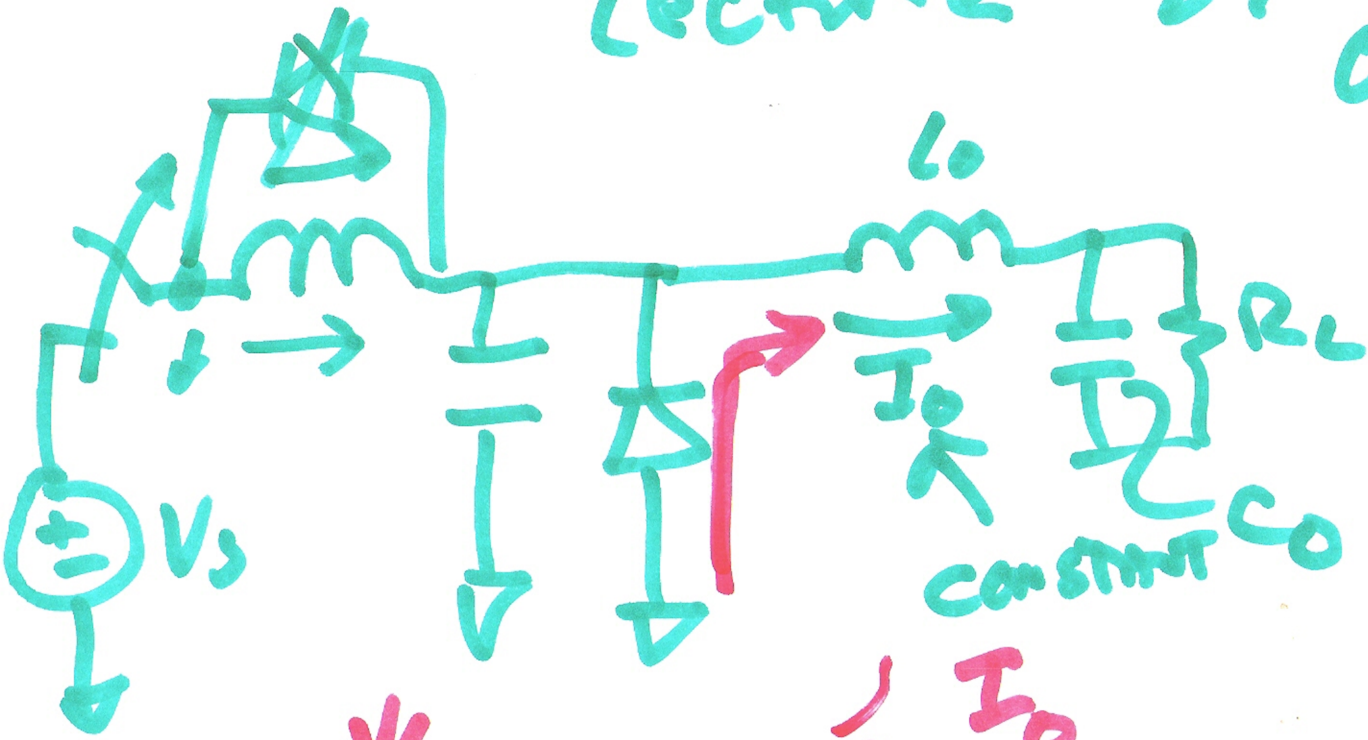
ECE 5/472 Power Electronics

BOISE STATE UNIVERSITY

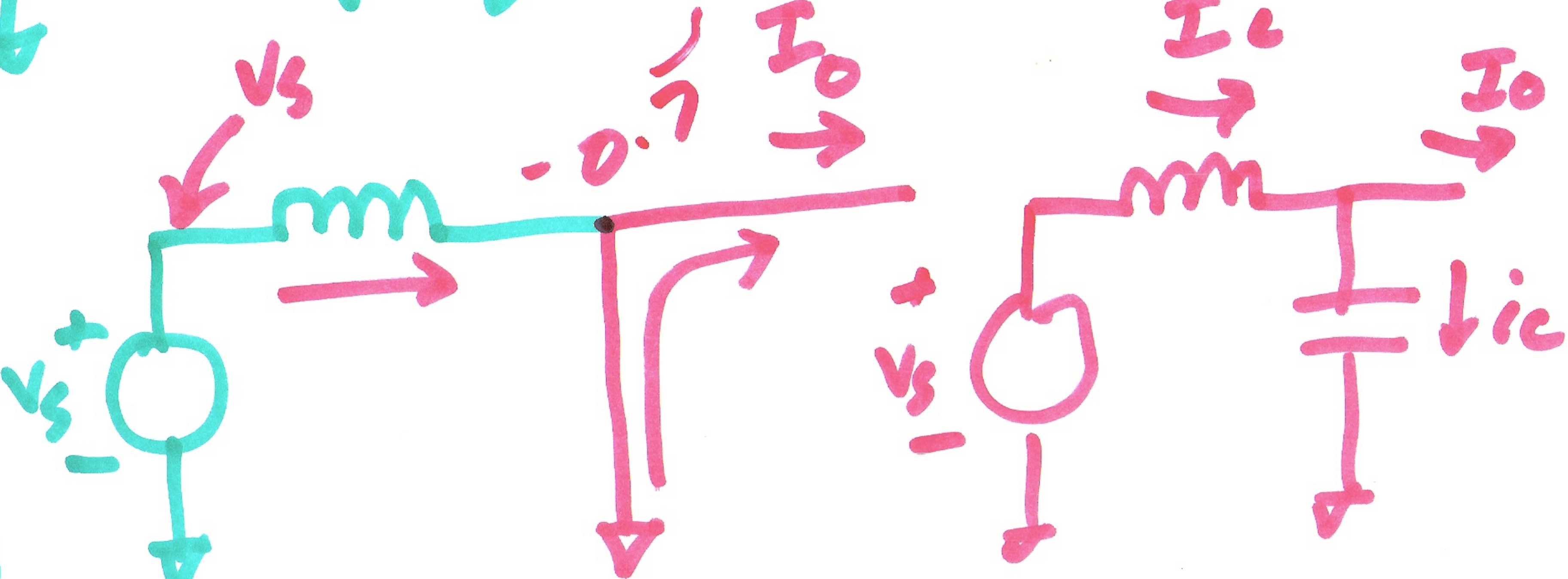
