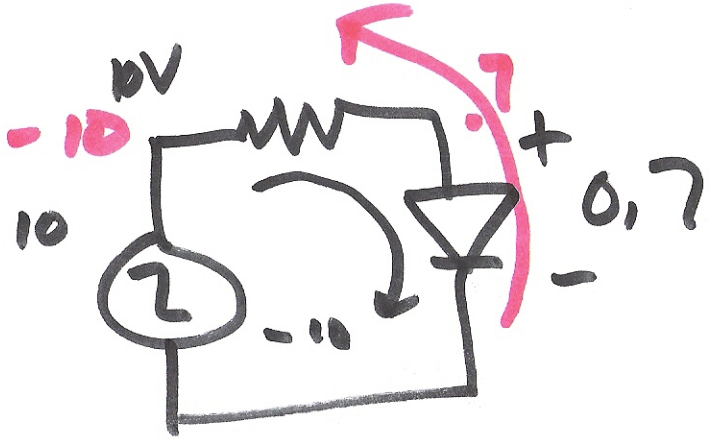
ECE 5/472 Power Electronics

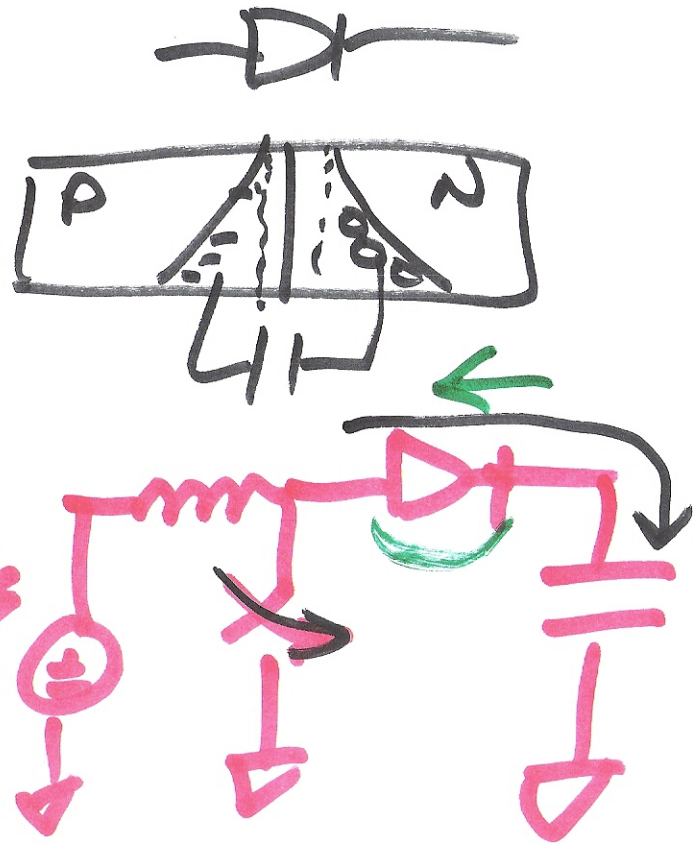
BOISE STATE UNIVERSITY

Lecture 14 (study/review)

Sept. 26, 2010

Reverse Recovery



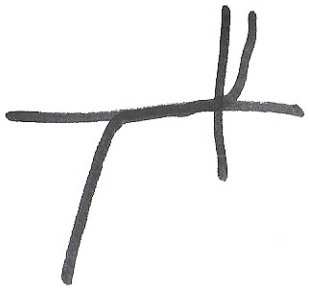


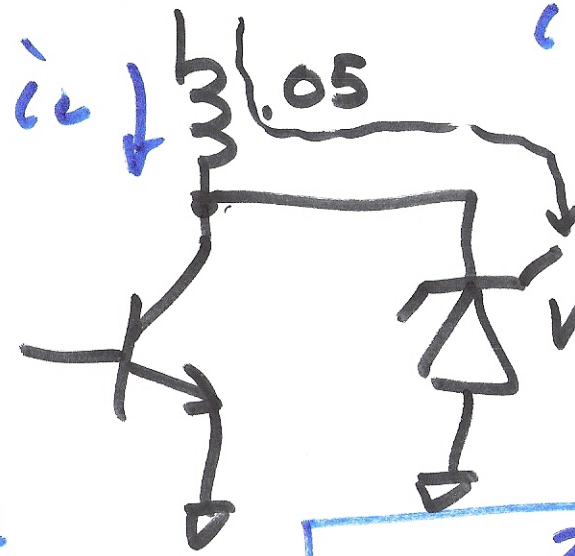
1)

