

## **EXPERIMENT 3: Study of Boost Converter Designing**

### **Name -**

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**Objective -** To study input and output characteristics of a Boost converter in DCM and CCM mode of operation.

### **Software tool:**

MATLAB Simulink, Simscape toolbox (power GUI)

### **Switch used:**

Power MOSFET and Power Diode from Simscape Electrical

### **Parameters:**

Input voltage = 25V

Load Resistance: 50 Ohms

Pulse: Amplitude = 1, Period = 1e-4 seconds, Pulse width = 50%, Phase delay = 0 sec

Bypass Capacitor = 30uF

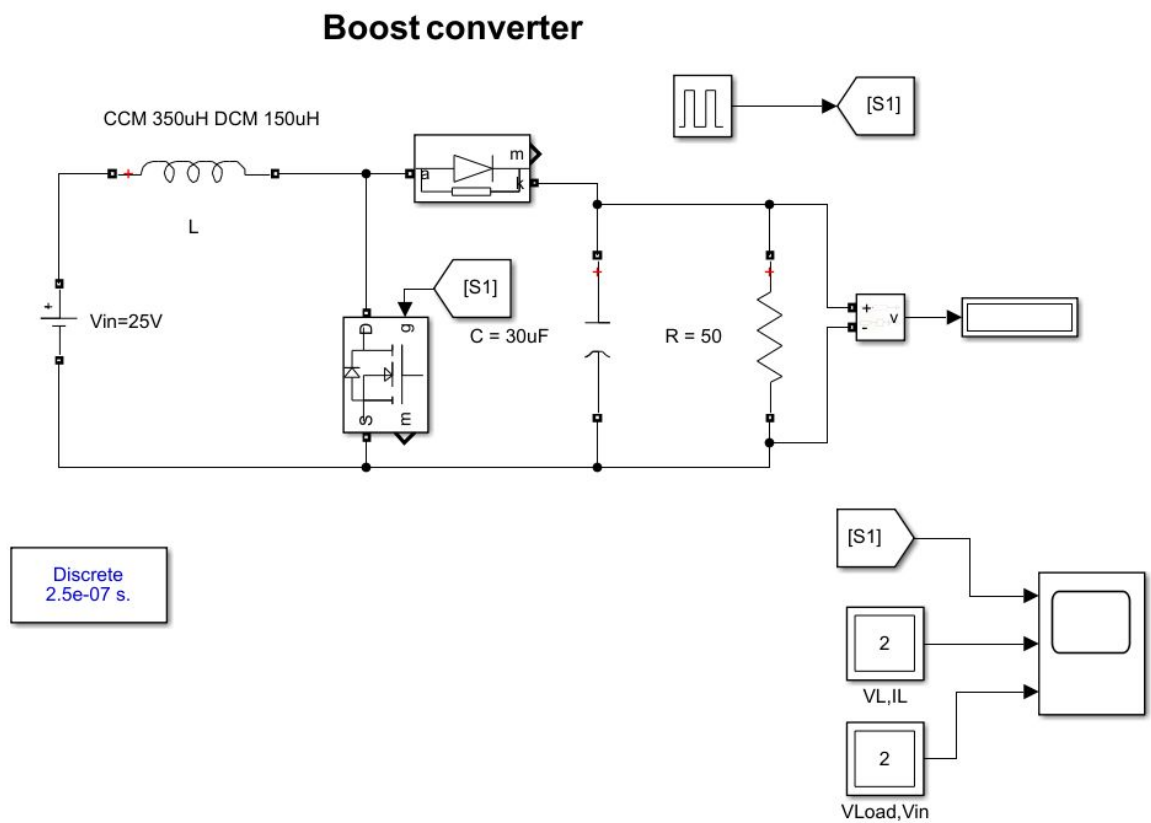
Powergui = 2.5e-7 s (Discrete)