Lecture 27

OCT. 27 2010



$$v = L \cdot \frac{di}{dt}$$

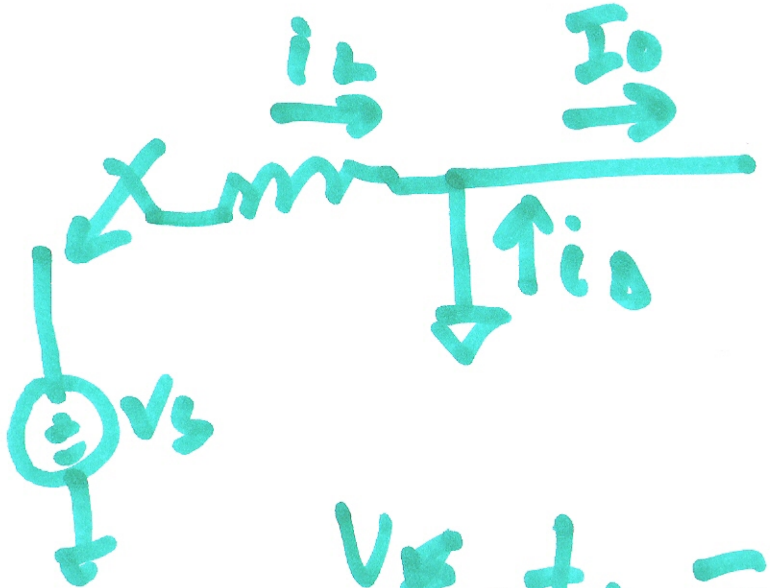
1)



