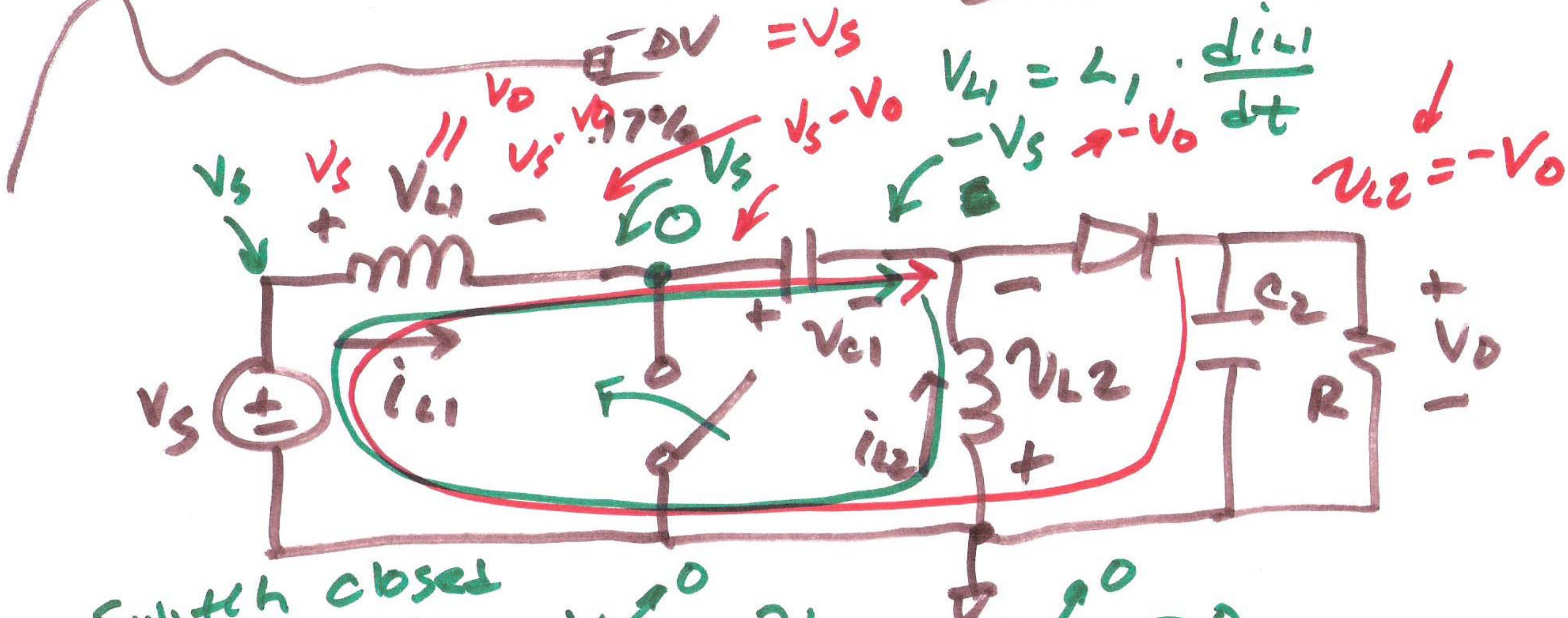
ECE 5/472 Power Electronics

BOISE STATE UNIVERSITY

Sept. 15, 2011

Lecture 8



Switch closed

$$V_S - \cancel{v_{L1}}^{\,0} - v_{C1} + \cancel{v_{L2}}^{\,0} = 0$$

$v_{L1} = V_S$

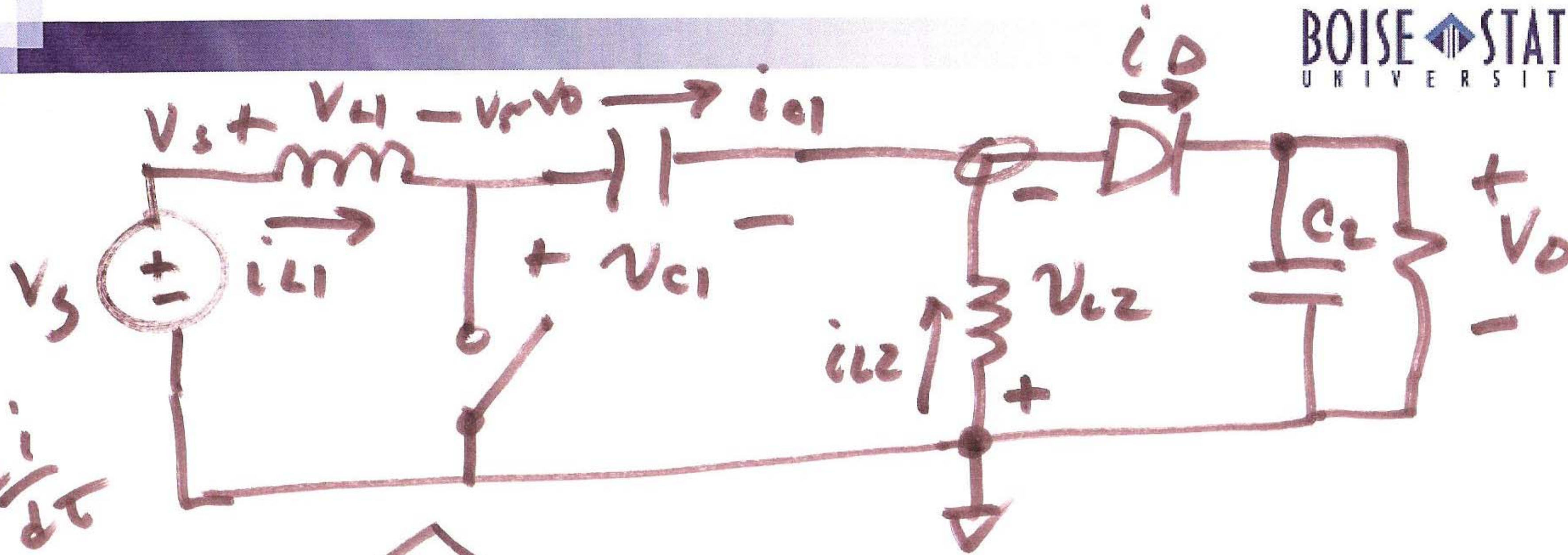
$v_{L2} = -V_S$

$$\boxed{V_S = v_{C1}}$$

Switch open

$$V_S - \underset{V_0}{\cancel{v_{L1}}} - \underset{V_S}{\cancel{v_{C1}}} - V_0 = 0$$

1)



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

$$\underbrace{\frac{V_S \cdot D\cancel{T}}{\cancel{L}}}_{\text{switch closed}} - \underbrace{\frac{V_o \cdot (1-D)\cancel{T}}{}}_{\text{swittch open}} = 0$$

$$\boxed{D = \frac{V_o}{V_o + V_s}} \qquad \boxed{V_S\left(\frac{D}{1-D}\right) = V_o}$$

2)

