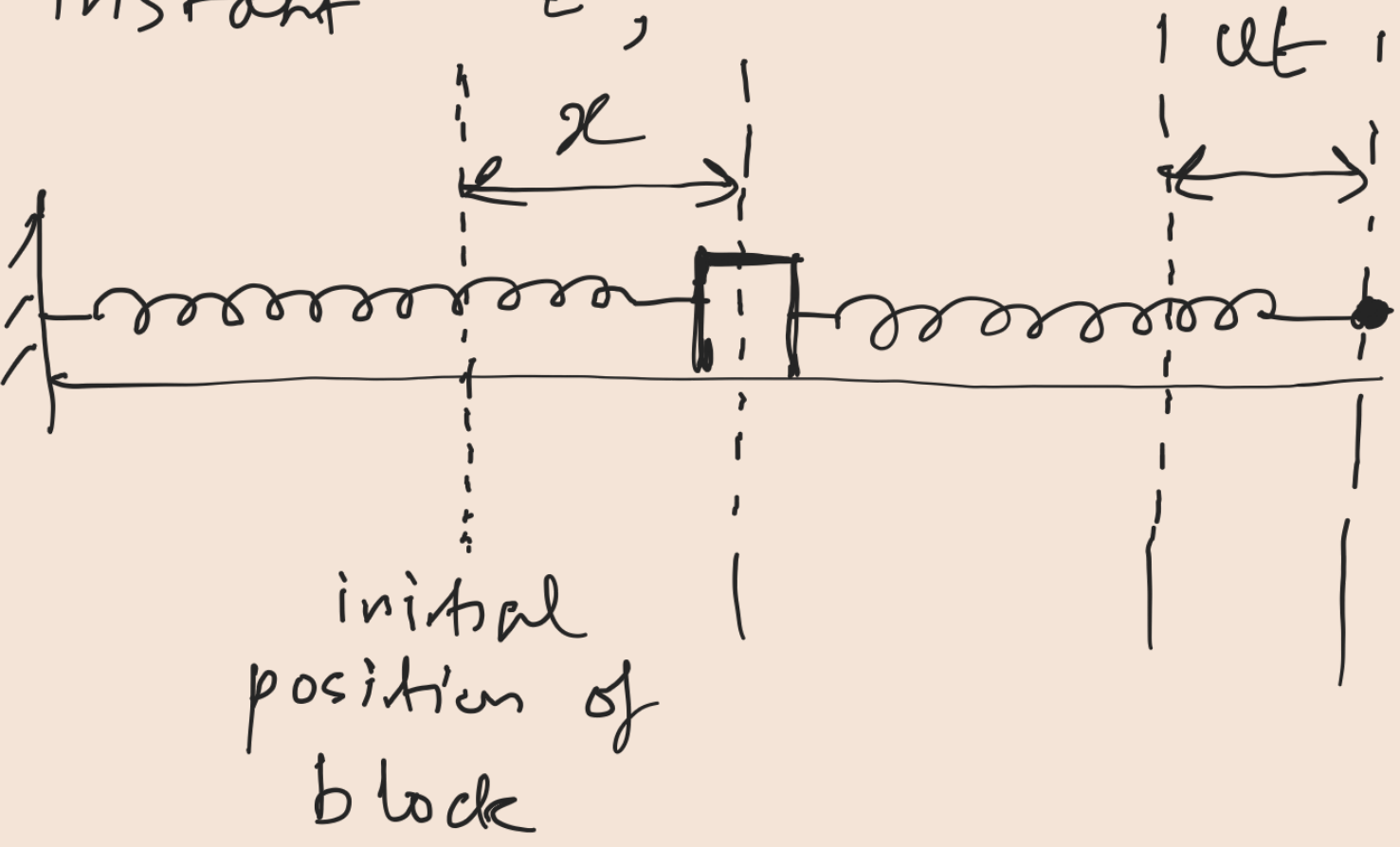
At any general time instant 't',



Displacement of right end wrt block will be $(ut - x)$. Hence, the elongation of right spring $= (ut - x)$. Now lets draw block FBD.



$$kx - k(ut - x) = -m\frac{d^2x}{dt^2}$$

$$2kx - kut = -m\frac{d^2x}{dt^2}$$

$$2k\left\{x - \frac{u}{2}t\right\} = -m\frac{d^2x}{dt^2}.$$

Lets consider an obs', moving right with vel. '$\frac{u}{2}$'. The displ. of block wrt to this obs' will be $\left(x - \frac{u}{2}t\right)$. Let this value be '$X$'.

$2kX = -m\frac{d^2X}{dt^2}$, no

pseudo force wrt this observer as his velocity is constant. This is pure SHM differential eqn wrt this observer. Hence, wrt this 'obs',



$X = A\sin(\omega t)$

(mean)

$V = (A\omega)\cos(\omega t)$, $V_{max} = \frac{u}{2}$

$$A\sqrt{\frac{2k}{m}} = \frac{u}{2} \;;\quad A = \frac{u}{2}\sqrt{\frac{m}{2k}}.$$

Block achieves velocity u for first time when it is travelling right & passing through mean position wrt the moving obs^r. So time taken $= \frac{T}{2} = \frac{\pi}{\omega}$. Also, in this interval, the displacement of block wrt the observer is zero. Hence, the

displacement of block is $\left(\frac{A}{2}\right) \times \frac{\pi}{\omega} = \frac{A}{2} \times \pi\sqrt{\frac{m}{2k}}$.

Also, since velocity of block is unidirectional during this period, the distance travelled is also the same.