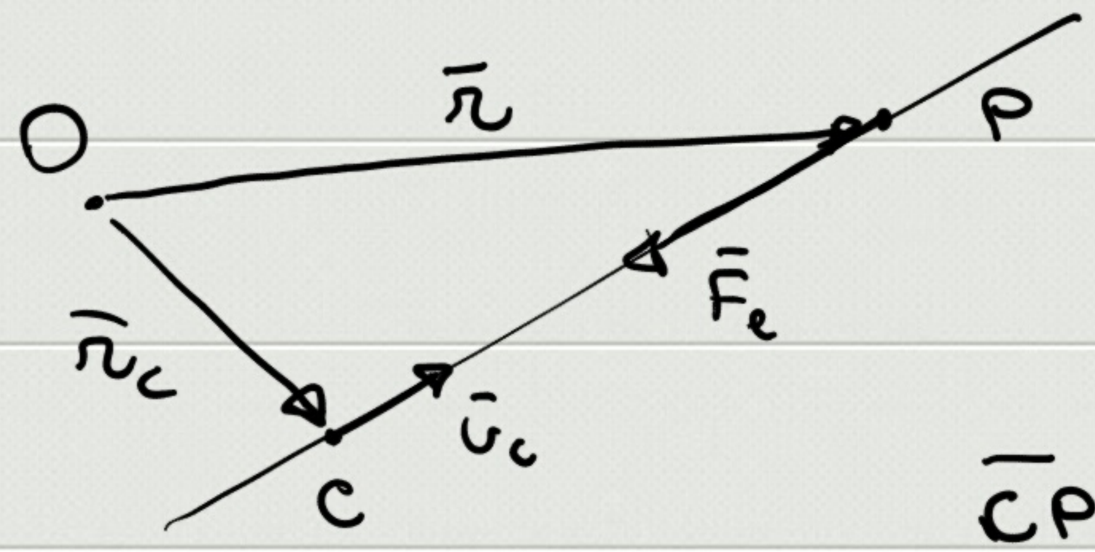


$|\bar{F}_{el}| \propto |\bar{PC}|$

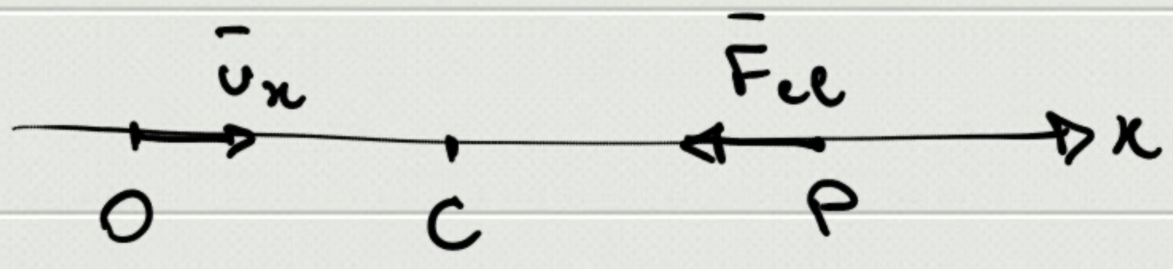
C : centro della forza

$\bar{CP} = \bar{r} - \bar{r}_c$

$$\boxed{\bar{F}_{el} = -k(\bar{r} - \bar{r}_c)} = -k|\bar{r} - \bar{r}_c|\,\bar{v}_c$$

