Going back to our diff. eq: $x''(t) + \frac{\kappa x(t)}{m} = 0$ $\frac{x(t + \Delta t) - 2x(t) + x(t - \Delta t)}{\Delta t^2} + \frac{kx(t)}{m} = 0$ $x(t + \Delta t) - 2x(t) + x(t - \Delta t) \qquad kx(t)$

kx(t)

$$egin{split} x(t+\Delta t) - 2x(t) + x(t-\Delta t) &= -rac{kx(t)\Delta t^2}{m} \ x(t+\Delta t) &= -rac{kx(t)\Delta t^2}{m} + 2x(t) - x(t-\Delta t) \end{split}$$