ELE 613

SWITCH MODE POWER SUPPLIES

HOMEWORK 1

HAKAN POLAT

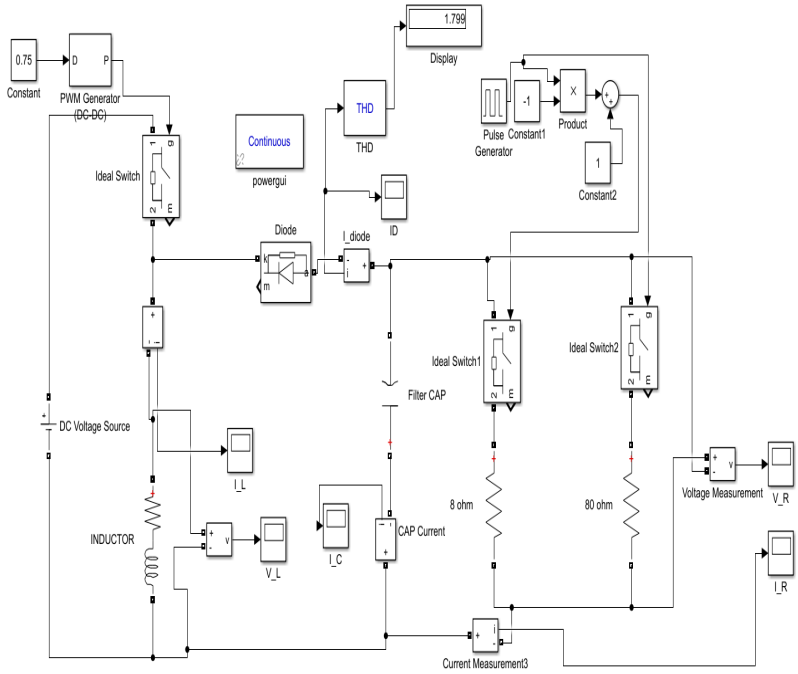

Figure 1: Buck Boost Simulink Model

Figure 1 shows the Simulink model built for the buck-boost converter.

