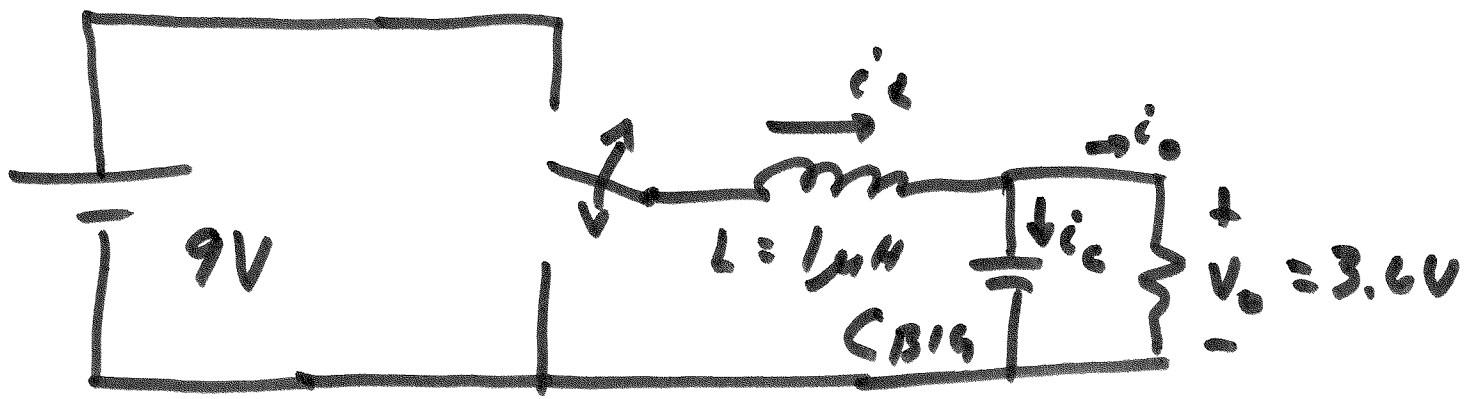
ECE 404-TD / 504-TD

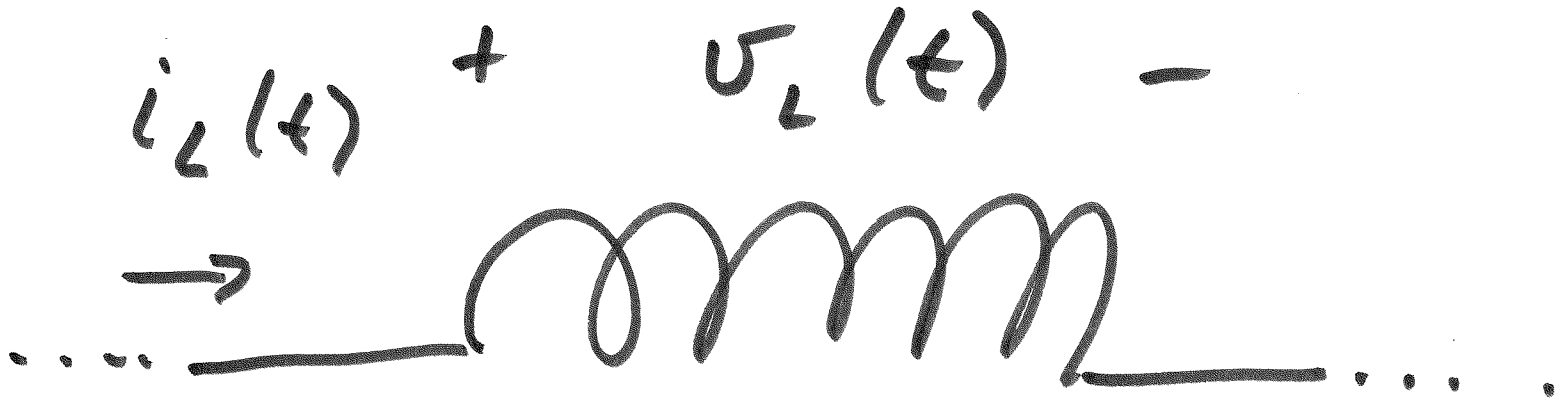
ST: T&D APPLICATIONS OF VOLTAGE SOURCE CONVERTERS

SESSION no. 3



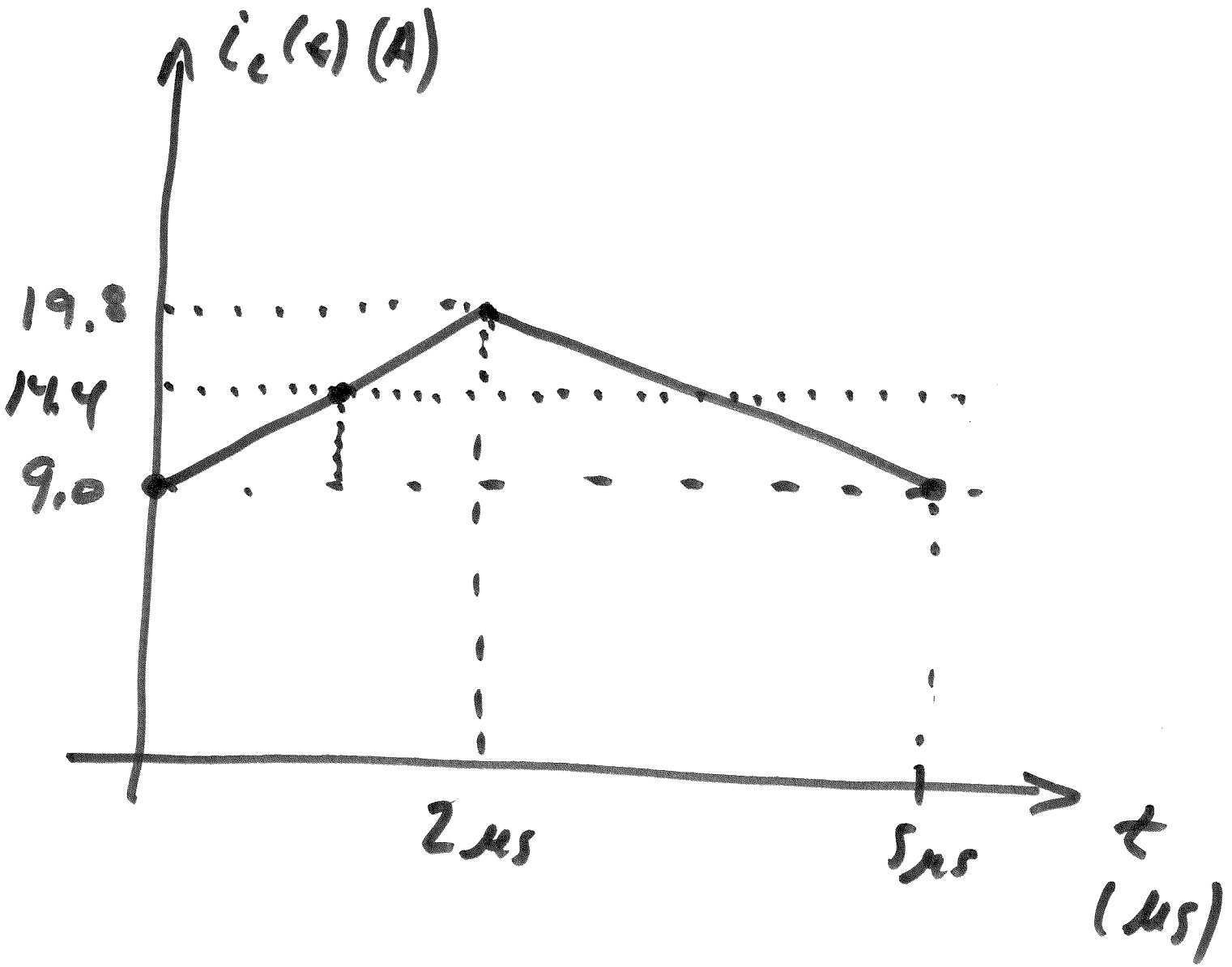
$d_A = 0.4$ $f_s = 200kHz$ $R = 0.25\Omega$

Find V_o, $i_L(t)$, P_{out}



$\begin{bmatrix} 9V \\ 0V \end{bmatrix}$ $\begin{bmatrix} 3.6V \\ 3.6V \end{bmatrix}$

$$i_L(t) = \frac{1}{L} \int v_L(t)\, dt$$


$i_L(t)$ (A)
19.8
14.4
9.0
2 ms
5 ms
t (ms)

$$i_L(2\mu s) = i_L(0\mu s) + \frac{1}{L}\int_{0\mu s}^{2\mu s} (V_{in} - V_o)\, dt$$

