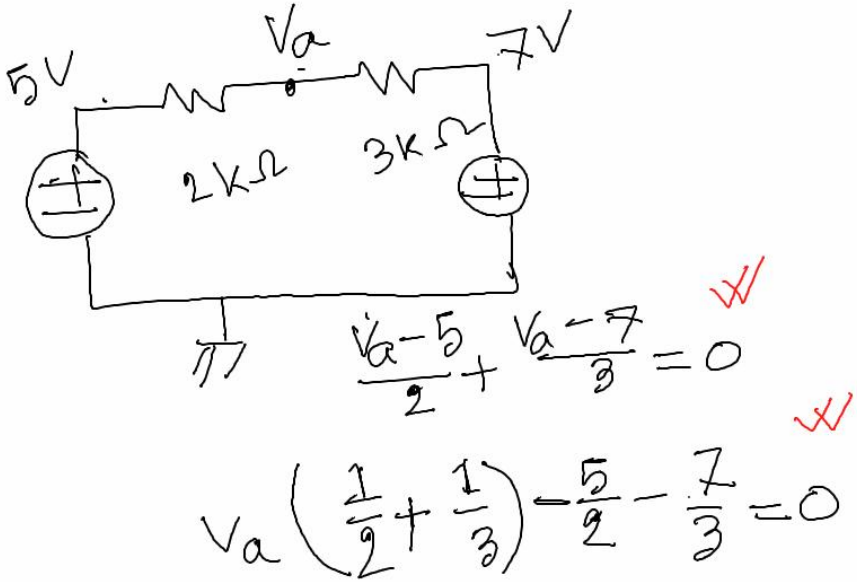
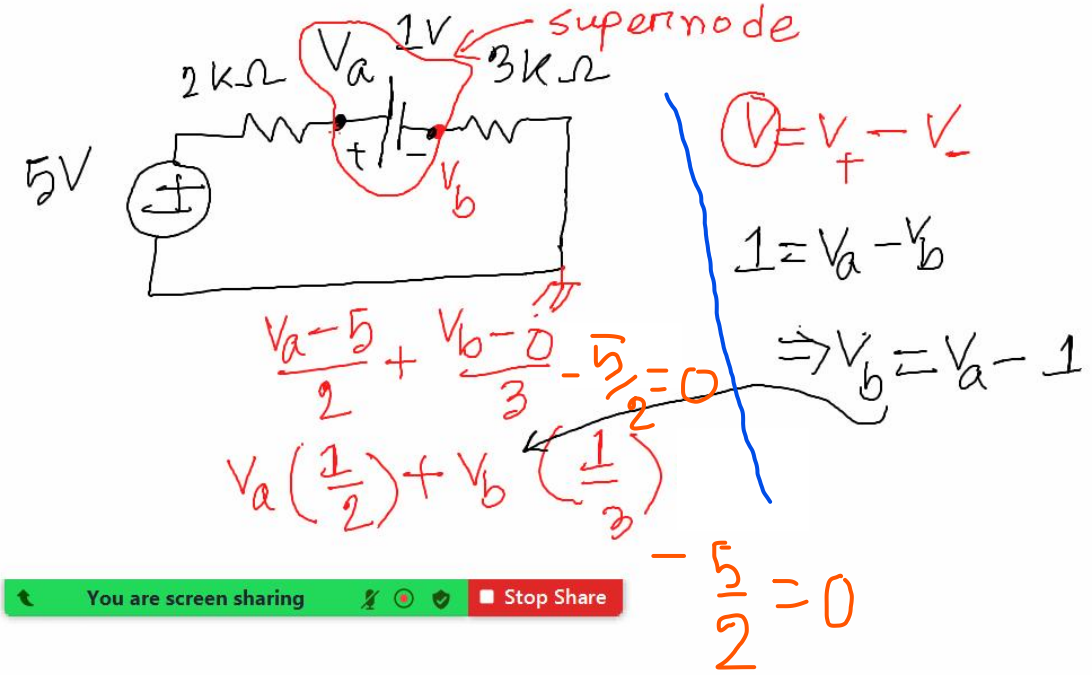
Lecture 8: Method of assumed state

Review:

When should we consider a 'supernode' in nodal analysis?