## Calculation for L (of low pass filter):

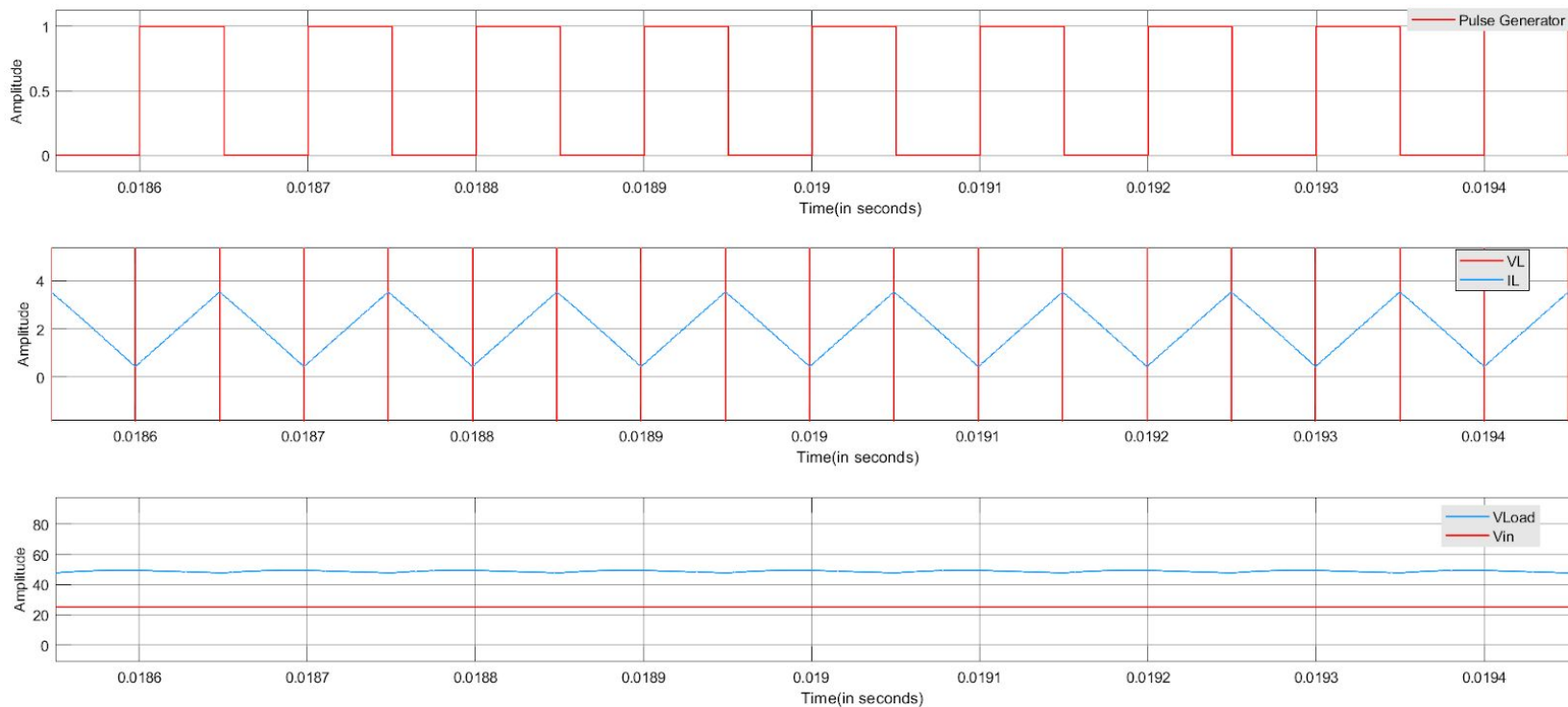
Comparing  $K_{critical} = D(1-D)^2$  and  $K = 2L/RT_s$ , we arrive at the following assumed values of L:

- 1) For DCM mode of operation,  $k < K_{critical}$ , hence,  $L = 150\mu H$
- 2) For CCM mode of operation,  $k > K_{critical}$ , hence,  $L = 350\mu H$