$L = 1\mu H$

$V_{in} = 9V$

$V_o = 3.6V$

$$i_L(2\mu s) = i_L(0\mu s) + 10.8\,A$$

$$i_L = i_c + i_0$$

$$\overline{i_L} = \overline{i_c} + \overline{i_0}$$

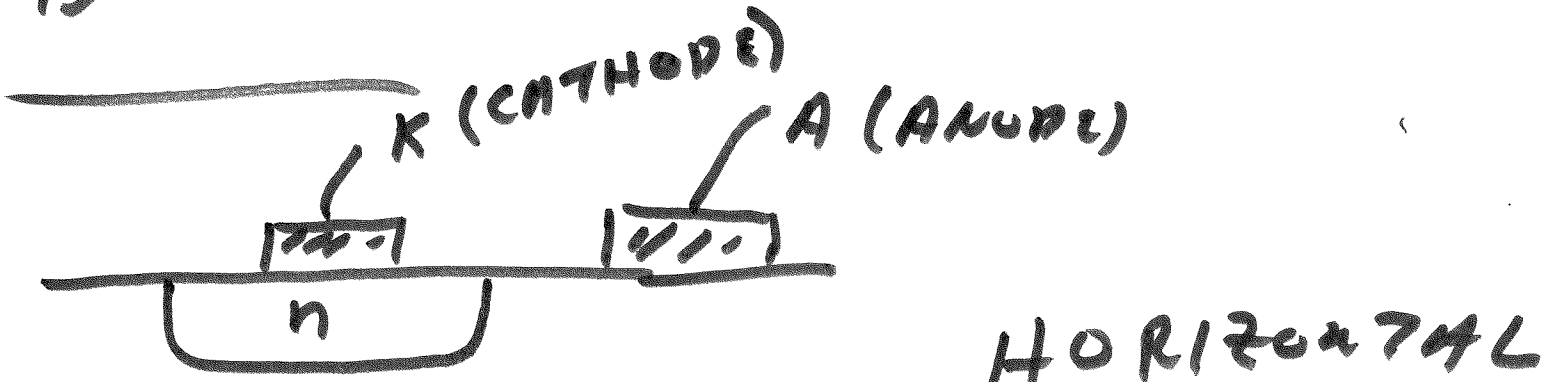
$$\overline{i_L} = 0 + \frac{3.6\,V}{0.25\,\Omega}$$

$$i_L = 14.4\,A$$

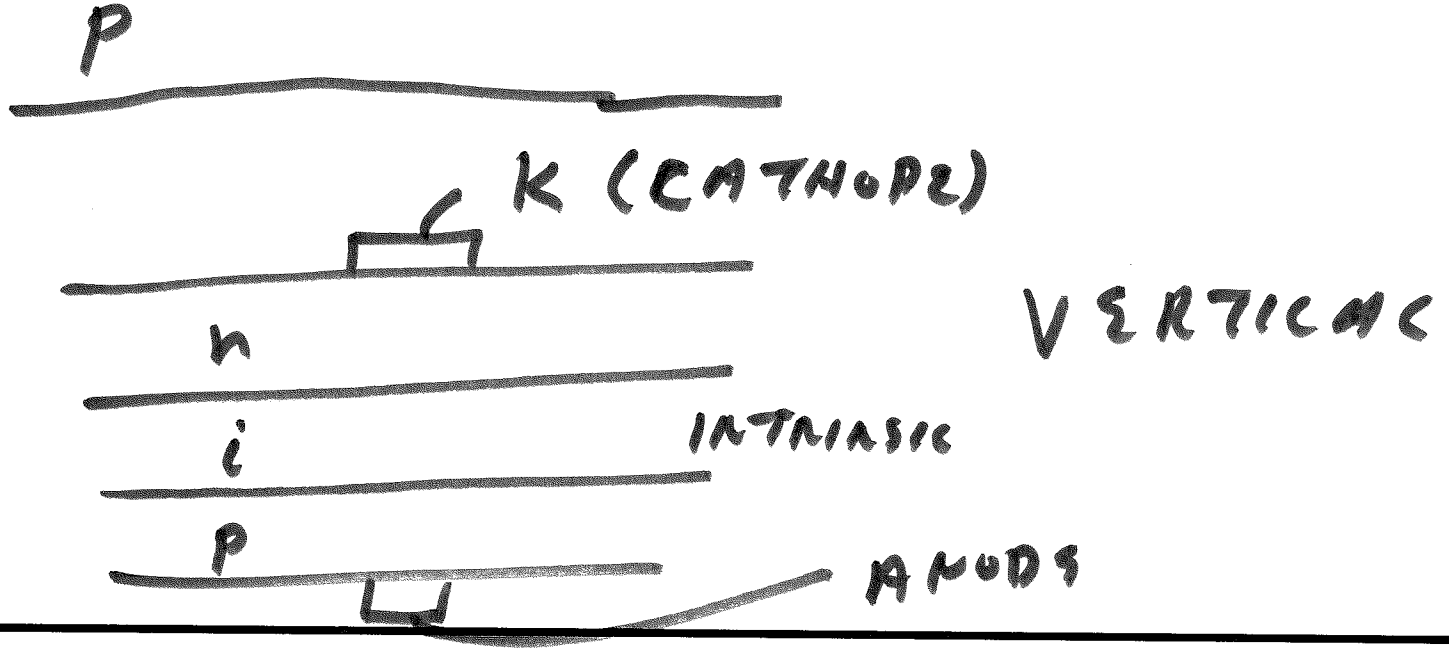
$$14.4\,A = i_L(0) + \frac{10.8\,A}{2}$$

