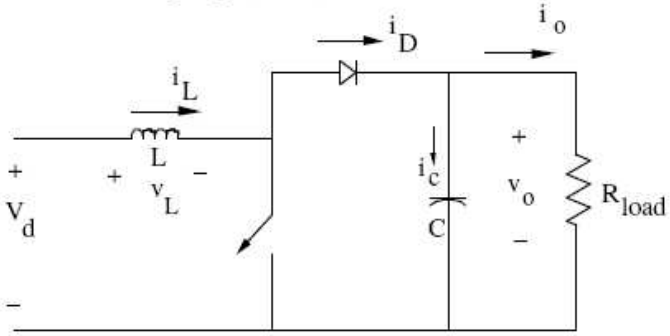
LAB 05

Step-Up (Boost) dc-dc Converter



Nominal Values: $V_d = 9$ V
$L = 10\ \mu H$
$rL = 10\ m\Omega$
$C = 50\ \mu F$
$R_{load} = 5\ \Omega$
$f_s = 100$ kHz
switch duty ratio $D = 0.625$

Problems

1. In steady state obtain the following waveforms using Boost:
   (a) v_L and i_L waveforms
   (b) v_o, i_D and i_c waveforms

2.

Increase the load resistance to 50 Ω. Obtain v_L and i_L waveforms in the discontinuous conduction mode [Hint: use $V_o(0) = 28$ V and $I_L(0) = 0$]. Check if the results agree with the analytical calculations.

$$\frac{V_o}{V_d} = \frac{\frac{2LI_o}{V_d T_s} + D^2}{\frac{2LI_o}{V_d T_s}}$$

3. Calculate a analytical D

$$D = \left[\frac{4}{27} \frac{V_o}{V_d} \left(\frac{V_o}{V_d} - 1 \right) \frac{I_o}{I_{oB,\max}} \right]^{1/2} \qquad I_{oB,\max} = \frac{2}{27} \frac{T_s V_o}{L}$$

so that V_o is kept constant to the same value as in continuous mode and check to see if results agree with the analytical calculations.

4. Obtain the peak-to-peak ripple in the output voltage and check to see if results agree with the analytical calculations.

5. Calculate the rms value of the current through the output capacitor as a ratio of the average load current Io