Lecture 8: Method of assumed state

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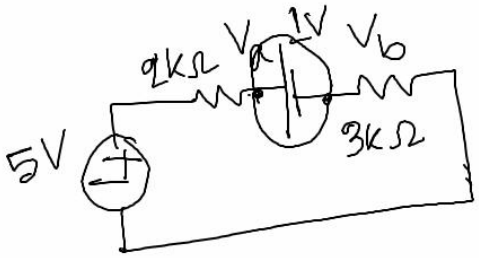
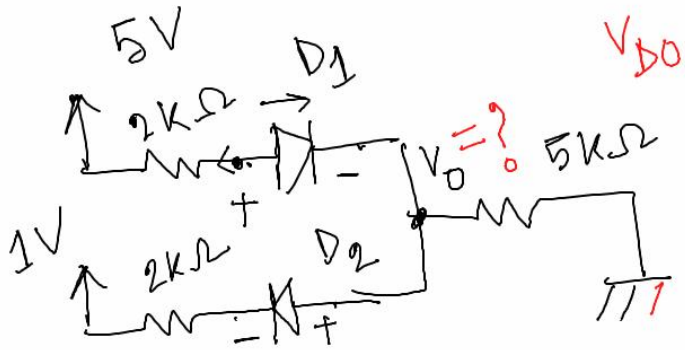


$$V_a\left(\frac{1}{2}\right) + V_b\left(\frac{1}{3}\right) - \frac{5}{2} = 0$$

$$V_a - V_b = 1$$

Lecture 8: Method of assumed state



$V_{D0} = 0.7V$ [cvD]

$0.7 = V_+ - V_-$

$\Rightarrow 0.7 = V_a - V_o \Rightarrow V_o = V_a - 0.7$

Step 1: D_1 ON, D_2 OFF

Step 2:

at V_a,

$$\frac{V_a - 5}{2} + \frac{V_o - 0}{5} = 0$$

$$V_a\left(\frac{1}{2}\right) + V_o\left(\frac{1}{5}\right) - \frac{5}{2} - \frac{0}{5} = 0$$

$$\Rightarrow V_a\left(\frac{1}{2}\right) + (V_a - 0.7)\frac{1}{5} - \frac{5}{2} = 0$$

$V_a = 3.77V$

$V_o = V_a - 0.7 = 3.07V$

Step 3: $i_{D1} = \frac{5 - V_a}{2} = \frac{5 - 3.77}{2} > 0$

$V_{D_2} = V_A - V_C = V_o - V_N$

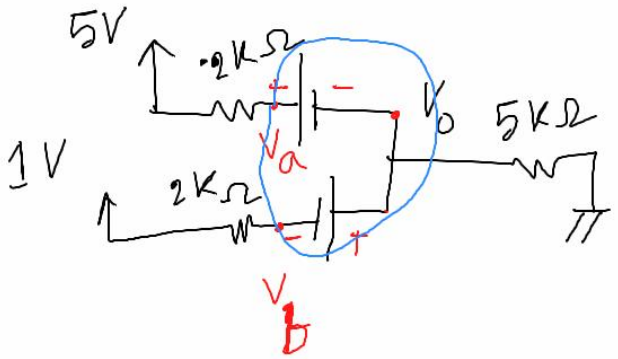
$= 3.07 - 1 = 2.07 \not< 0.7$ ∴ assumption wrong