1 Question 1

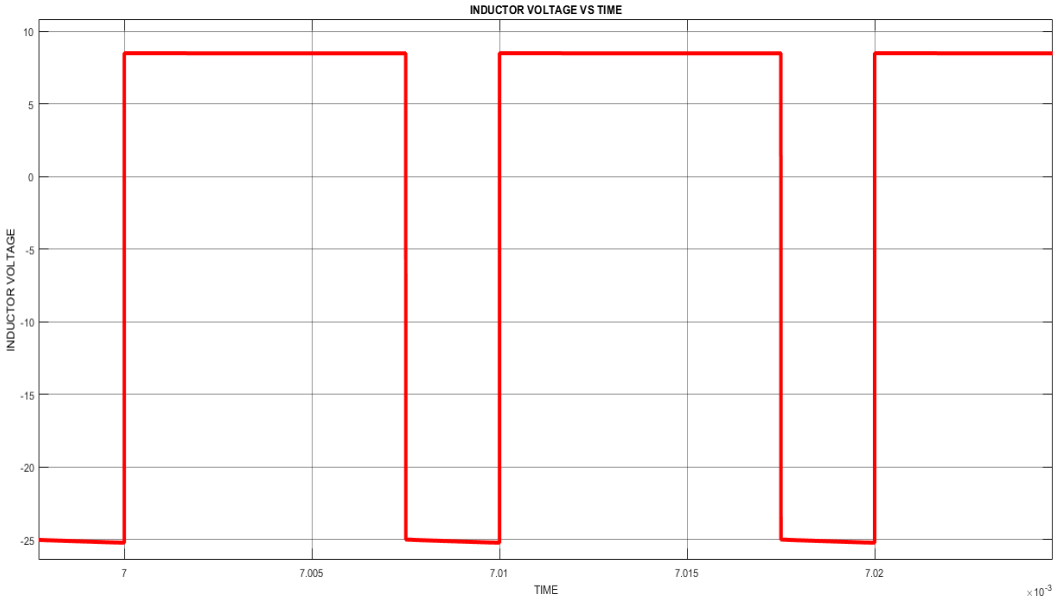

Figure 2: Inductor Voltage

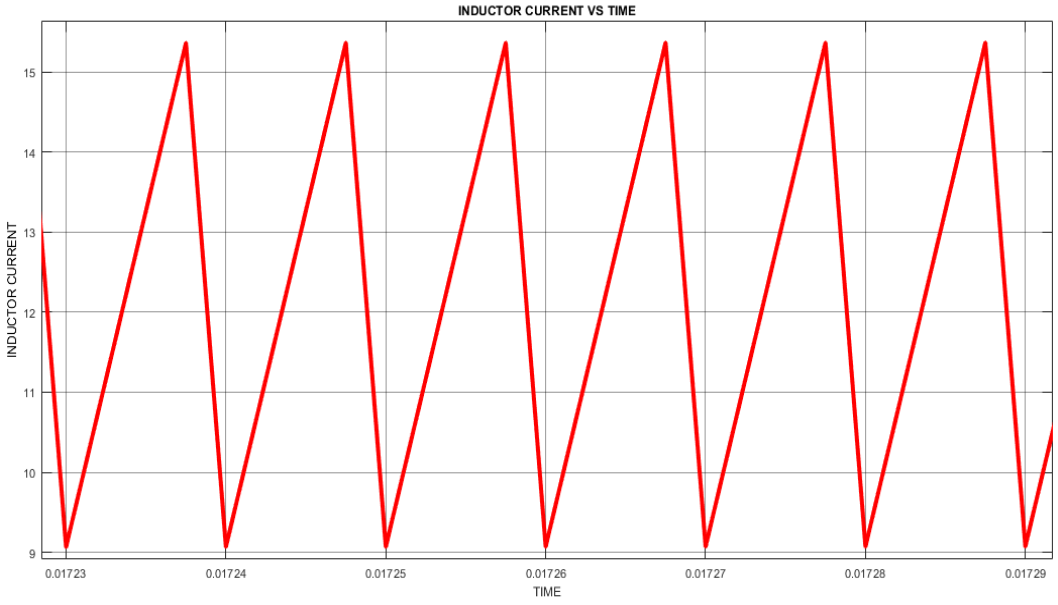

Figure 3: Inductor Current

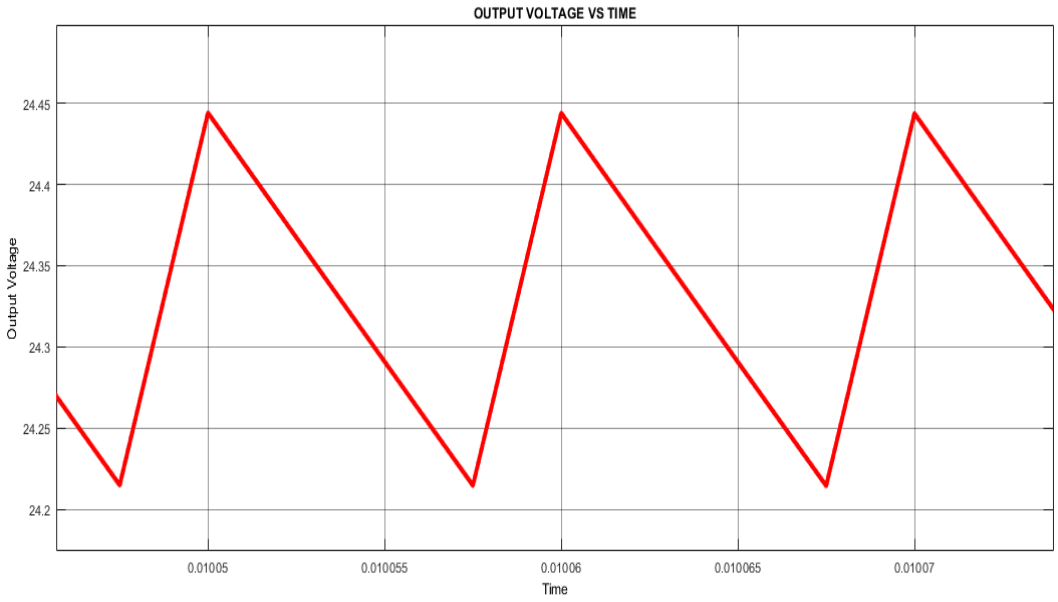

Figure 4: Output Voltage

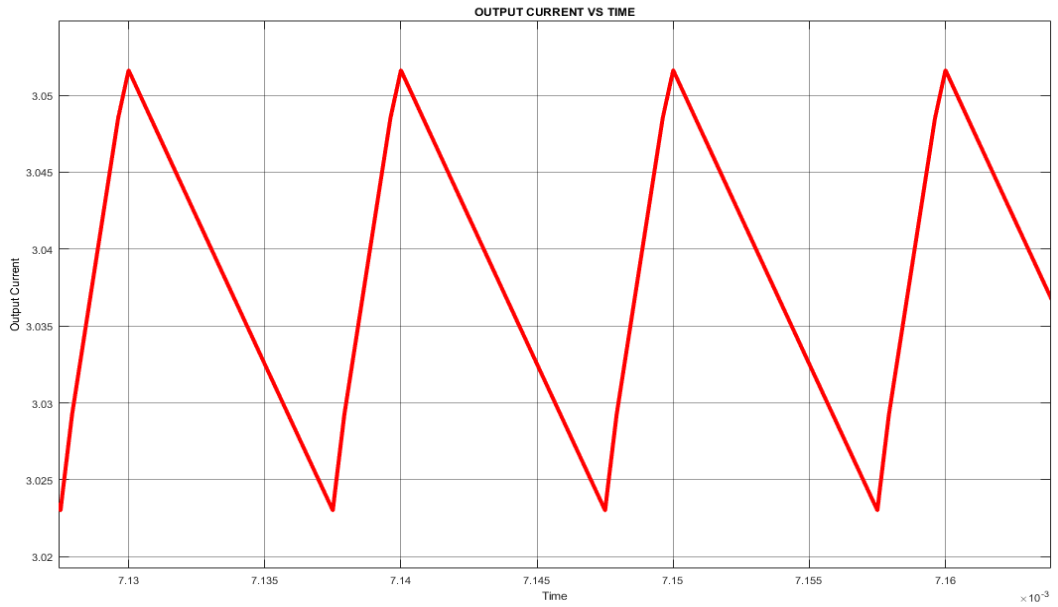