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$$P_S = P_O$$

$$V_S I_S = V_S I_{L1} = P_O = P_S$$

$$V_S I_{L1} = \frac{V_O^2}{R}$$

$$I_{L1} = I_S = \frac{V_O^2}{V_S \cdot R}$$

$$v_{L1} = V_S = L_1 \cdot \frac{\Delta i_{L1}}{DT}$$

$$\Delta i_{L1} = \frac{V_S \cdot DT}{L_1}$$

$$\underbrace{\cancel{i_{C1}}}_{0} + i_{L2} = i_O = I_O + \underbrace{\cancel{i_{C2}}}_{0}$$

$$\boxed{I_{L2} = I_O}$$

3)

Switch is closed

$$V_S = v_{L2} = L_2 \frac{\Delta i_{L2}}{DT} \quad V_S$$

$$\Delta i_{L2} = \frac{\cancel{v_{L2}} \cdot DT}{L_2}$$

$$\Delta i_{L2} = \frac{V_S \cdot DT}{L_2}$$

switch open

$$v_{L2} = L_2 \frac{\Delta i_{L2}}{(1-D)T} = -V_0$$

$$\Delta i_{L2} = \frac{-V_0 \cdot (1-D)T}{L_2}$$

4) $V_S\left(\frac{D}{1-D}\right) = V_0 \qquad \Delta i_{L1} = -\Delta i_{L2}$