Lecture 8: Method of assumed state

Mouse Select Text Draw Stamp Spotlight Eraser Format Undo Redo Clear Save

Who can see what you share here? Recording On

Step 1: D_1 ON, D_2 ON



$V_a - V_o = 0.7$

$V_o - V_b = 0.7$

$V_b = V_o - 0.7$

$= V_a - 0.7 - 0.7$

$= V_a - 1.4$

$V_o = V_a - 0.7$

$= 2V$

$V_b = V_o - 0.7$

$= 1.3V$

$i_{D1} = \frac{5 - V_a}{2} = 1.15 > 0$

$i_{D2} = \frac{V_b - 1}{2} = 0.15 > 0$

$\frac{V_a - 5}{2} + \frac{V_o - 0}{5} + \frac{V_b - 1}{2} = 0$

$V_a\left(\frac{1}{2}\right) + V_o\left(\frac{1}{5}\right) + V_b\left(\frac{1}{2}\right) - \frac{5}{2} - \frac{1}{2} - \frac{0}{5} = 0$

$V_a\left(\frac{1}{2}\right) + (V_a - 0.7)\frac{1}{5} + (V_a - 1.4)\frac{1}{2} = \frac{5}{2} + \frac{1}{2}$

$V_a = 2.7V$

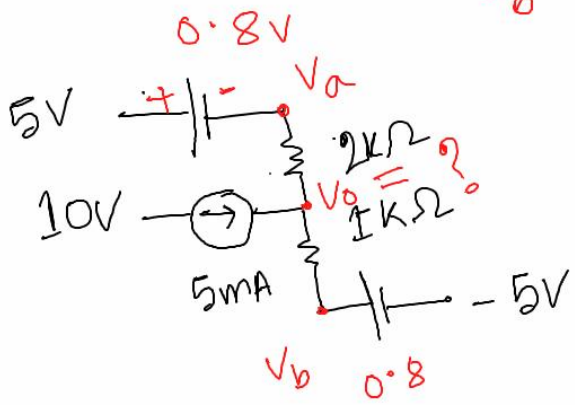
You are screen sharing Stop Share

Lecture 8: Method of assumed state

$5 - V_a = 0.8 \Rightarrow V_a = 4.2\,V$

$V_b - (-5) = 0.8$

$\Rightarrow V_b = -4.2\,V$



at V_o, $\frac{V_o - V_a}{2} + \frac{V_o - V_b}{1} - 5 = 0$

$\Rightarrow V_o\left(\frac{1}{2} + \frac{1}{1}\right) - \frac{V_a}{2} - \frac{V_b}{1} - 5 = 0$