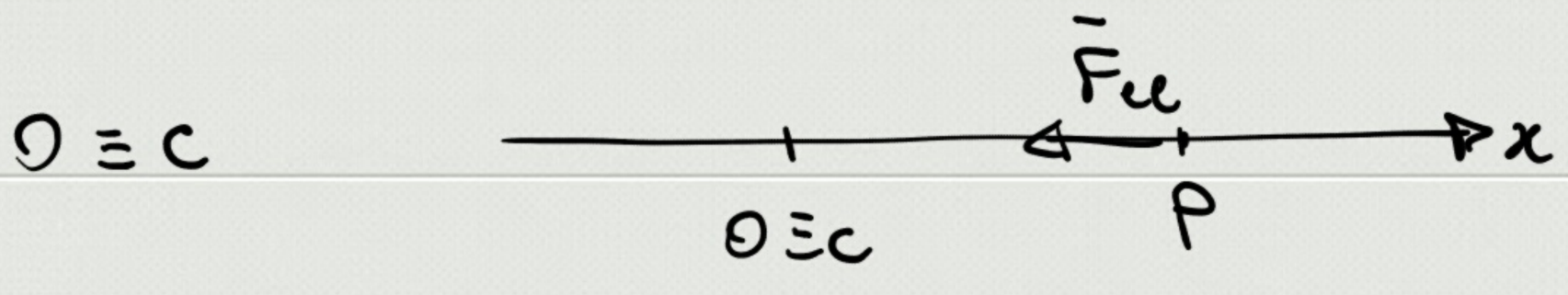
K : costante elastica

$$[k] = \left[\frac{F}{r}\right] = N/m$$

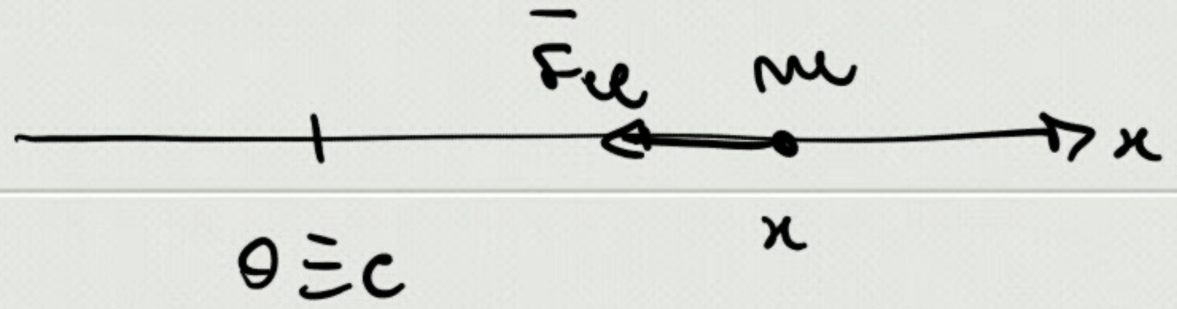


$$\bar{F}_{el} = -k(x - x_c)\,\bar{v}_x$$

$$\Rightarrow \boxed{F_{el} = -k(x - x_c) = -k\Delta x} \quad *$$



$$\boxed{F_{el} = -kx}$$



$$F_{el} = ma \quad \Rightarrow \quad -kx = m\frac{d^2x}{dt^2}$$

$$\Rightarrow \quad \frac{d^2x}{dt^2} + \frac{k}{m}x = 0 \qquad \frac{k}{m} = \omega^2$$

$$\frac{d^2x}{dt^2} + \omega^2 x = 0 \quad \rightarrow \text{eq. moto armonico}$$

$$x(t) = A\sin(\omega t + \phi) \qquad *$$

$$v(t) = A\omega\cos(\omega t + \phi)$$

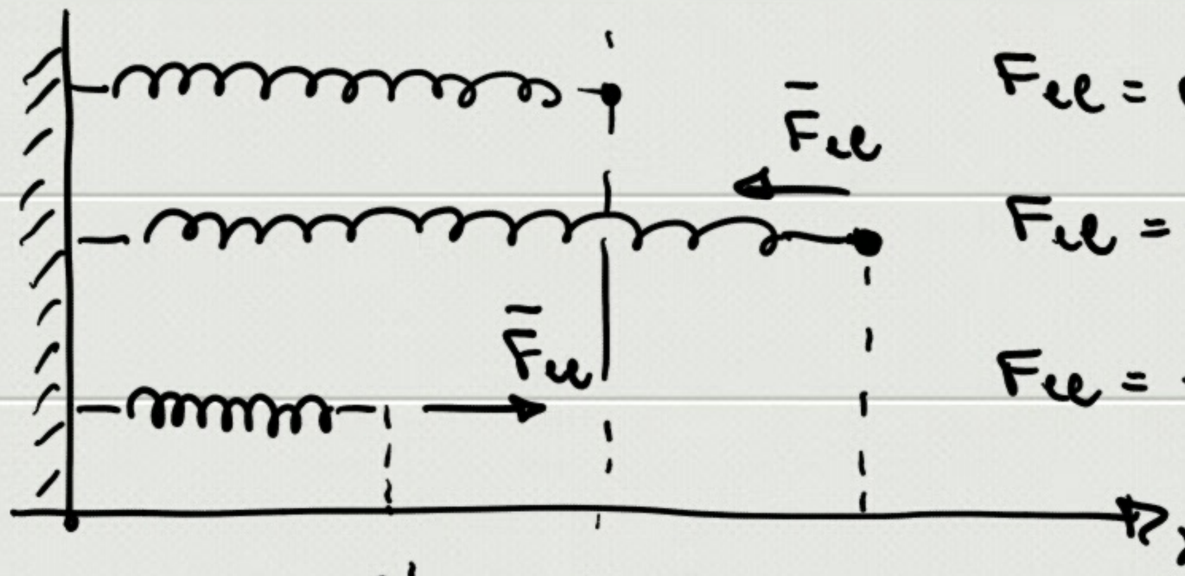
$$x(t=0) = x_0 \qquad v(t=0) = 0$$

$$\Rightarrow \quad v(0) = 0 = A\omega\cos\phi \quad \Rightarrow \quad \underline{\phi = \pi/2}$$

