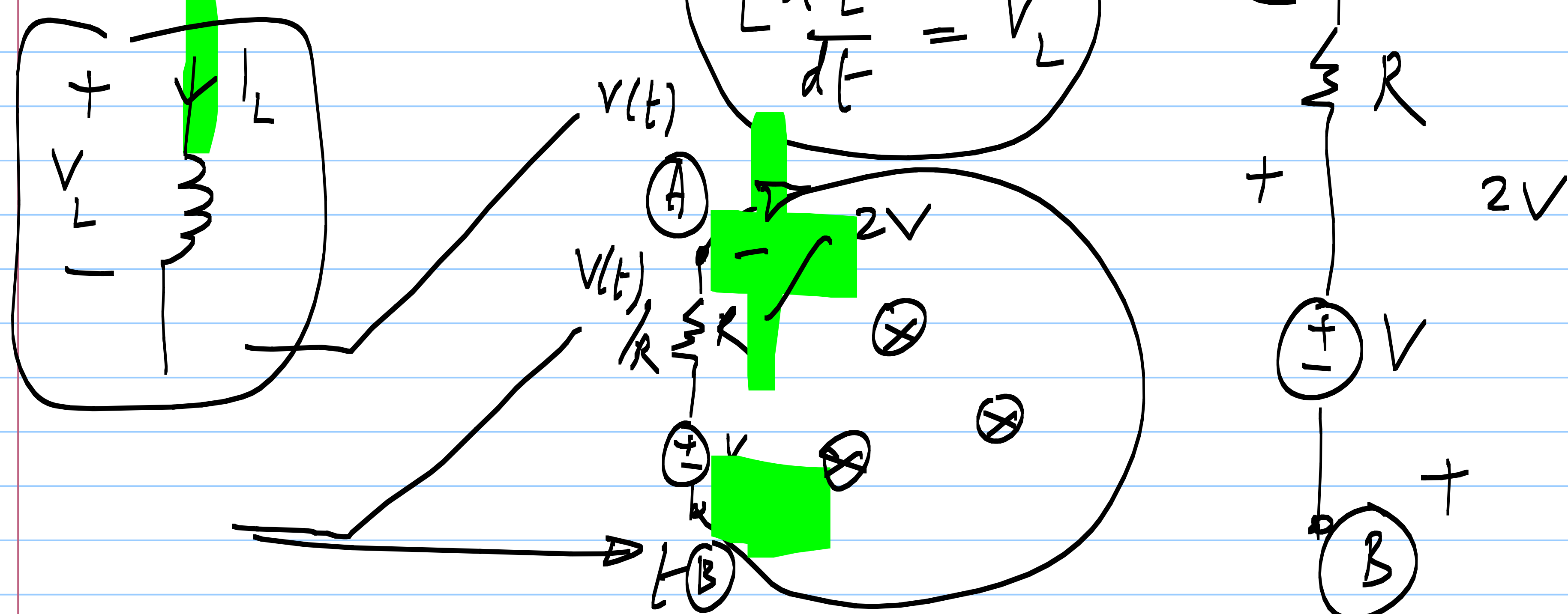