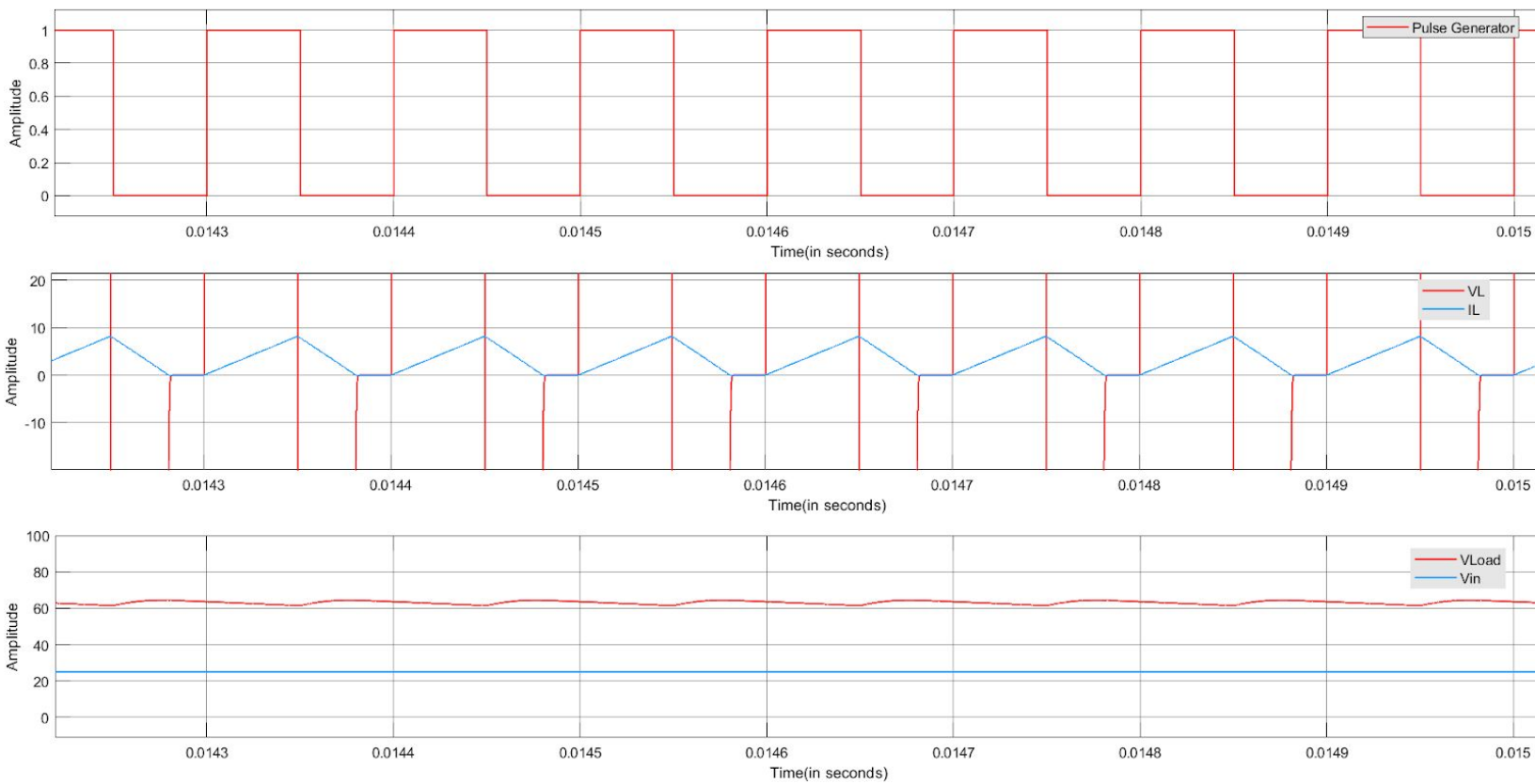
## Schematic Diagram:



Observations Graphs:



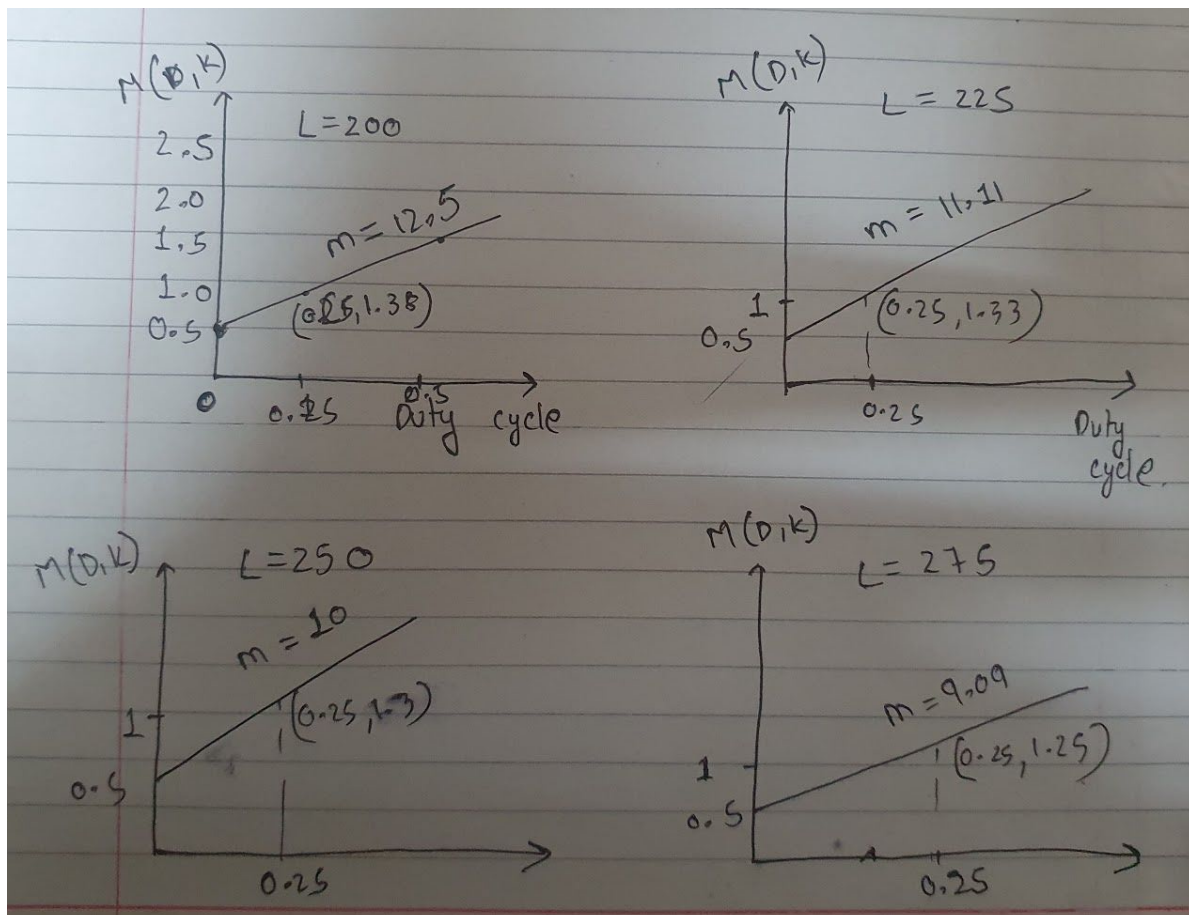
CCM graph

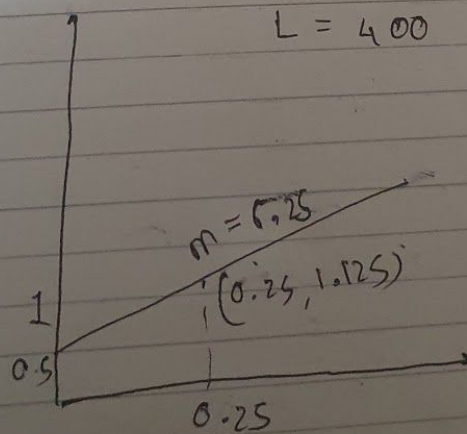
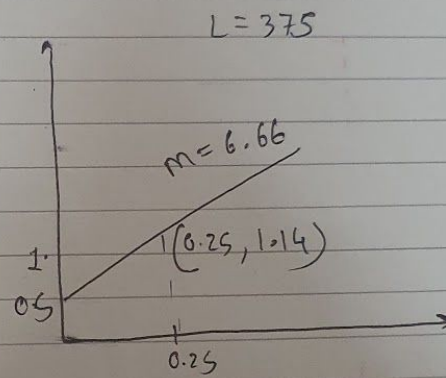
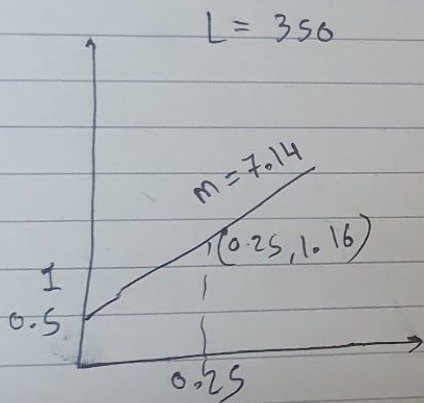
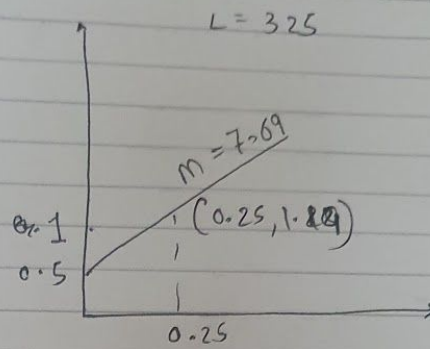
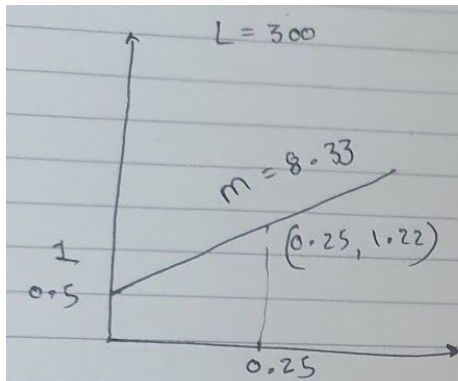


