat{i})$$

$$= -k \int_i^f xdx(\hat{i} \cdot \hat{i})$$

$$\to W_{i\to f} = -k \int_{x_i}^{x_f} xdx = \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2$$



Fjäder:

$$\frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2 = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$\text{Läges eller potentiell energi} => \frac{1}{2}mv_f^2 + \frac{1}{2}kx_f^2 = \frac{1}{2}mv_i^2 + \frac{1}{2}kx_i^2$$

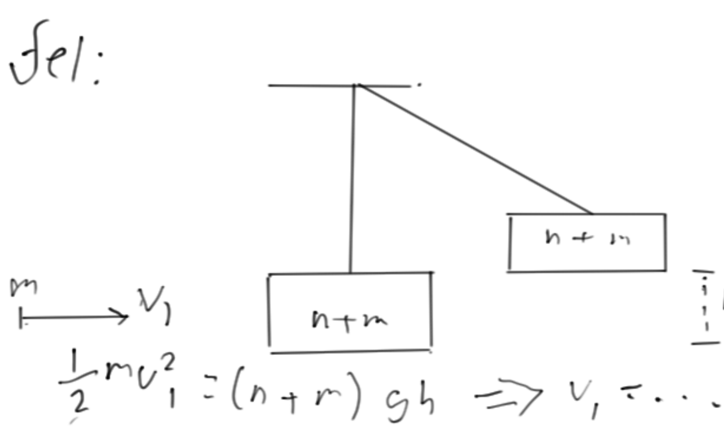
$$U = \frac{1}{2}kx^2, -\Delta U = \Delta K$$

Gavitation:

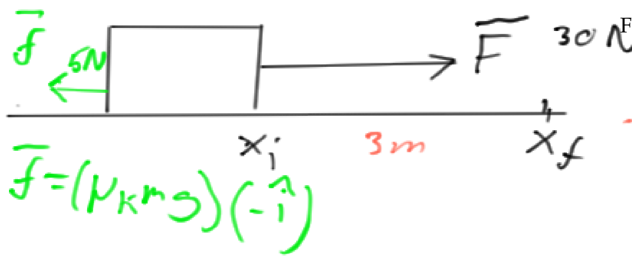
$$W_{i\to f} = \int_i^f mg(-\hat{j})dy(\hat{j}) =$$

$$= -mg\int_i^f dy = -mg(y_f - y_i) = mgy_i - mgy_f =$$

$$mgy_i - mgy_f = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$



Figur 2: Exempel på felaktig energi beräkning. Energi går åt för uppvärming och deformering av trä blocket.

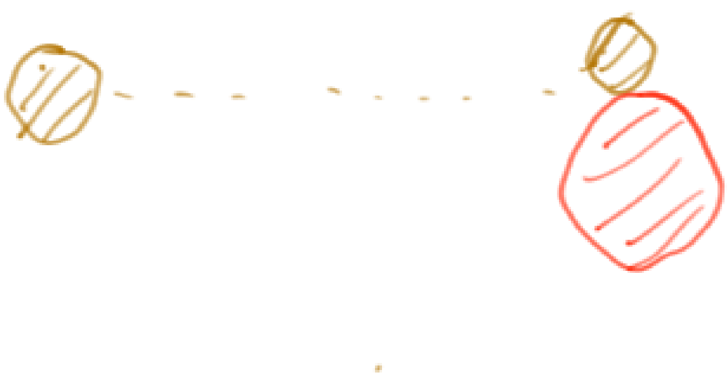


Figur 3: Friktion

Nettorkraft: $\bar{F} + \bar{f}$

$$
\begin{aligned}
|\bar{F} + \bar{f}| = |\bar{F}| - |\bar{f}| = 30 - 5 = 25N \\
W_{x_i \to x_f} = (\bar{F} + \bar{f}) \cdot \bar{x} = \\
= 25 * 3 = 75Nm
\end{aligned}
$$

Rörelsemängd



$$\bar{p} = m\bar{v}$$

Netwons 2:a lag: $\bar{F} = \dfrac{d\bar{p}}{dt}$

Två partiklar(Isolerat system)

$$
\begin{aligned}
&\bar{F}_1 = \frac{d\bar{p}_1}{dt}, \bar{F}_! = \bar{F}_2 \\
&\bar{F}_2 = \frac{d\bar{p}_2}{dt} \to \frac{d\bar{p}_1}{dt} = -\frac{d\bar{p}_2}{dt} \\
&\to \frac{d\bar{p}_1}{dt} + \frac{d\bar{p}_2}{dt} = 0, \text{ Den totala rörelsemängden bevaras}
\end{aligned}
$$