$$x(0) = \underline{x_0 = A\sin\phi = A}$$

$$\Rightarrow \boxed{x(t) = x_0\cos\omega t}$$

l_0: lunghezza a riposo

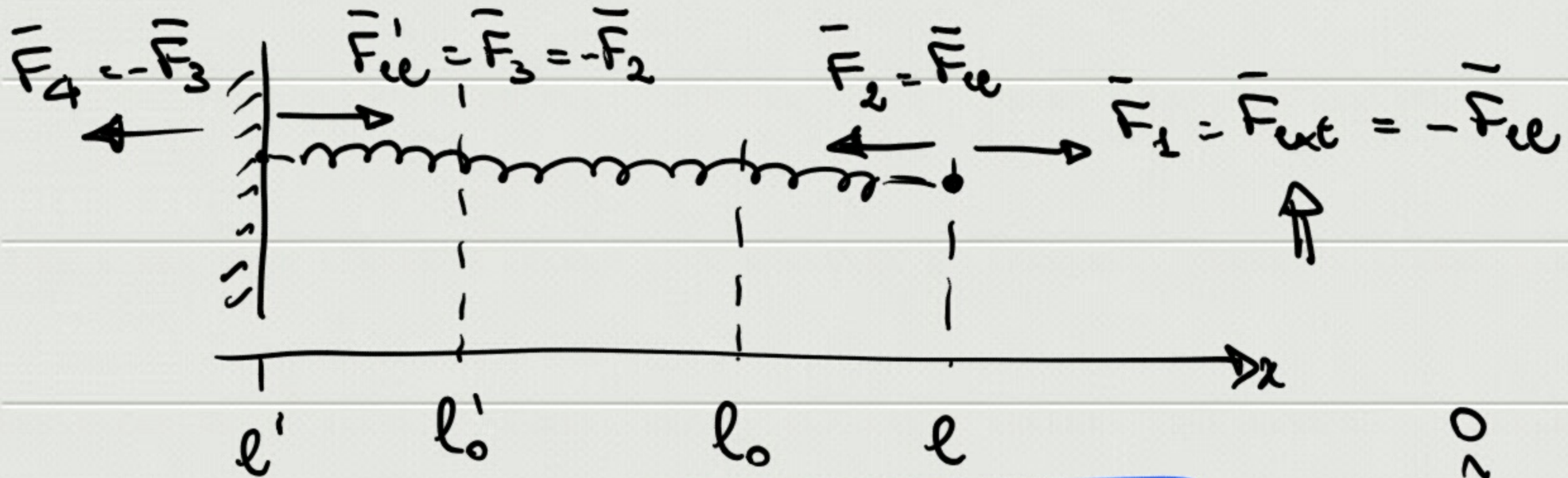


$F_{el} = 0$ ($l = l_0$)