**DCM graph**

## Duty Cycle V/s M (D, K)

L =	200	225	250	275	300	325	350	375	400
K =	0.08	0.09	0.1	0.11	0.12	0.13	0.14	0.15	0.16
Duty Cycle	M(D,K)								
0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.25	1.383883 476	1.333333 333	1.290569 415	1.253778 361	1.221687 836	1.193375 245	1.168153 105	1.145497 224	1.125
0.5	2.267766 953	2.166666 667	2.081138 83	2.007556 723	1.943375 673	1.886750 491	1.836306 21	1.790994 449	1.75
0.75	3.151650 429	3	2.871708 245	2.761335 084	2.665063 509	2.580125 736	2.504459 314	2.436491 673	2.375
1	4.035533 906	3.833333 333	3.662277 66	3.515113 446	3.386751 346	3.273500 981	3.172612 419	3.081988 897	3

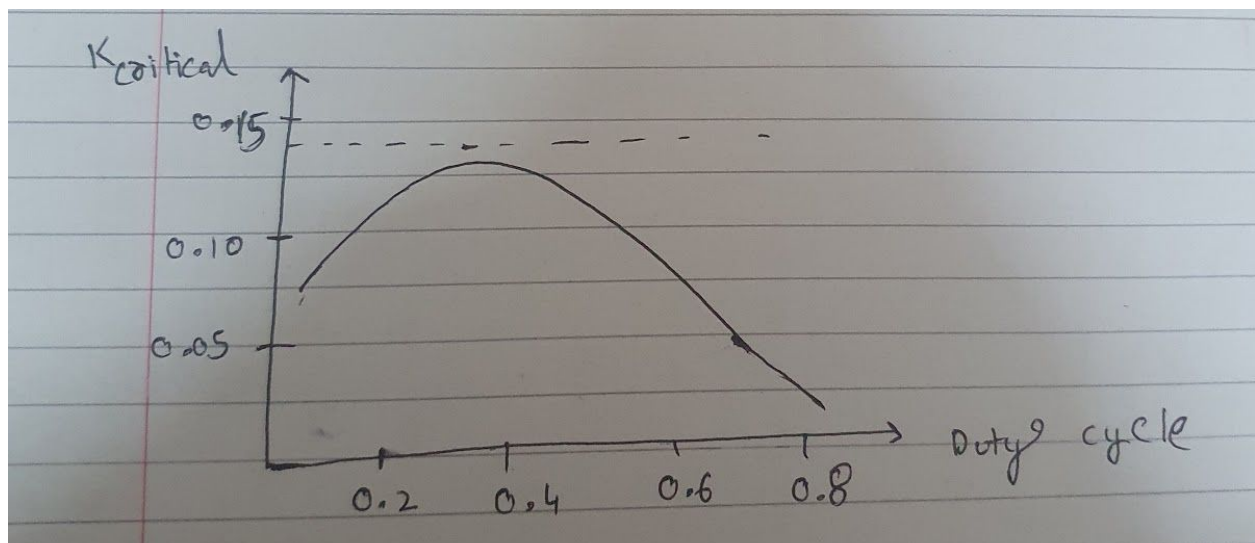




## Duty Cycle V/s $K_{critical}$

Duty Cycle	$K_{critical}$
0.1	0.081
0.15	0.108375
0.2	0.128
0.25	0.140625
0.3	0.147
0.35	0.147875
0.4	0.144
0.45	0.136125
0.5	0.125
0.55	0.111375
0.6	0.096
0.65	0.079625
0.7	0.063
0.75	0.046875
0.8	0.032

Plotting these values in the plot below



**Results and Conclusions:**

- 1) The model was simulated in Simulink using Simscape library
- 2) Output Voltage for DCM mode was approximately 63.34V
- 3) Output Voltage for CCM was approximately 49.13V