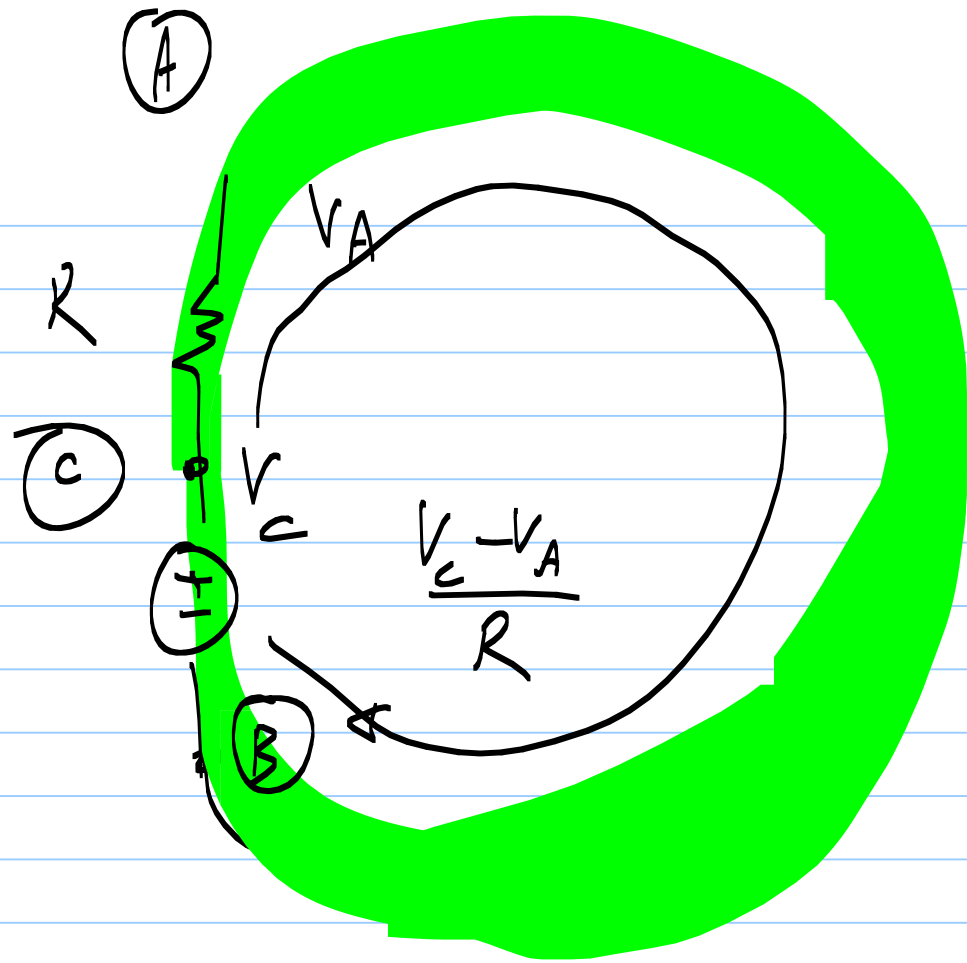
EE2015