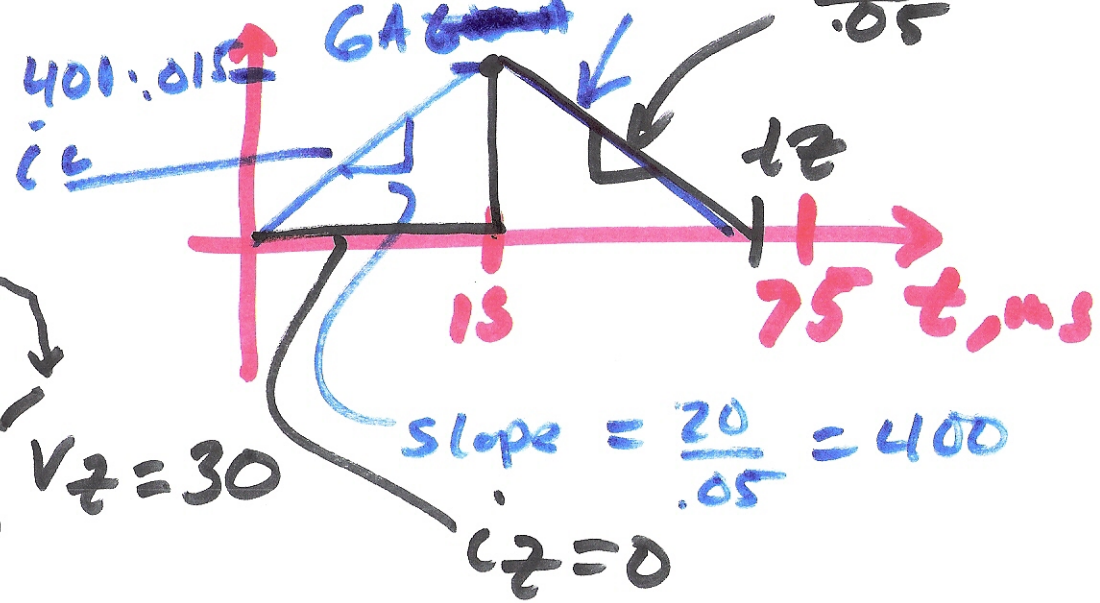
2-14)

