EE-363 Power Electronics

Assignment # 4

Spring 2022

Due Date: 11th June ,2022

Question 1

Derive impedance transformation of buck converter.

Question 2

Describe common components or necessary steps between buck and boost converter to make buck boost converter

Question 3

Take ups readings and give remarks.

Rafay Aamir

Bsee 19047 (PE-A4)

Q#1

$$I_s = \frac{1}{T}\int_0^T i_s d(t) = I_s = \frac{1}{T}\int_0^{DT} i(t)\,dt$$

$$I_s = D I_L \quad \text{— ①}$$

$$V_L = V_s D - I_L R_L - V_c$$

$$V_s D = -V_c + I_L R_L = I_L R_L - V_R \quad \text{— ②}$$

the equivalent circuit of eq ① and ② has been shown below.

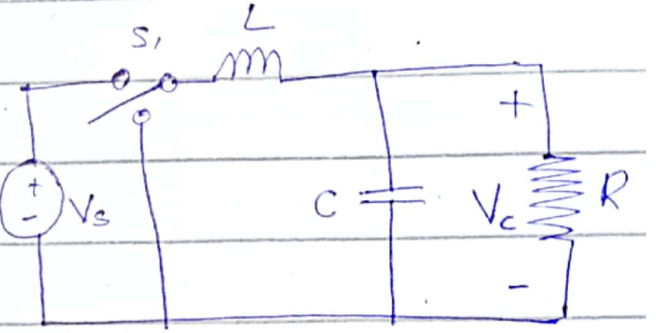
Now, combining them and converting it to a transformer.

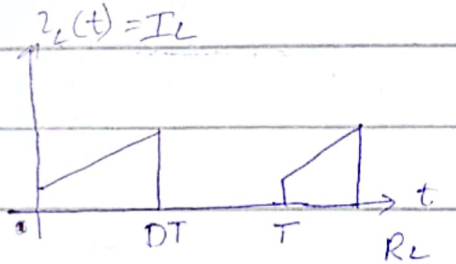
$$\frac{V_s}{V_H} = \frac{1}{D} \quad \text{as} \quad V_H = V_s D$$

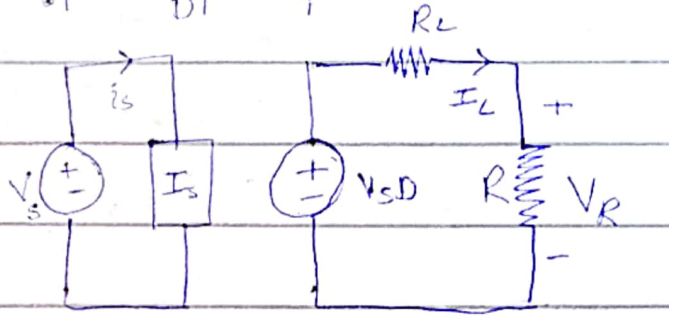
$$Z_{in} = V_s / I_s = \left((1/D)V_H\right)/I_s = \frac{V_H}{D} \times \frac{1/D}{I_L}$$

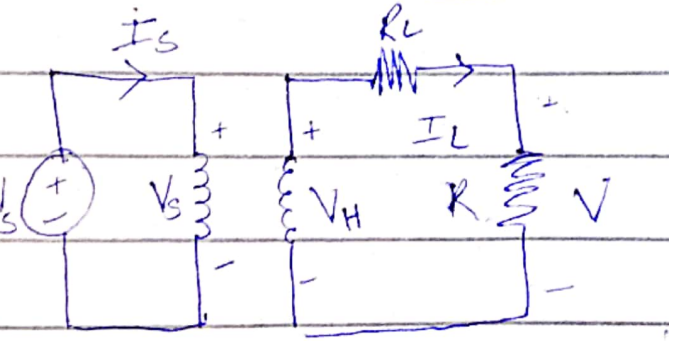
$$Z_{in} = \frac{V_H}{I_L} \times \left(\frac{1}{D}\right)^2$$

$$Z_L = \frac{V_H}{I_L}, \quad \frac{Z_{in}}{Z_L} = \frac{1}{D^2}, \quad \frac{Z_L}{Z_{in}} = D^2$$









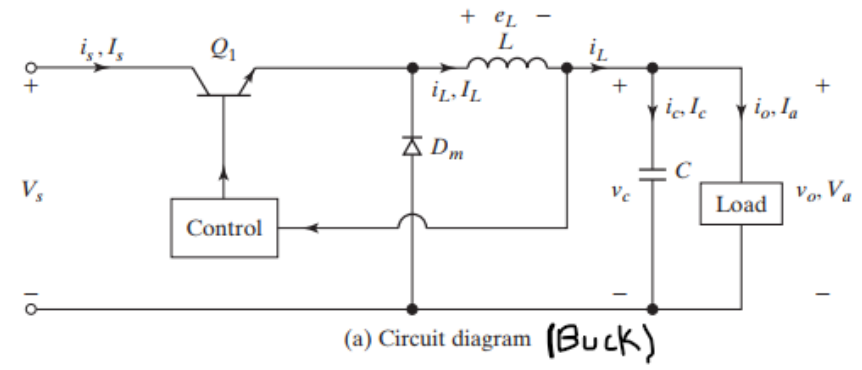
Q2:

As we can see from the circuit diagrams, almost all the components of a buck-boost regulator/converter is taken from the buck and boost converters as the name suggests. A buck-boost converter came into the picture just by combining the buck and boost whereas the position of a couple of components is switched.

