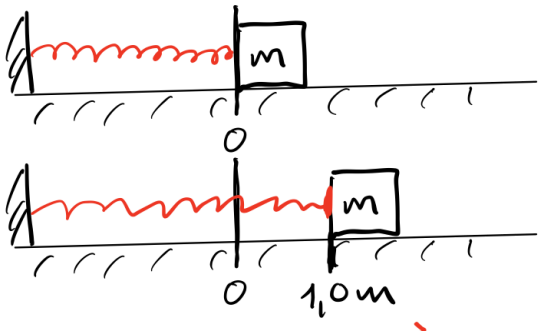
Fra 24. August - Harmonisk Oscillator



$$\ddot{x} + \frac{k}{m} x = 0$$

$$x(0) = 1{,}0\ \text{m}$$

$$v(0) = 0\ \text{m/s}$$

$y'' + \omega^2 y = 0$

$y'' + 4y = 0$

løsning

$y = A \cdot \sin(2t) + B\cos(2t)$

Antar

$$x(t) = A \cdot \cos\left(\sqrt{\frac{k}{m}} \cdot t\right) + B \cdot \sin\left(\sqrt{\frac{k}{m}} \cdot t\right)$$

$$\omega = \sqrt{\frac{k}{m}} \quad \Rightarrow \quad \omega^2 = \frac{k}{m}$$

$$X(t) = A\cos(\omega t) + B\sin(\omega t)$$

$$\dot{x} = x'(t) = A\cdot\omega\sin(\omega t) - B\omega\cos(\omega t)$$

$$\ddot{x} = x''(t) = -A\omega^2\cos(\omega t) - B\omega^2\sin(\omega t)$$

$$\ddot{X} + \omega^2 X = 0$$

$\ddot{x}$

$$-A\omega^2\cos(\omega t) - B\omega^2\sin(\omega t)$$

$$+ \omega^2 \underbrace{\left(A\cos(\omega t) + B\sin(\omega t)\right)}_{x} = 0$$

OK

$$X(t) = A\cdot\cos(\omega t) + B\cdot\sin(\omega t)$$

Initialverdier:

$$x(0) = 1{,}0\ \text{m}$$

$$A \cdot \underbrace{\cos(\omega \cdot 0)}_{=1} + B \underbrace{\sin(\omega 0)}_{=0} = 1{,}0\,\text{m}$$

$$A = 1{,}0\,\text{m}$$

$$v(0) = 0\,\text{m/s}$$

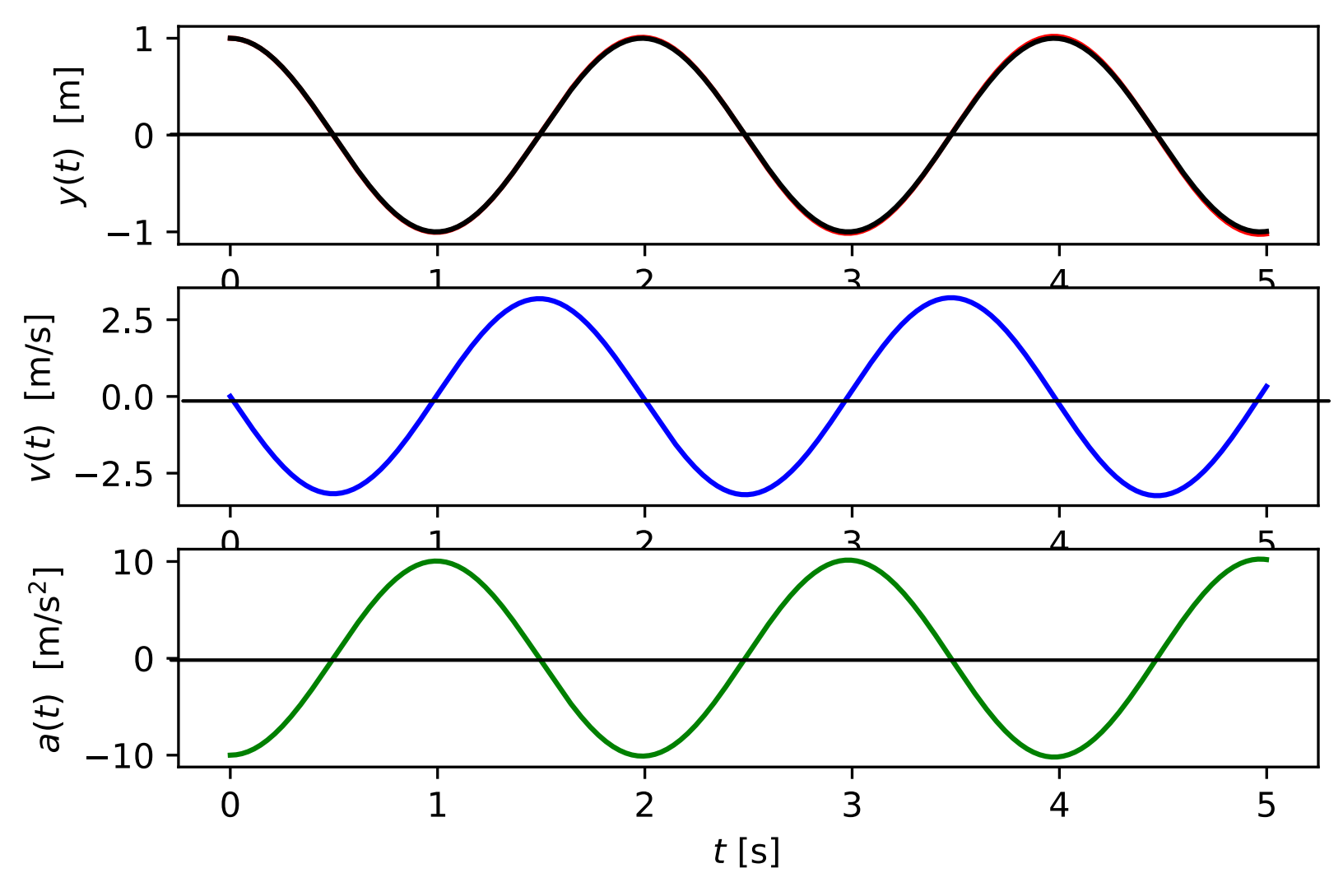
$$\omega A \underbrace{\sin(\omega \cdot 0)}_{=0} - \omega B \underbrace{\cos(\omega \cdot 0)}_{=1} = 0\,\text{m/s}$$