$Q_c = C \cdot V_c$ $\quad$ $I_c = C \cdot \frac{dV_c}{dt}$ $\quad$ 7/8/2017

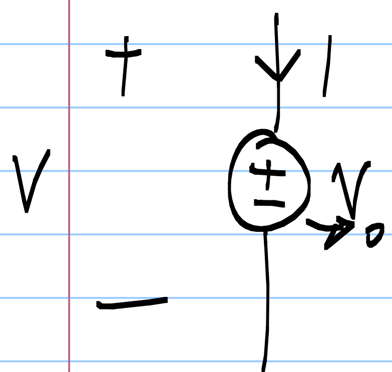
Inductor: $\psi_L = L \cdot I_L$

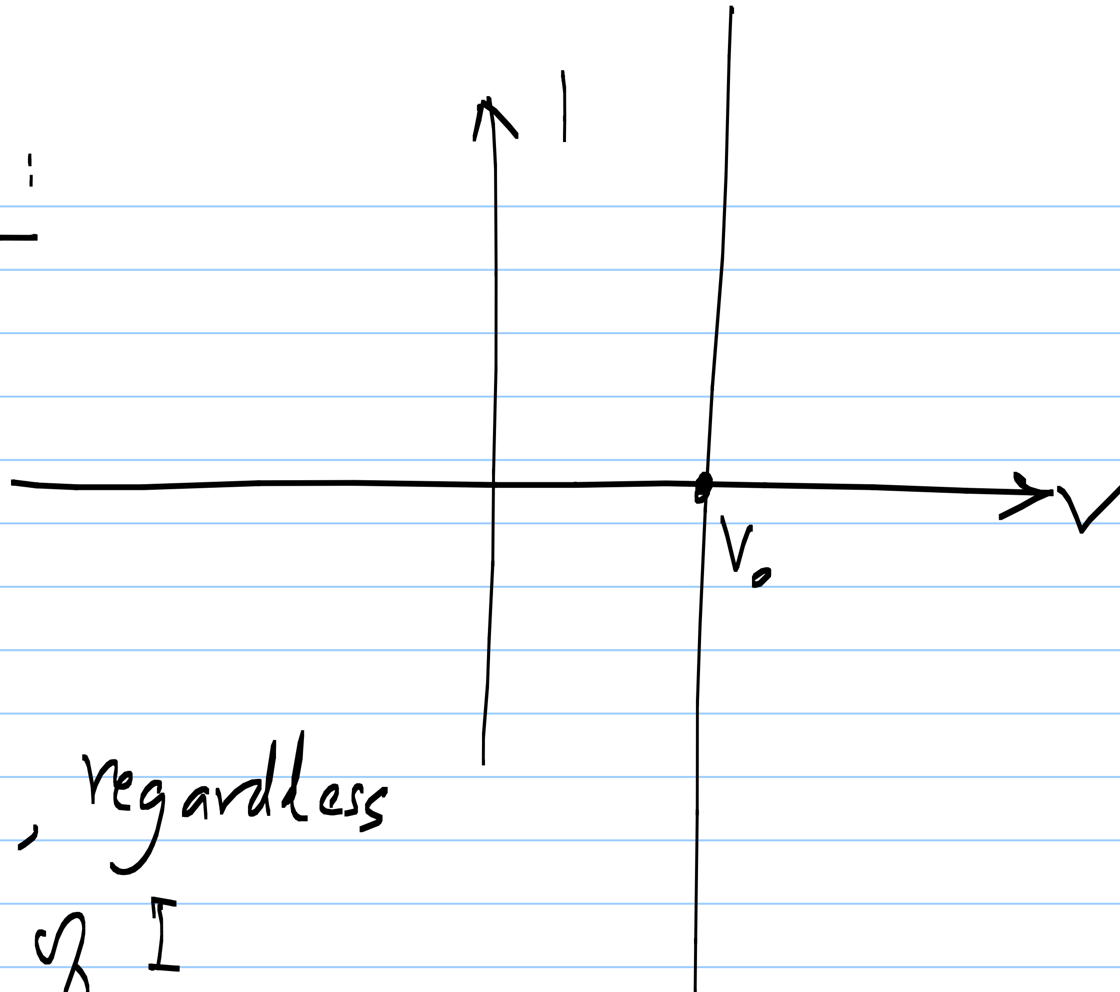
$L \frac{dI_L}{dt} = V_L$




A
R
C
V_A
V_C
B
$\frac{V_C - V_A}{R}$

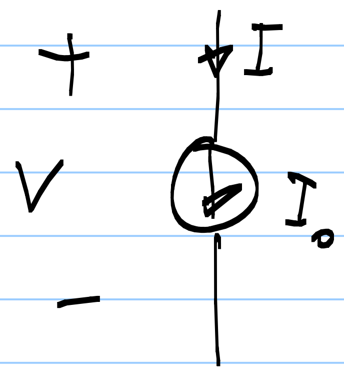
Ideal Voltage source:



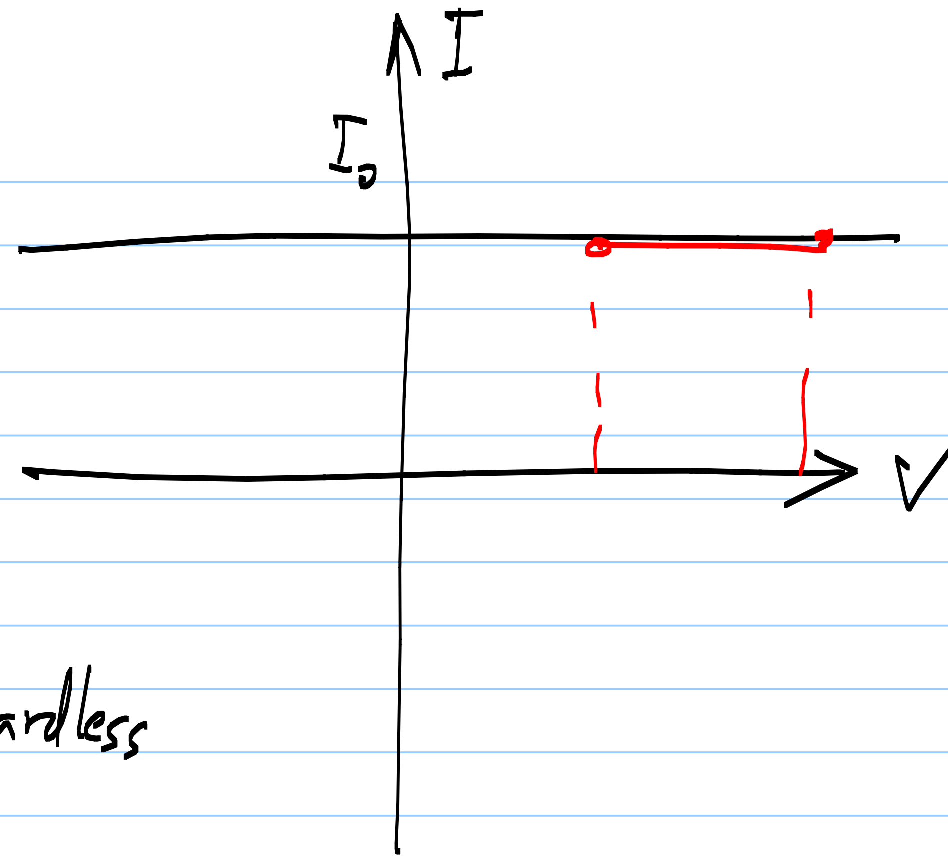


Maintains $V = V_0$, regardless of I

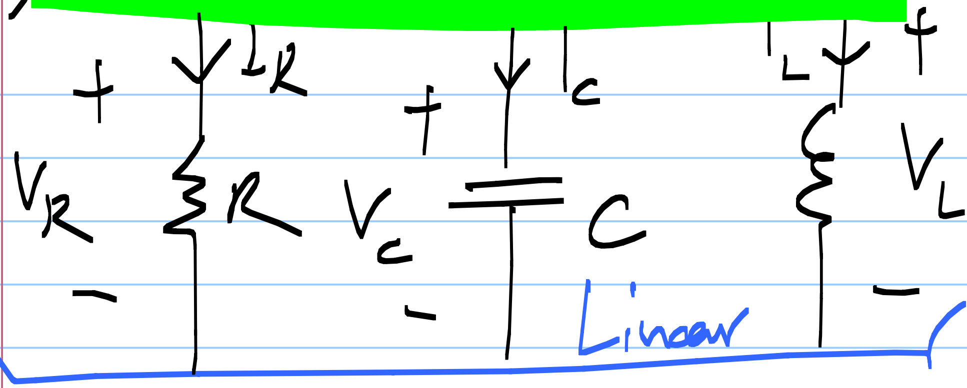
Current source



Maintains $I = I_o$ regardless of V

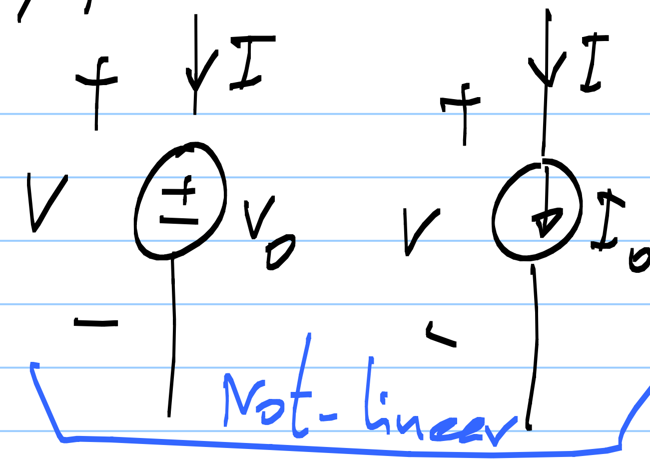


Passive elements



$V_R = R \cdot i_R$ $\quad i_c = C \frac{dV_c}{dt}$ $\quad V_L = L \cdot \frac{di_L}{dt}$

Independent sources



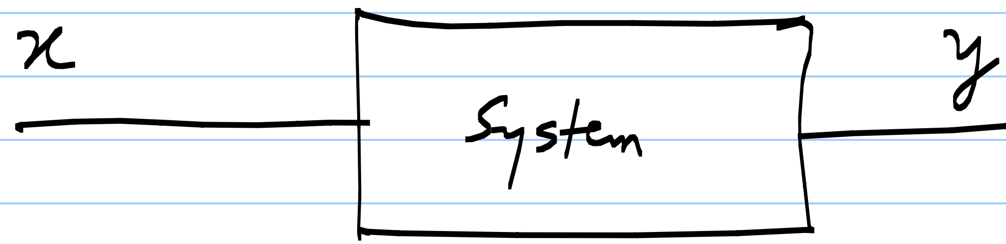
$V = V_0$ $\quad I = I_0$

Are the I-V relationships linear?

Linearity & superposition:

homogeneity

$x = 0 : y = 0$



$x_1 \longrightarrow y_1$

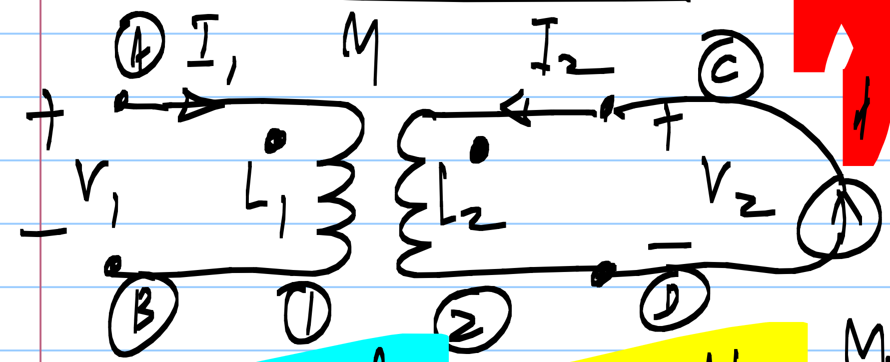
$x_2 \longrightarrow y_2$

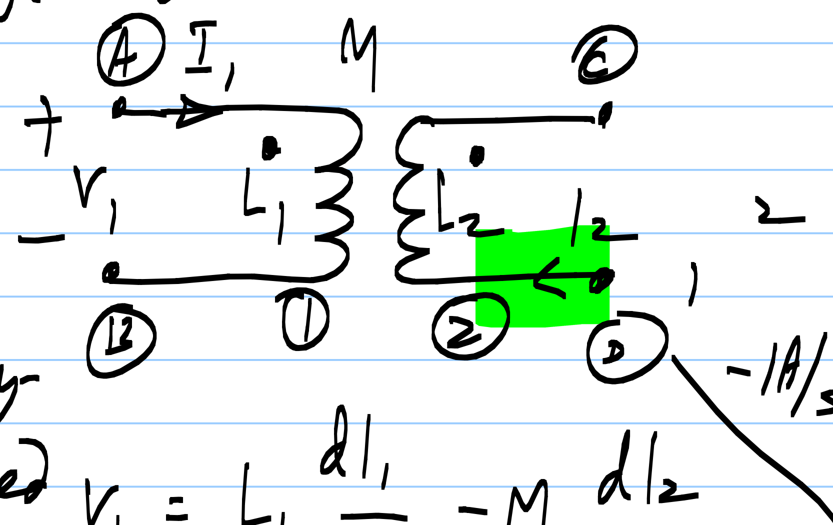
$\Longrightarrow \quad a x_1 + b x_2 \longrightarrow a y_1 + b y_2$

[redacted]

Mutual inductor.

Coupling coefficient $k = \frac{M}{\sqrt{L_1 L_2}}$ $|k| \leq 1$





$v_1 = \frac{dI_1}{dt} + \frac{dI_2}{dt}$

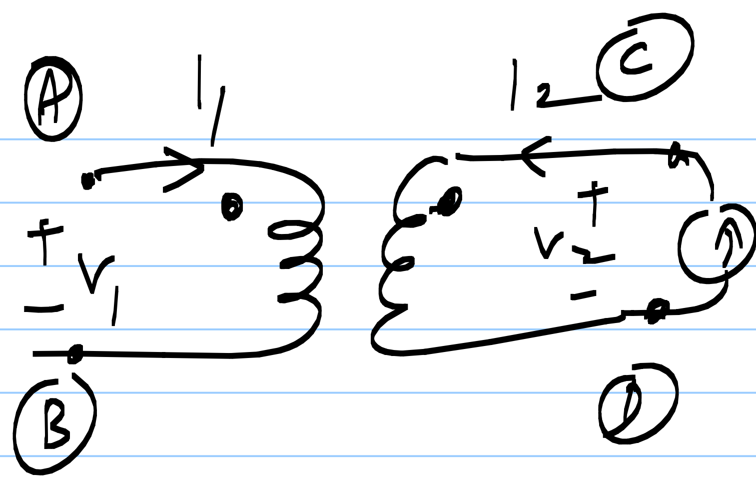
$v_2 = M \cdot \frac{dI_1}{dt} + L_2 \cdot \frac{dI_2}{dt}$

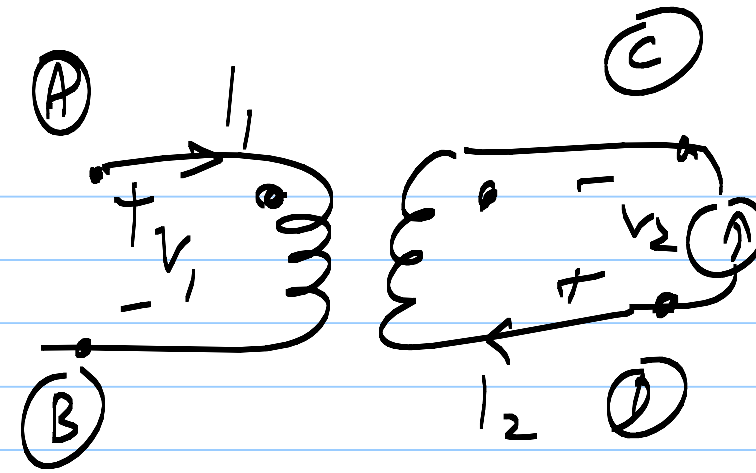
Mutually-induced voltage

$v_1 = L_1 \frac{dI_1}{dt} - M \frac{dI_2}{dt}$

L_1, L_2 : Self inductance

M : Mutual inductance





dot-convention: avoids ambiguity in the sign of the mutually-induced voltage