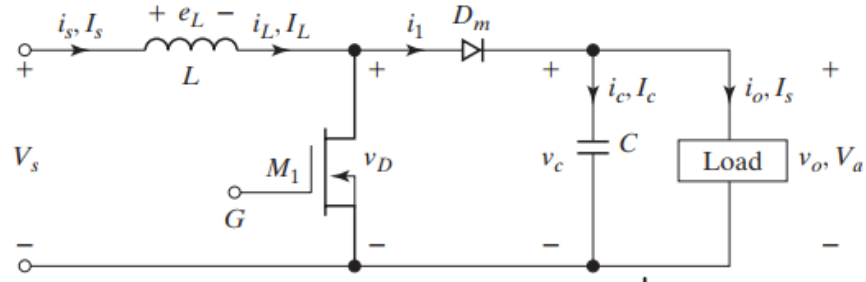
When the switch of a buck-boost converter is closed the current in the inductor will be the same as of in the boost converter.

A buck–boost regulator provides an output voltage that may be less than or greater than the input voltage—hence the name "buck–boost"; the output voltage polarity is opposite to that of the input voltage. This regulator is also known as an *inverting regulator*. The circuit arrangement of a buck–boost regulator is shown in Figure. Transistor Q1 acts as a controlled switch and diode Dm is an uncontrolled switch. They operate as two SPST current-bidirectional switches. The circuit in Figure is often represented by two switches as shown in Figure.

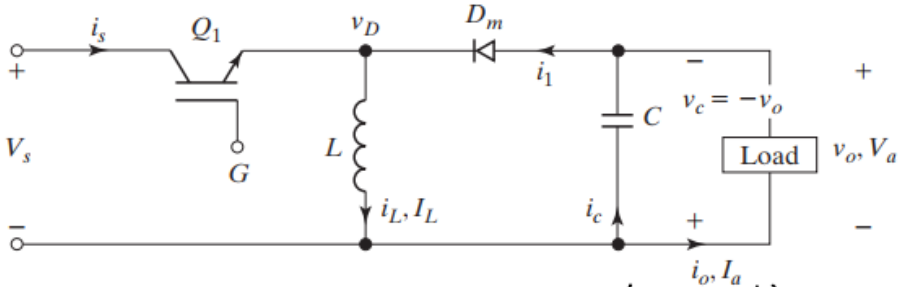
The circuit operation can be divided into two modes. During mode 1, transistor *Q*1 is turned on and diode *Dm* is reversed biased. The input current, which rises, flows through inductor *L* and transistor *Q*1. During mode 2, transistor *Q*1 is switched off and the current, which was flowing through inductor *L*, would flow through *L*, *C*, *Dm*, and the load. The energy stored in inductor *L* would be transferred to the load and the inductor current would fall until transistor *Q*1 is switched on again in the next cycle. The equivalent circuits for the modes are shown in Figure 5.19c. The waveforms for steady state voltages and currents of the buck–boost regulator is shown in the picture for a continuous load current.



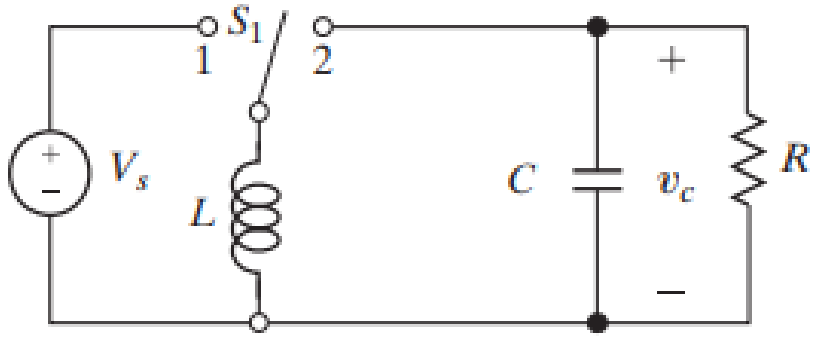
(a) Circuit diagram (Buck)



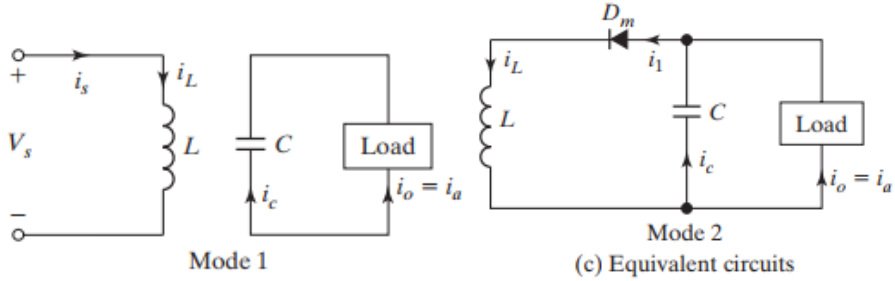
(a) Circuit diagram (Boost)



(a) Circuit diagram (Buck-Boost)



(b) Switch representation



Mode 1

Mode 2

(c) Equivalent circuits

Q3:

UPS Name:	**Digitech**
Model:	**Ex-1244A**
Power:	**1000 VA**
Max-Load:	**4 fans, 4 lights (24W)**
Input volt:	**260(wide)160(narrow) VAC**
Output vol:	**220VAC**
Output current:	**2amps for 1 fan (approx.)**