$V_{CC} = +20V$ $L = 50 \sim H$ $V_z = 30V$

$t_{ON} = 15ms$ $t_{off} = 60ms$







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

$i_L = \frac{20}{L} \cdot t$

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

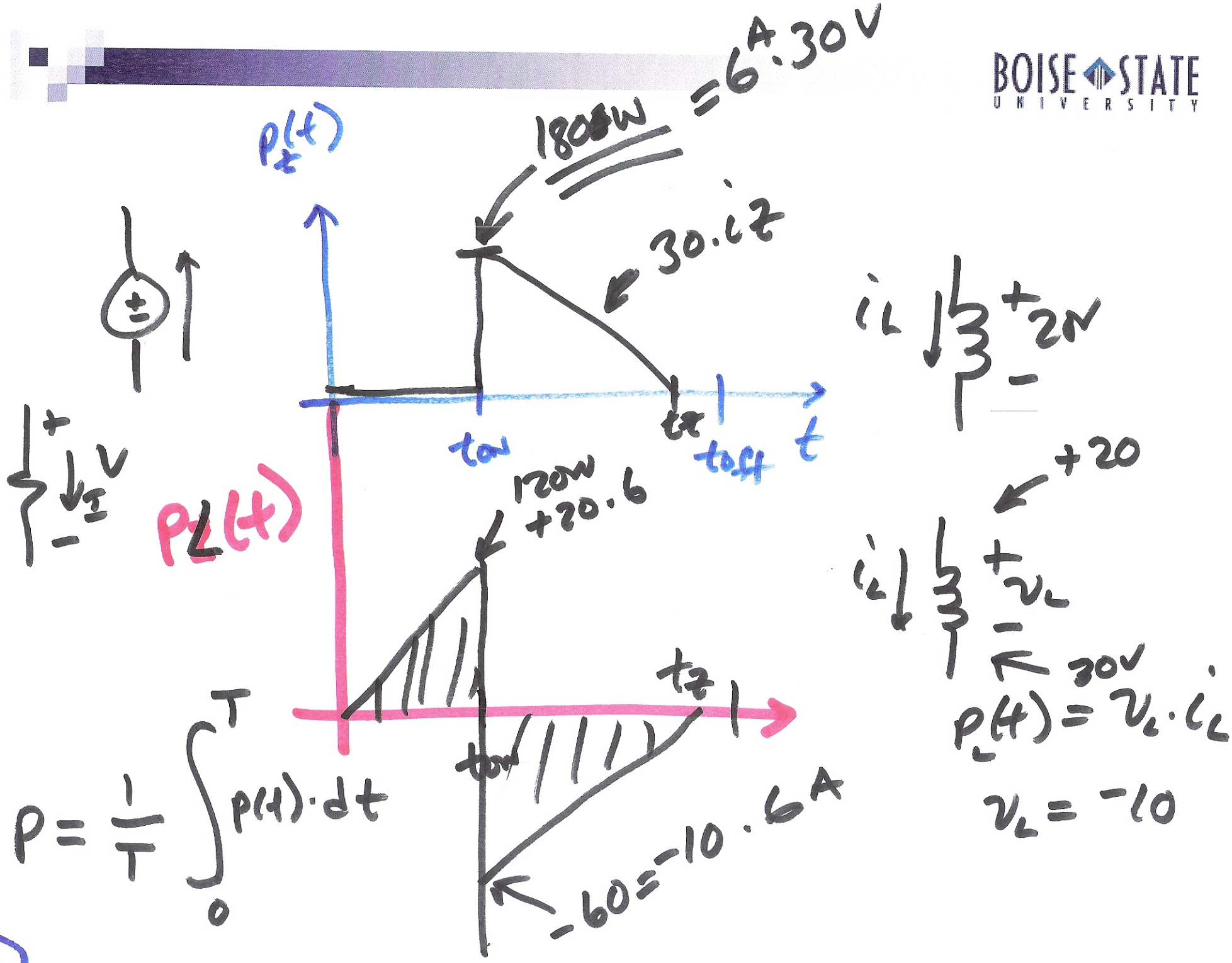
$20 = .05 \cdot \frac{di_L}{dt}$

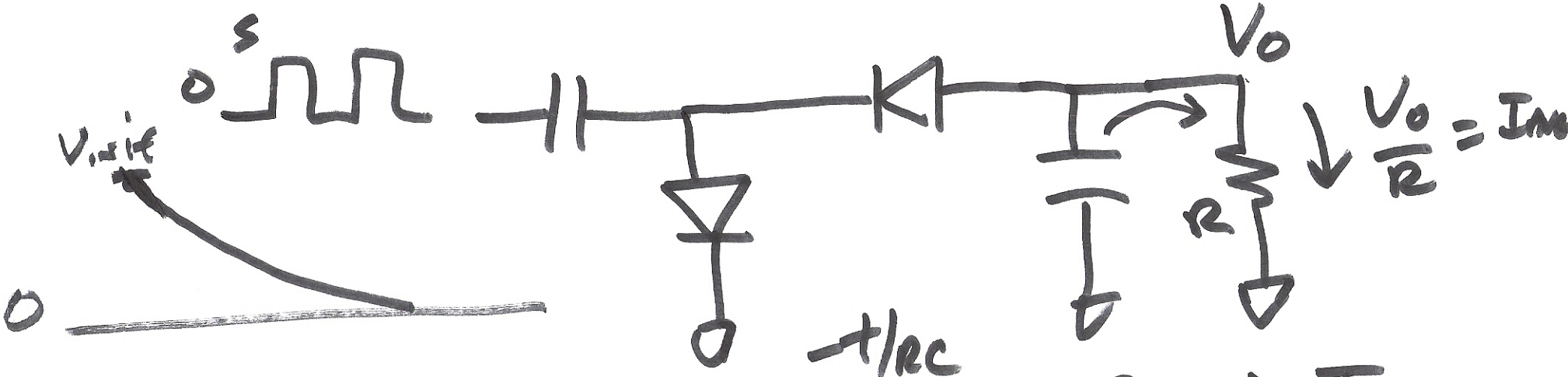
$20 - 30 = L \cdot \frac{di_L}{dt}$

$6 = \frac{10}{L}(t_z - .05)$

$i_L = \frac{6-10}{L}(t - 15ms)$

2)


