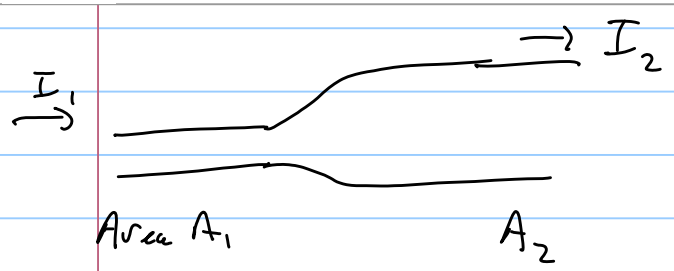
Lecture 33 April 14

Note Title 4/14/2006



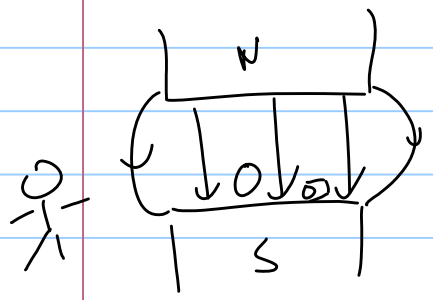
$$I = \int J \, dA = JA$$

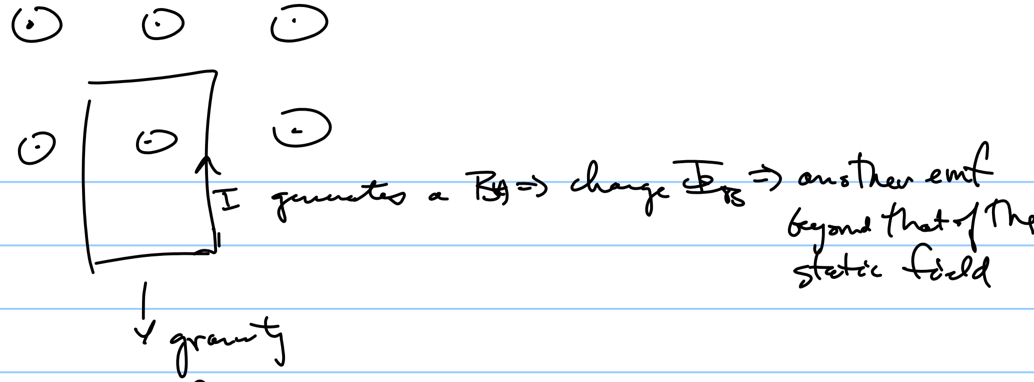
$$J_1 A_1 = J_2 A_2$$

$$\rho v_{d_1} A_1 = \rho v_{d_2} A_2$$

$$v_{d_2} = v_{d_1} \frac{A_1}{A_2}$$ incompressible flow (like H_2O ~ pipe)

Film loop





We accnt for this effect by cal $\Phi_{\text{due to current}} \propto i$ ← current in circuit

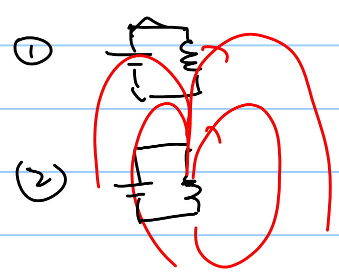
$$\Phi = L i$$

↑ inductance (self) internal flux

$$\mathcal{E}mf_{self} = -\frac{d\Phi}{dt} = -L\frac{di}{dt}$$

↑ assumed constant

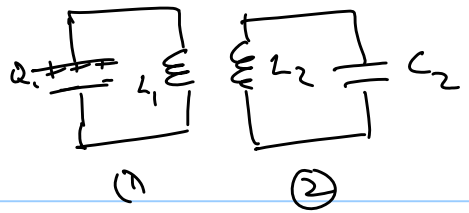
Mutual inductance



$$\Phi_{①②} = M_{12} I_{②}$$

(①② : due to) ← external flux; M_{12} ← mutual inductance

Ex:



① $\sum_i V_i = 0$

$$\frac{Q_1}{C_1} - L_1\frac{di_1}{dt} + M\frac{di_2}{dt} = 0$$

$$\frac{Q_2}{C_2} - L_2\frac{di_2}{dt} + M\frac{di_1}{dt} = 0$$

} 2 coupled ODE's

$i_1 \& Q_1$ $\quad i_1 = -\frac{dQ_1}{dt}$ $\quad i_2 = -\frac{dQ_2}{dt}$

$$Q_1(t) = A\sin(\omega_N t + \alpha) \qquad Q_2(t) = B\sin(\omega_N t + \alpha)$$

$$\omega_N = \frac{\omega_0}{\sqrt{1+K}} \qquad \omega_0^2 = \frac{1}{L_1C_1} = \frac{1}{L_2C_2} \quad \text{let } k^2 = \frac{M^2}{L_1L_2}$$

Normal modes