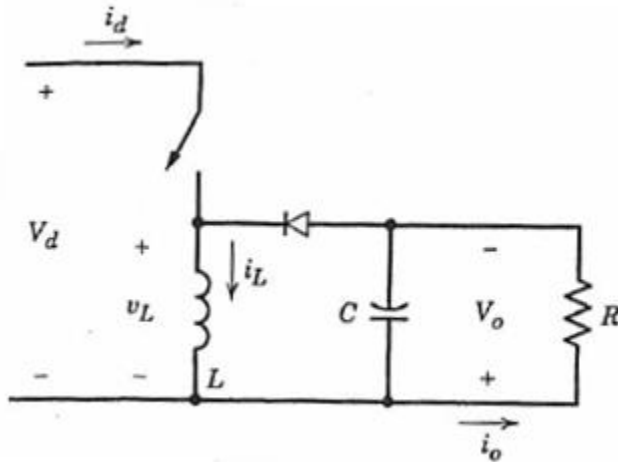


Power Electronics Chapter 7 and 8 HW

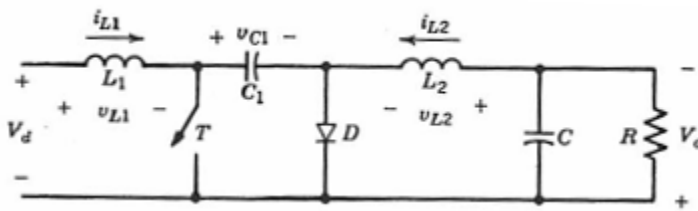
1. Use LT spice to build a buck-boost converter, use this schematic with the following device values:



- $C=50\mu\text{F}$
- $R=100\Omega$
- $L=100\mu\text{H}$
- $V_d=15\text{V}$
- switch=IRF7343P p-channel power MOSFET, operate the switch with a  $10V_{pp}$  250kHz square wave with  $D=0.5$ .

- a) Is the converter in continuous or discontinuous mode? Justify your answer using the simulation.
- b) Calculate (by hand) the output voltage for this circuit.
- c) Measure the average output voltage for this circuit and calculate the percent difference between the measured and predicted values.
- d) Determine the steady-state efficiency of the converter from your simulation.

2. Use LT spice to build a Ćuk converter, use the schematic with the following device values:



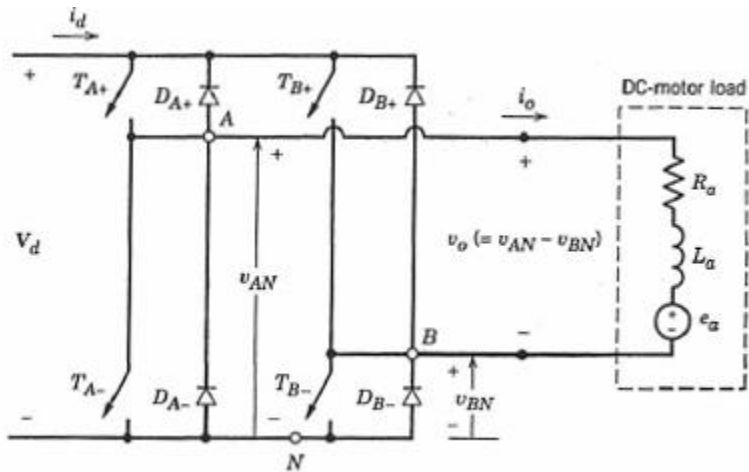
- $L_1=L_2=100\mu\text{H}$
- $C_1=3\mu\text{F}$
- $C=5\mu\text{F}$
- $R=10\Omega$
- $V_d=15\text{V}$
- switch=IRFZ44N n-channel power MOSFET, operate the switch with a  $10V_{pp}$  250kHz square wave with  $D=0.5$ .

channel power MOSFET, operate the switch with a  $10V_{pp}$  250kHz square wave with  $D=0.5$ .

Figure 1 Ćuk converter from textbook

- a) Is the converter in continuous or discontinuous mode? Justify your answer using the simulation.
- b) Calculate (by hand) the output voltage for this circuit.
- c) Measure the average output voltage for this circuit and calculate the percent difference between the measured and predicted values.
- d) Determine the steady-state efficiency of the converter from your simulation.

3. For the circuit



explain how to

- operate the switches to make current flow through the motor in the direction shown by the arrow  $i_o$  with a voltage  $V_d$  across the motor,
  - operate the switches to make current flow through the motor against the direction shown by the arrow  $i_o$  with a voltage  $V_d$  across the motor,
  - operate the switches to make current flow through the motor in the direction shown by the arrow  $i_o$  with a voltage  $V_d/3$  across the motor.
- What is the difference between a full bridge DC->DC converter and an inverter?
  - Consider a load driven by an inverter powered by a battery. If the load creates reactive power what happens to it (e.g., where does the current flow)?