$\Rightarrow V_o \frac{3}{2} - \frac{4.2}{2} - \frac{-4.2}{1} = 5$

$\Rightarrow V_o = 1.93\,V$

$i_{D_1} = \frac{V_a - V_o}{2}$

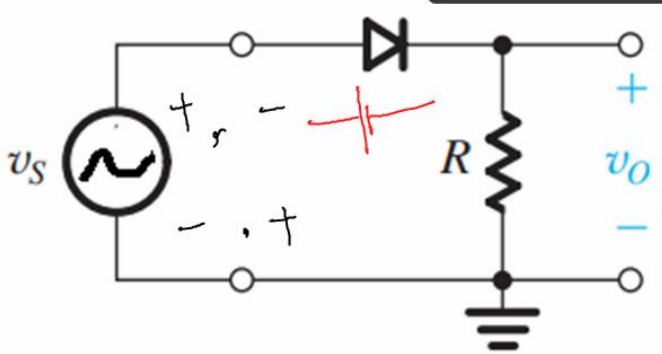
$= \frac{4.2 - 1.93}{2} > 0$

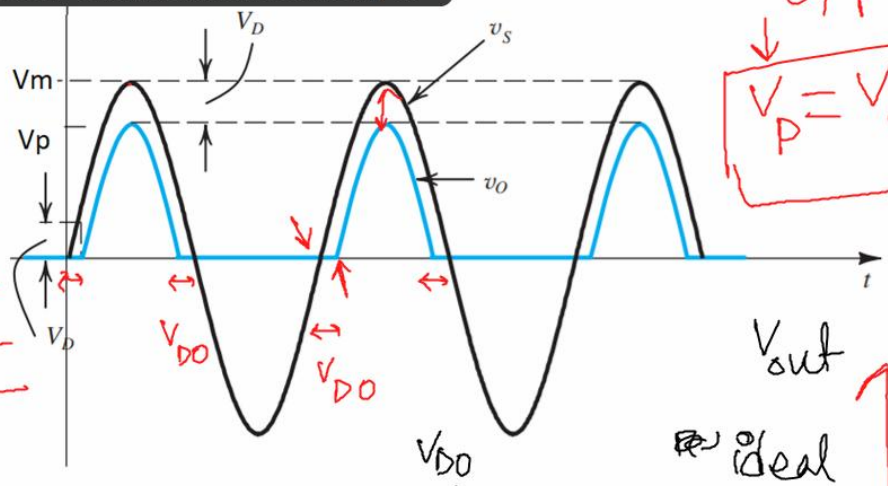
$i_{D_2} = \frac{V_o - V_b}{1}$

$= 1.93 - (-4.2)$

> 0

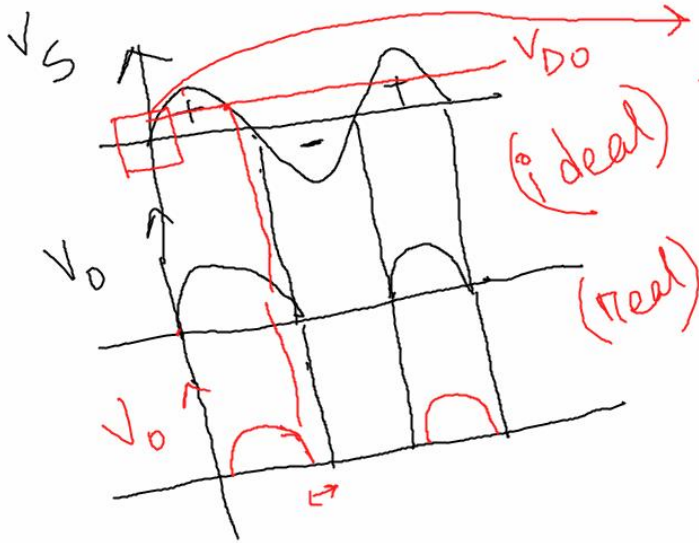
Lecture : Half-wave rectifier



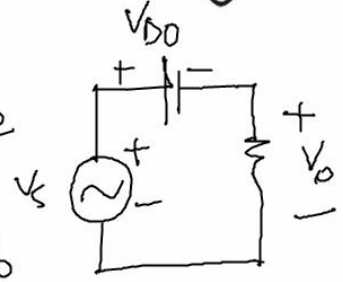


o/p i/p