$F_{el} = -k(l - l_0) < 0$ ($l > l_0$) $\leftarrow \bar{F}_{el}$

$F_{el} = -k(l' - l_0) > 0$ ($l' < l_0$) $\rightarrow \bar{F}_{el}$

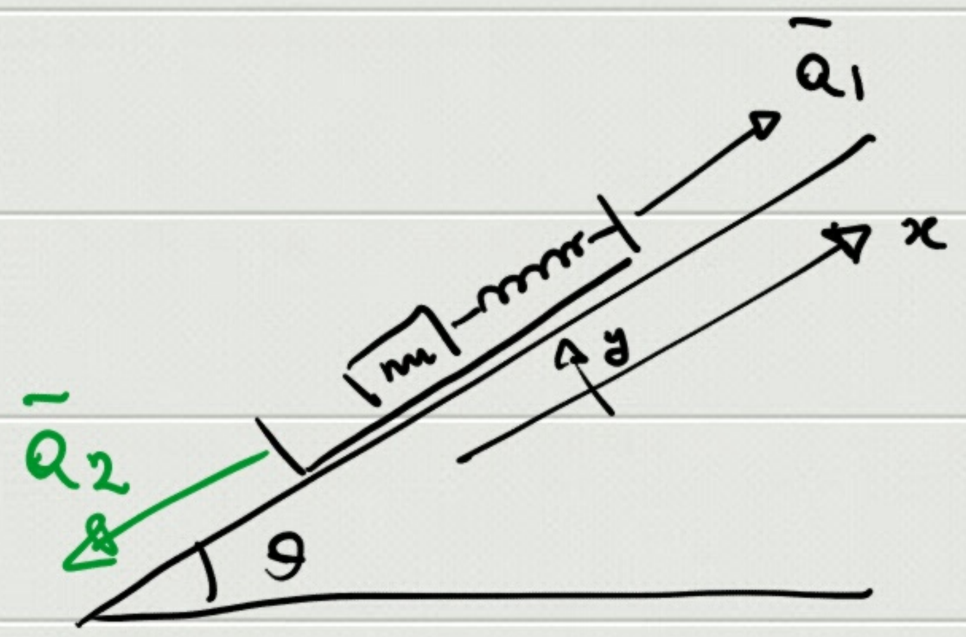
$$\boxed{F_{el} = -k\,\Delta x}$$



$F_2 = F_{el} = -k(l - l_0) < 0$ ($l < l_0$) $\leftarrow \bar{F}_{el}$

x'

$F_3 = F'_{el} = -k(l' - l'_0) > 0$ ($l' < l'_0$) $\xrightarrow{\bar{F}_{el'}}$



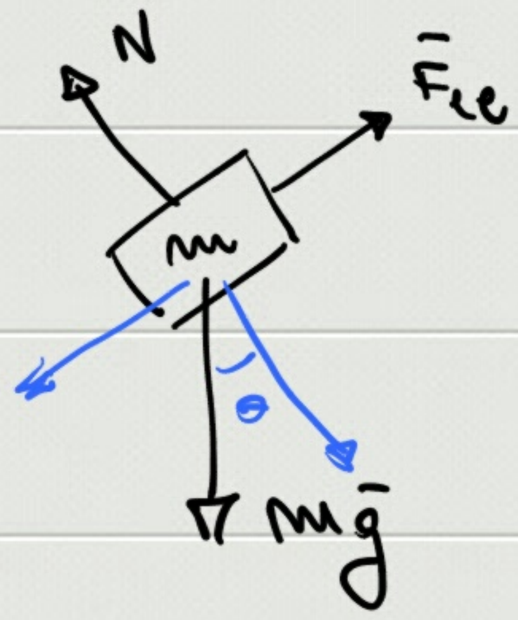
$\vartheta = 20°$

$a_1 = 1\ m/s^2$

$m = 0.5\ kg$

$k = 12\ N/m$

$\Delta x = ?$



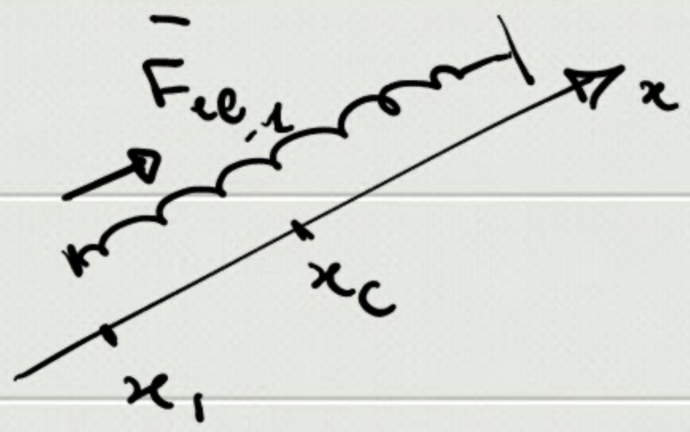
$$m\bar{g} + \bar{N} + \bar{F}_{el,1} = m\bar{a}_1$$

x: $$-mg\sin\vartheta - k\Delta x_1 = m a_1$$

$$\Rightarrow \Delta x_1 = -\frac{m}{k}\left(g\sin\vartheta + a_1\right) = -0.181\ m$$

$$= x_1 - x_c < 0$$

$$\bar{F}_{el,1} = -k\Delta x_1 > 0$$



$Q_2 = 5\ m/s^2$ $\Rightarrow$ $m\bar{g} + \bar{N} + \bar{F}_{el,2} = m\bar{a}_2$

$$-mg\sin\vartheta - k\Delta x_2 = -m a_2$$

$$\Delta x_2 = \frac{m}{k}\left(a_2 - g\sin\vartheta\right) = 0.069\ m > 0$$

$$= x_2 - x_c$$