$P_s(t)$
180W
$= 6^A \cdot 30^V$
$30 \cdot i_z$
t_{on}
t_z
t_{off}
t
$P_L(t)$
120W
$+20 \cdot 6$
t_z
t_{on}
$-60 = -10 \cdot 6^A$
i_L
$+ 2V -$
$+20$
i_L
$+ v_L -$
$30V$
$P_L(t) = v_L \cdot i_L$
$v_L = -10$
$+ V_s -$
$P = \frac{1}{T} \int_0^T p(t) \cdot dt$
3)



$RC >> T$

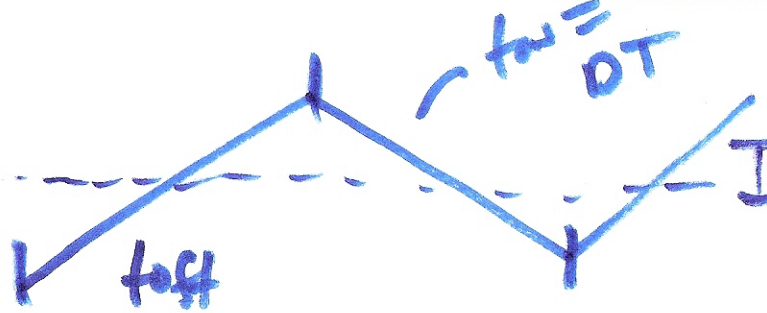
$$V_0(t) = V_{init}\, e^{-t/RC}$$

$$= V_{init}\left(1 + \left(\frac{-t}{RC}\right) + \frac{\left(-t/RC\right)^2}{2!} + \cdots\right)$$

$$\approx V_{init}\left(1 + \frac{-t}{RC}\right)$$

4)