$V_p = V_m - V_{DO}$

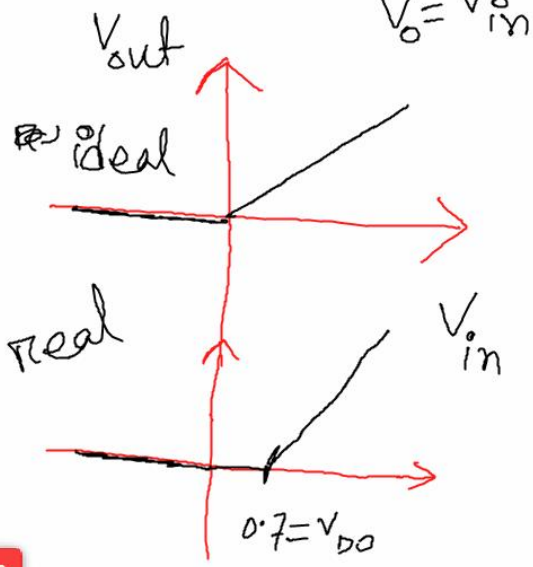


(+) half cycle

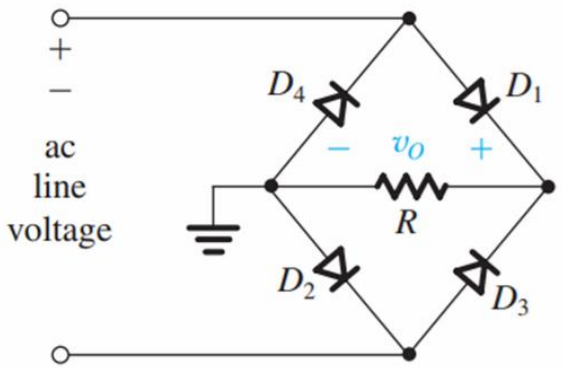


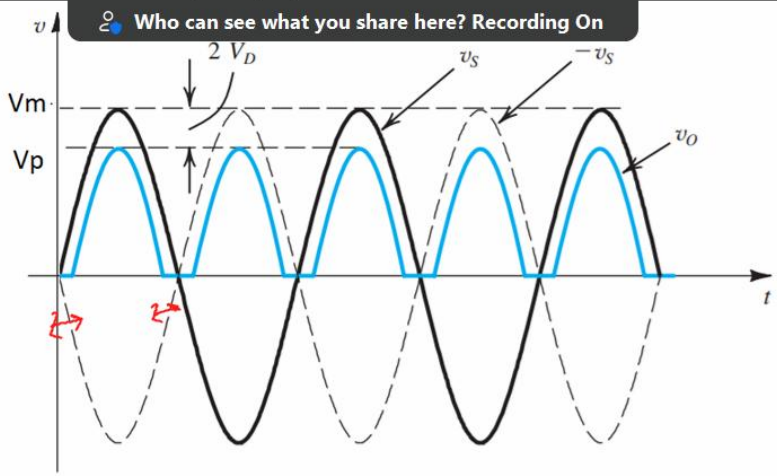
$V_{DO} = V_S - V_O$

$\Rightarrow V_O = V_S - V_{DO}$



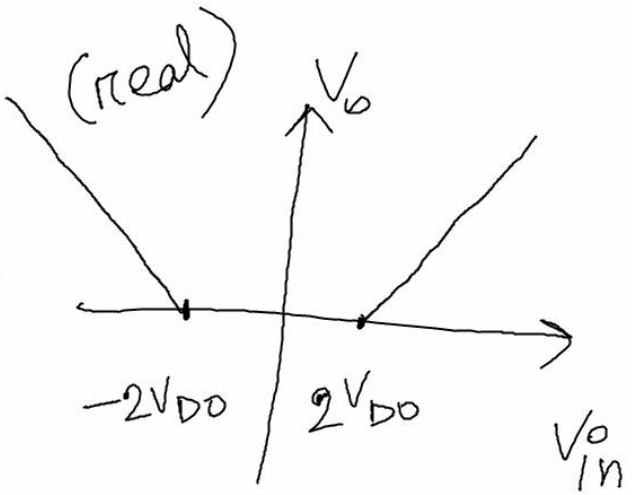
Lecture : Full-wave rectifier

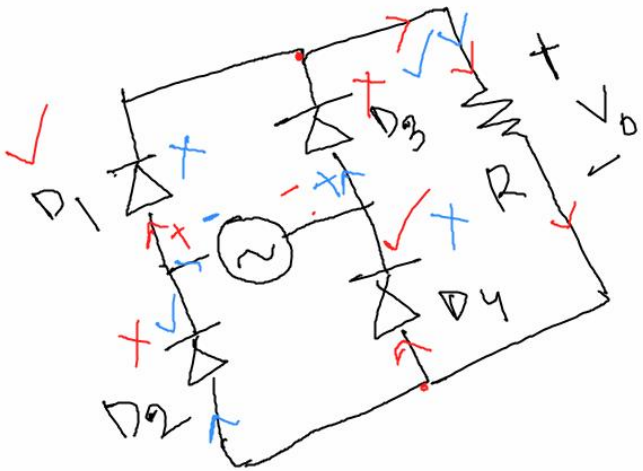




$V_o = V_s - 2V_{DO}$

$V_p = V_m - 2V_{DO}$





(+) half-cycle D_1, D_4 ON

(–) → D_2, D_3 ON