$0 < t < t_1$ diode is on

$I_o = I_L + I_D$

$$i_L(t) = \frac{1}{L_r}\int_0^t V_s \cdot dt = \frac{V_s}{L} \cdot t$$



$I_D = I_o - I_L$

t_1 occurs when $I_o = I_L$

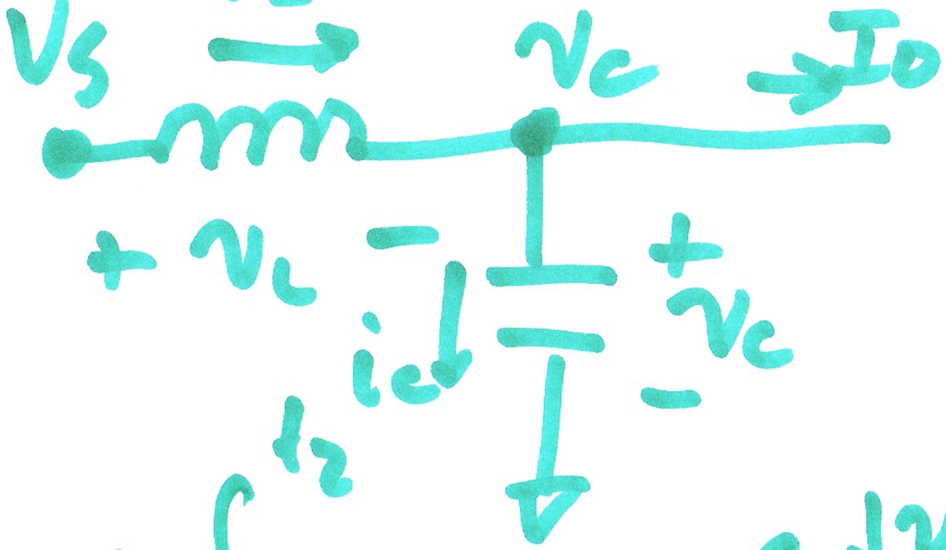
$$\frac{V_s}{L} \cdot t_1 = I_o$$

$$\boxed{t_1 = \frac{I_o \cdot L}{V_s}}$$

2)

$t_1 < t < t_2$

inductor, L_r, charges C_r and supplies current to load



$$v_L(t) = V_S - v_c(t)$$

$$i_L = \frac{1}{L}\int_{t_1}^{t_2} v_L(t)\cdot dt + I_o$$

$$\frac{1}{L}\int_{t_1}^{t_2} v_L \cdot dt = C\,\frac{dv_c}{dt} \qquad i_c = C\,\frac{dv_c}{dt}$$

$$i_L = i_c + I_o$$

(9-7)

$$L_r \frac{d^2 i_L(t)}{dt^2} + \frac{i_L}{L_r C_r} = \frac{I_o}{L_r C_r}$$

3)

$$t_2 - t_1 = \frac{1}{\omega_0}\cdot\left[\sin^{-1}\left(\frac{I_0 \cdot Z_0}{V_s}\right)+\pi\right]$$

$$\omega_0 = \frac{1}{\sqrt{L_r C_r}} \qquad Z_0 = \sqrt{\frac{L_r}{C_r}}$$

$t_2 < t < t_3$

$$I_0 = C_r \frac{dV_c}{dt}$$

$$V_c(t) = \frac{I_0}{C_r}\cdot t$$

$$V_c(t) = V_s + \frac{I_0}{C_r}\cdot(t - t_2)$$

$t < t_2$

$$v_0 = V_s \cdot f_s \cdot \left[\frac{t_1}{2} + (t_2 - t_1) + (t_3 - t_2)\right]$$

4

4)