$$-\omega B = 0\,\text{m/s}$$

$$B = 0\,\text{m/s}$$

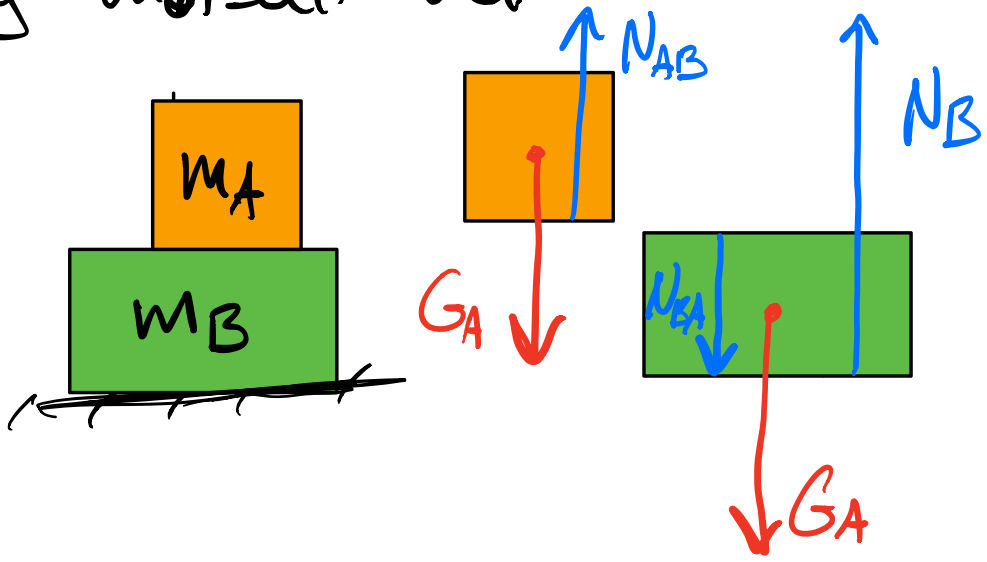
$$x(t) = 1{,}0\,\text{m} \cdot \cos(\omega t)$$

$$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{10\,\text{N/m}}{1{,}0\,\text{kg}}} = 3{,}2\,\text{s}^{-1}$$


y(t) [m]
1
0
−1
0
1
2
3
4
5
v(t) [m/s]
2.5
0.0
−2.5
0
1
2
3
4
5
a(t) [m/s²]
10
0
−10
0
1
2
3
4
5
t [s]

Newtons 3. lov

Alle krefter har en like stor og motsatt vektet motkraft.



N. 3 lov $N_{AB} = -N_{BA}$