$\frac{dv}{dt} = -v + I$
$\rightarrow \frac{v(t+\Delta t)-v(t)}{\Delta t} = -v(t) + I$
$v(t + \Delta t) - v(t) = \Delta t(-v(t) + I)$

$v(t + \Delta t) = v(t) + \Delta t(-v(t) + I)$

we could say:

$$\mathrm{t} = \mathrm{n}\Delta t$$

Hence:

$$\mathrm{v}((\mathrm{n}+1)\Delta t) = \mathrm{v}(\mathrm{n}\Delta \mathrm{t}) + \Delta \mathrm{t}(\text{-}\mathrm{v}(\mathrm{n}\Delta \mathrm{t})+\mathrm{I})$$

For having a simpler formula:

$$v_{n+1} = v_n + \Delta t(-v_n + I)$$