Energy in an L-C Circuit

Since the velocity V_x at any position x is

$$V_x = \pm\sqrt{\frac{k}{m}}\sqrt{A^2-x^2} \quad \text{--- (1)}$$

The L-C circuit is also a conservative system. Again let Q be the maximum capacitor charge. The magnetic-field energy $\frac{1}{2}Li^2$ in the inductor at any time corresponds to the kinetic energy $\frac{1}{2}mv^2$ of the oscillating body, and the electric-field energy $q^2/2C$ in the capacitor corresponds to the elastic potential energy $\frac{1}{2}kx^2$ of the spring. The sum of these energies is the total energy $Q^2/2C$ of the system.

$$\frac{1}{2}Li^2 + \frac{q^2}{2C} = \frac{Q^2}{2C} \quad \text{--- (2)}$$

The total energy in the L-C circuit is constant, it oscillates betn the magnetic & the electric forms. After solving eqn (2) for i, we find that when the charge on the capacitor is q, the current i is

$$i = \pm\sqrt{\frac{1}{LC}}\sqrt{Q^2-q^2} \quad \text{--- (3)}$$

Comparing eqn (1) & (3) we have $i = \frac{dq}{dt}$ and charge q ~~is~~ are related in same way as $V_x = \frac{dx}{dt}$ & position x in mechanical problem.