$$i_L(0) = 9.0\,A$$

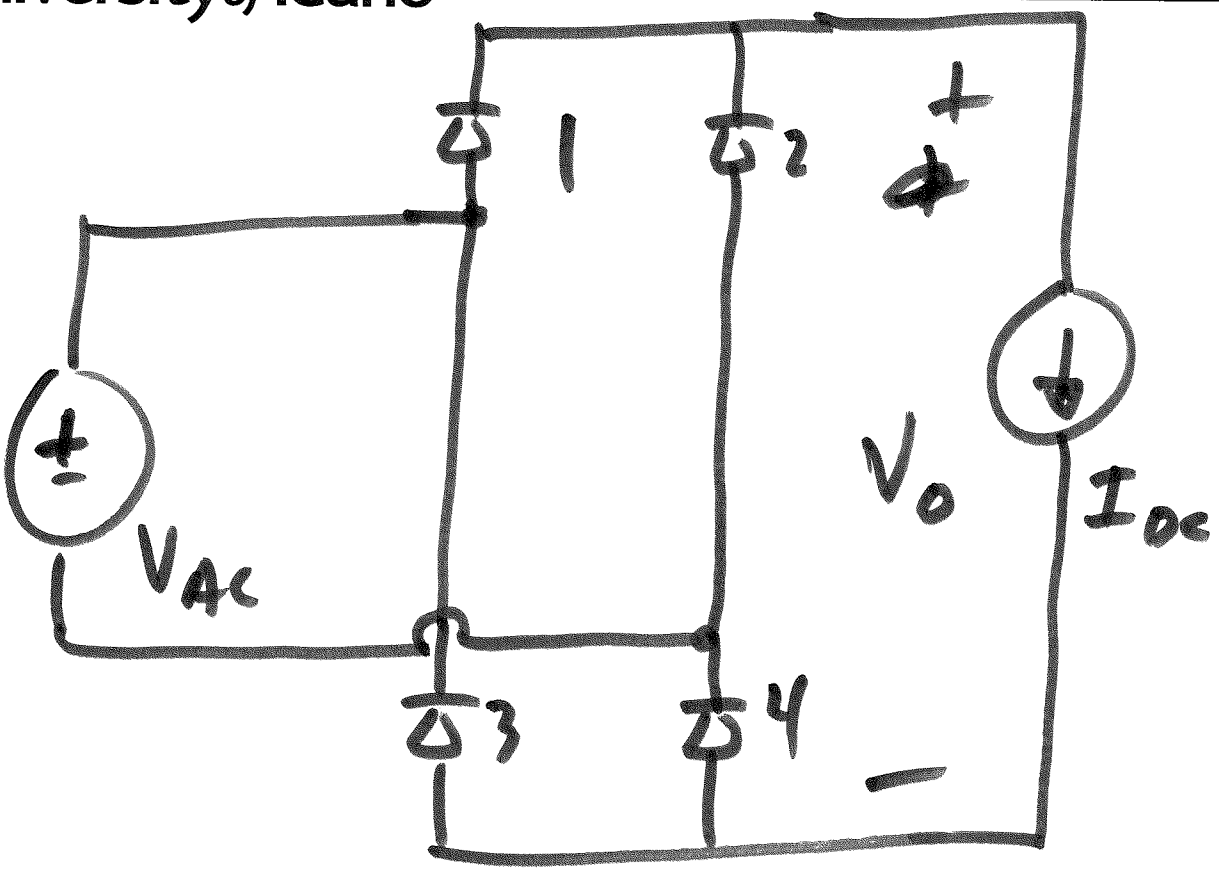
DIODE



HORIZONTAL

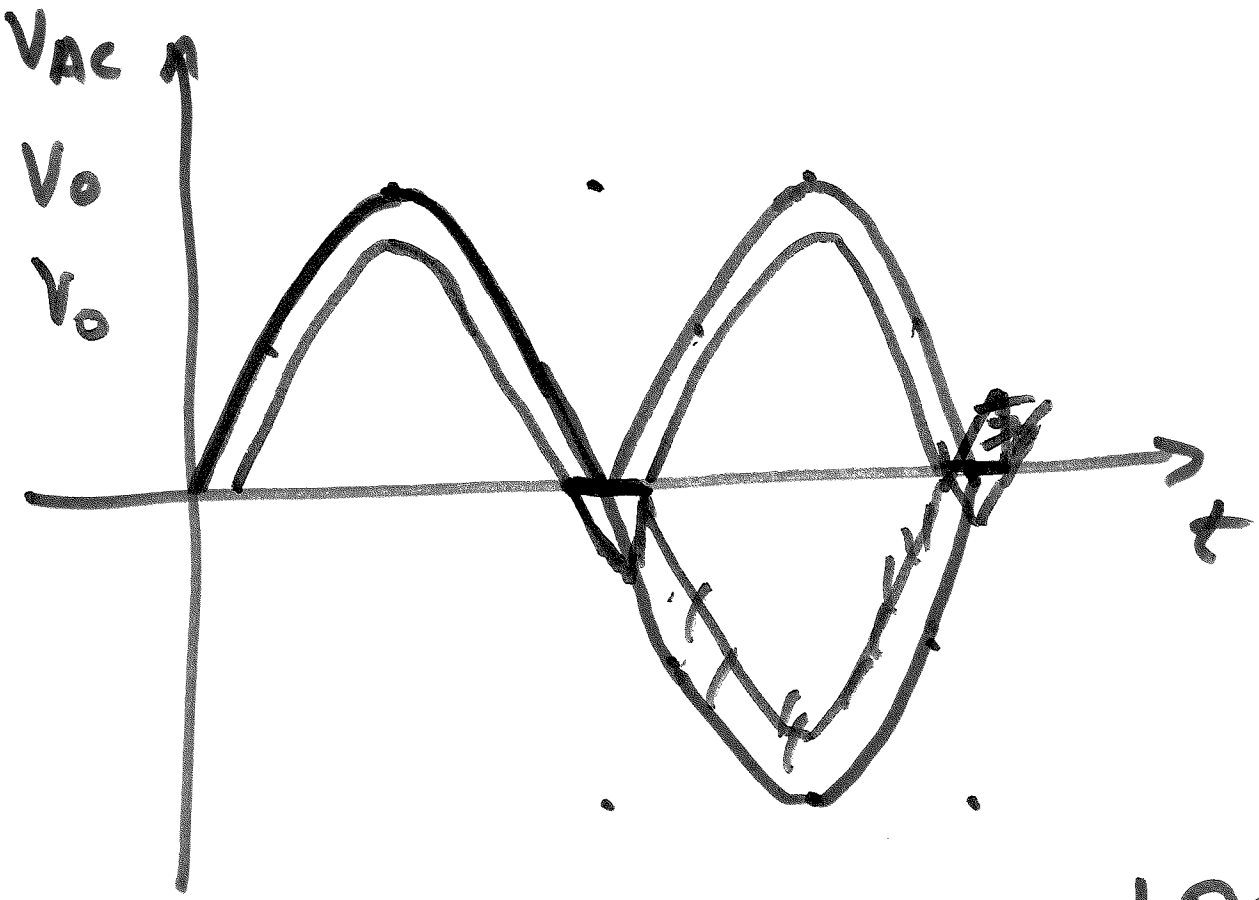


VERTICAL



Let $V_{AC}(t) = 12\sqrt{2} \sin \omega t$

$I_{DC} = 2.0\ A$



IDEAL

0.7 V

ECE 404 / 504

T & D Applications of Voltage Sourced Converters

Lesson 3

The inductor current is a ramp: Integrate the constant voltage over time and scale it...we get a ramp.

Let's build a biposition switch from available components.

Switching component types:

Uncontrolled switch: The rest of the circuit determines the switch state. Example: diode

Forward bias: try to place a positive voltage on the diode...it will conduct.

Reverse bias: try to place a negative current in the diode...it will block.

Semicontrolled switch: example: thyristor (silicon controlled rectifier SCR) SCR conducts when it has a positive (forward) voltage AND a trigger pulse; it blocks like a diode (try to reverse the current)

Controlled: conducts and blocks in response to commands. Example: MOSFET, Insulated Gate Bipolar Transistor (IGBT), Gate Turn-off Thyristor (GTO), others...

Diode (Power diode)

☺ Greater voltage capacity

☺ Greater current capacity

☹ Intrinsic region has more voltage drop and power loss

☹ Resistance term in series in the model