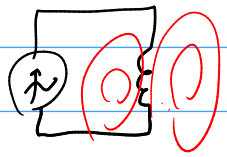
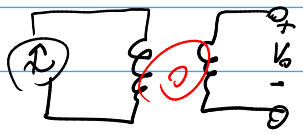
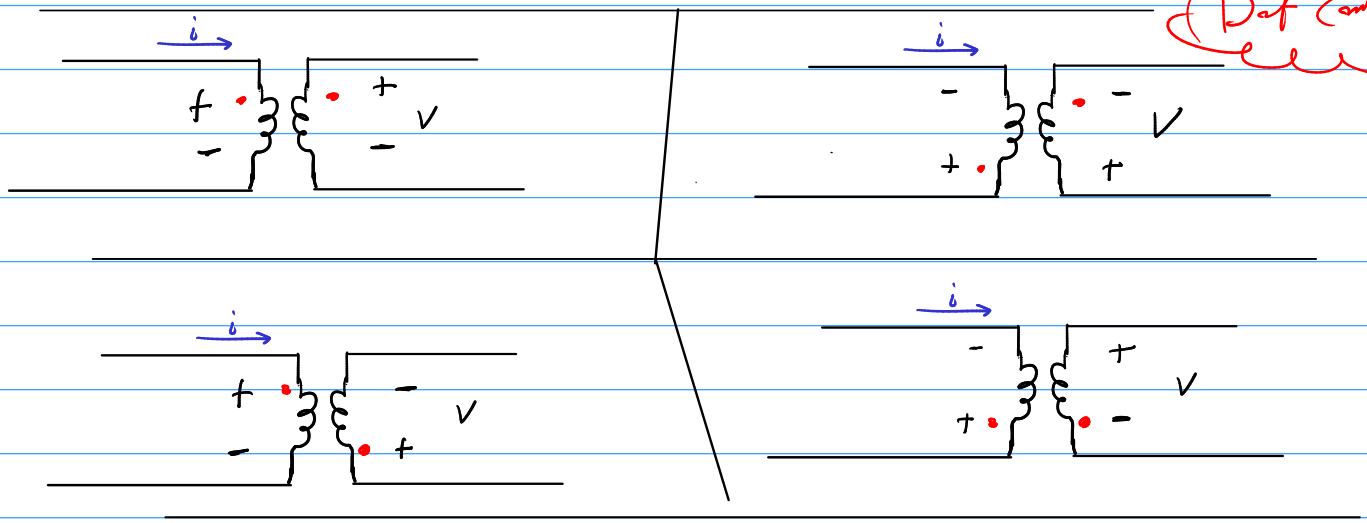
Self inductance



Mutual inductance



Def convention



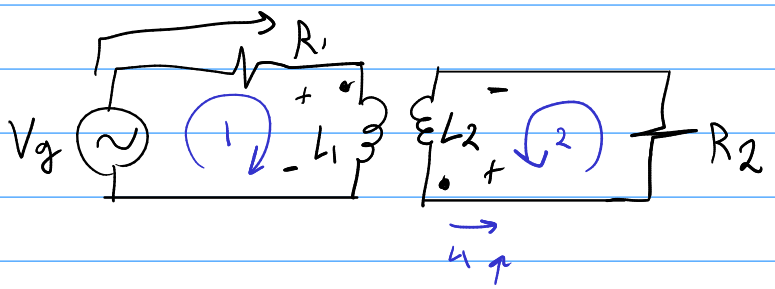
Self inductance: $L = N\frac{d\phi}{di}$; $N = n/\ell$

$$V = L\frac{di}{dt}$$

Mutual κ : $V_1 = N_1\frac{d\phi_1}{di_1}\frac{di_1}{dt} = L_1\frac{di_1}{dt}$

$\phi_1 = \phi_{11} + \phi_{12}$ (total = self + mutual)

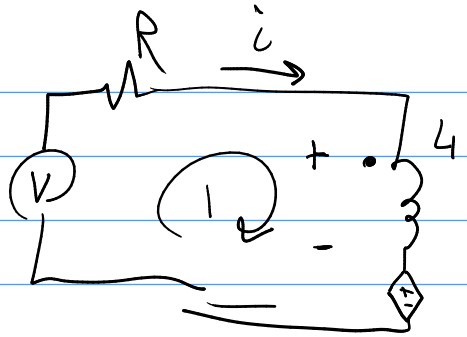
$$\Rightarrow V_2 = N_2\frac{d\phi_{12}}{di_1}\frac{di_1}{dt} = M_{21}\frac{di_1}{dt}$$

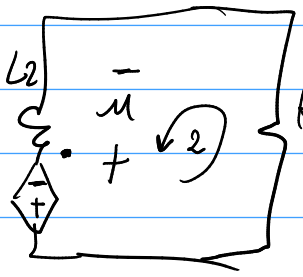


$$\begin{cases} (1)\ -V_g + i_1R + L_1\frac{di_1}{dt} - M\frac{di_2}{dt} = 0 \\ (2)\ i_2R_2 + L_2\frac{di_2}{dt} - M\frac{di_1}{dt} = 0 \end{cases}$$

In Frequency domain:

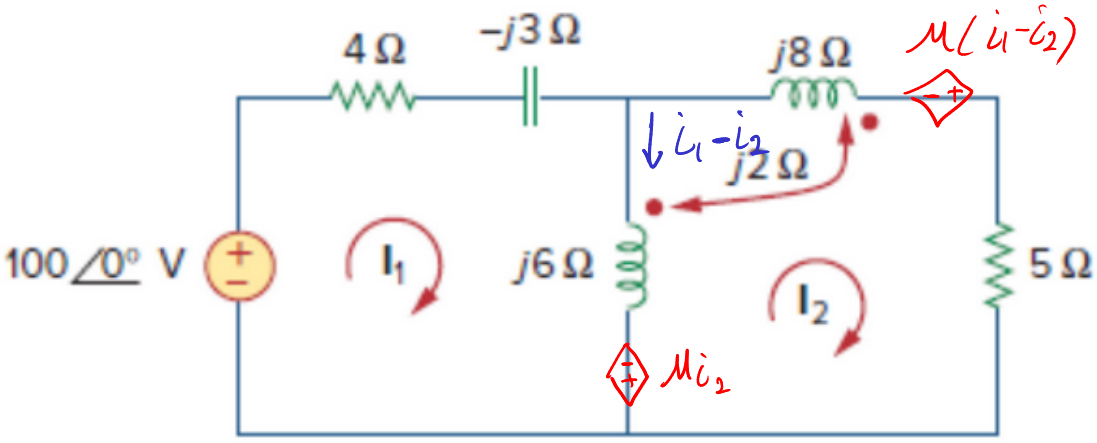
$$RI_1 + sL_1I_1 - sMI_2 = V_g(s)$$





$$Ri_1 + L_1\frac{di_1}{dt} - M\frac{di_2}{dt} = V$$

$$Ri_2 + L_2\frac{di_2}{dt} - M\frac{di_1}{dt} = 0$$



$$4I_1 - j3I_1 + j6I_1 - j2I_2 = 100\angle 0$$

$$2jI_2 + 6jI_2 + j8I_2 - 2j(I_1 - I_2) = 0 \Rightarrow$$