$CV = Q$

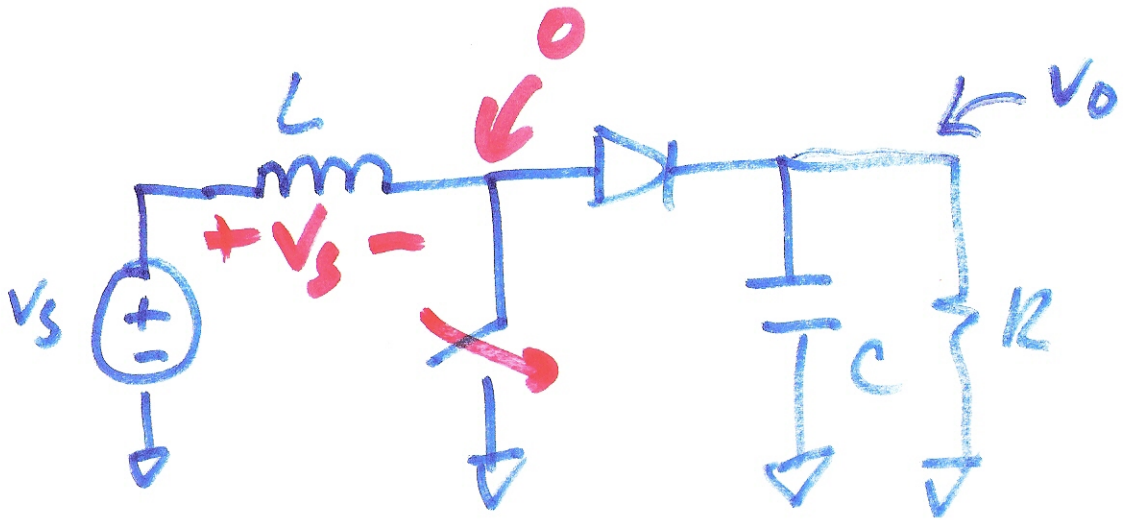


$$I_{AVG} = \frac{V_O}{R}$$

$$\Delta Q = \frac{V_O}{R} \cdot DT = C \cdot \Delta V_O$$

$$V_O \gg \Delta V_O$$

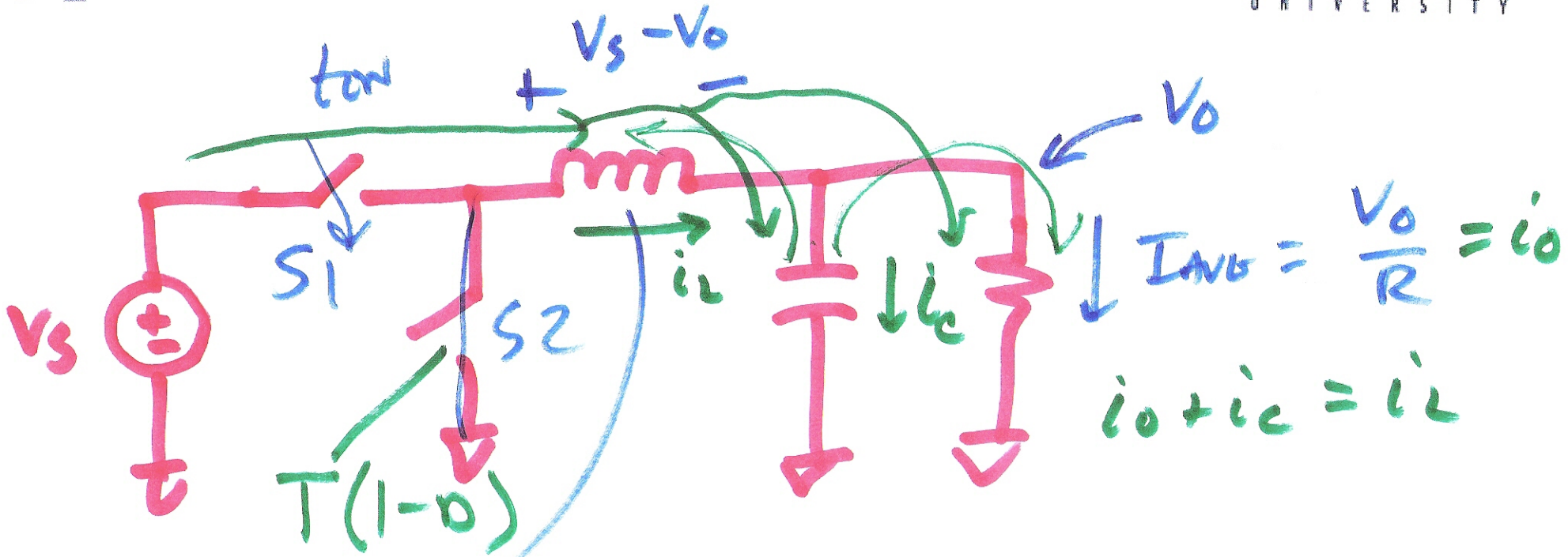
$$\frac{\Delta V_O}{V_O} = \frac{DT}{RC} = \frac{D}{RC \cdot f}$$



$$\Delta V_O = I_{AVG} \cdot \frac{D}{f \cdot C}$$

5)

Buck



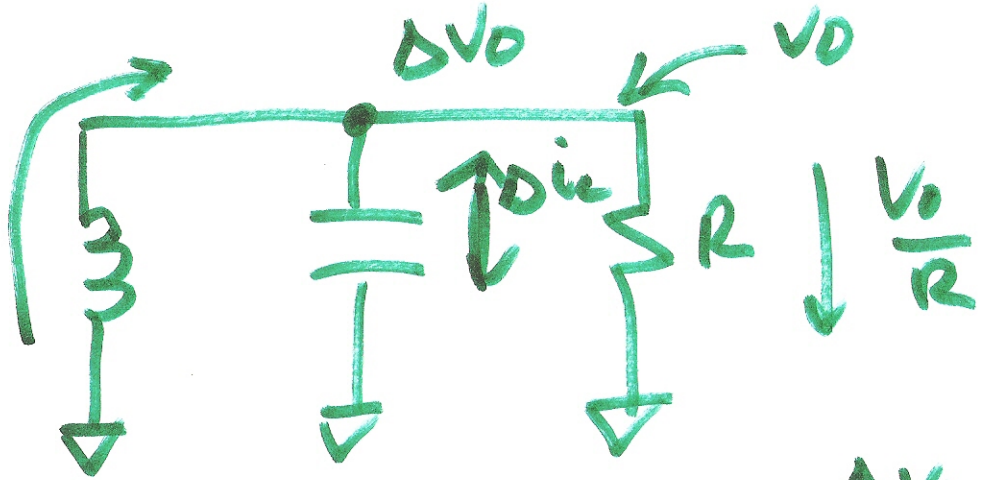
$$i_L(t) = \frac{V_s - V_o}{L} \cdot t$$

ON S1 is on

$$i_L(t) = -\frac{V_o}{L} t$$

S2 is on

6)



$$\Delta i_C = C \cdot \frac{\Delta V_o}{(1-D)T}$$

$$I_{L,init} - \frac{V_o}{L} \cdot (1-D)T = i_L$$

$$\Delta Q = \Delta V_o \cdot C$$

page 204

$$V_S \cdot I_S = V_O \cdot I_O$$

Assumes 100% efficiency.