Figure 5: Output Current

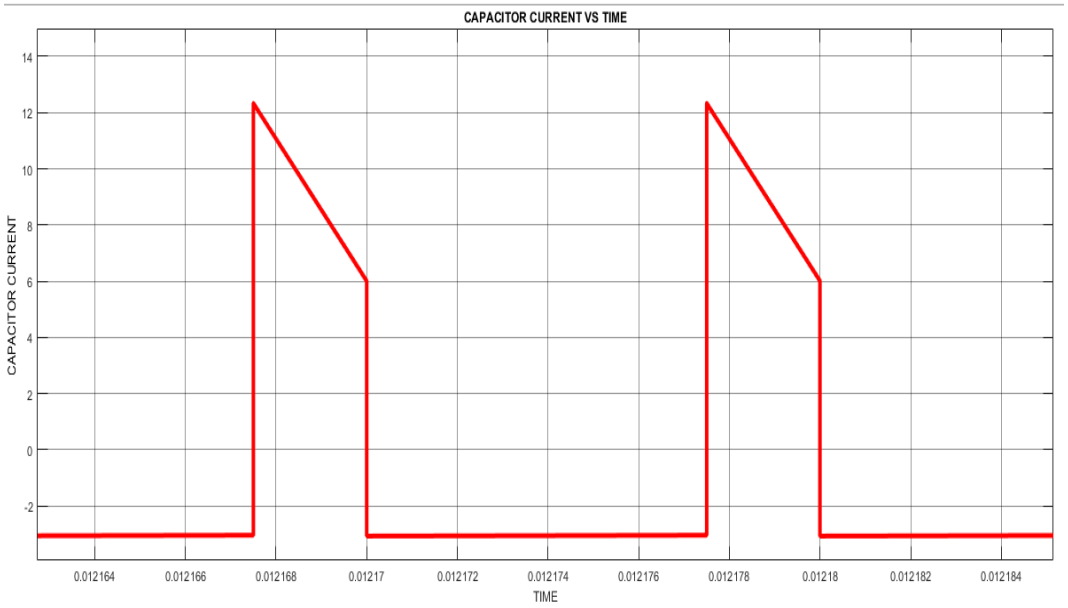

Figure 6: Capacitor Current

2 Question 2

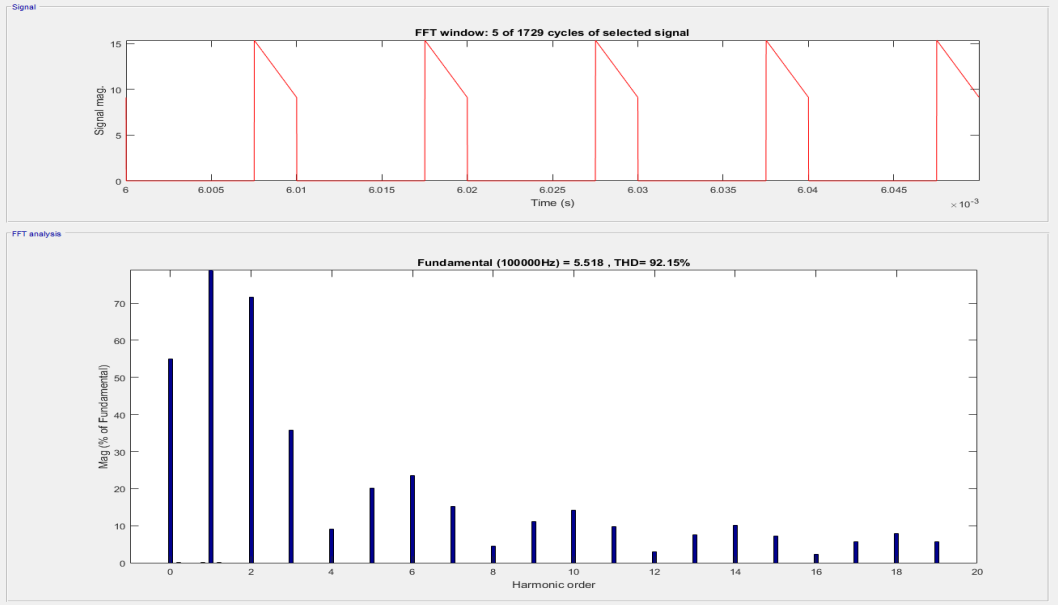

Figure 7: Diode Currents FFT Analysis

THD is found to be %94.

3 Question 3

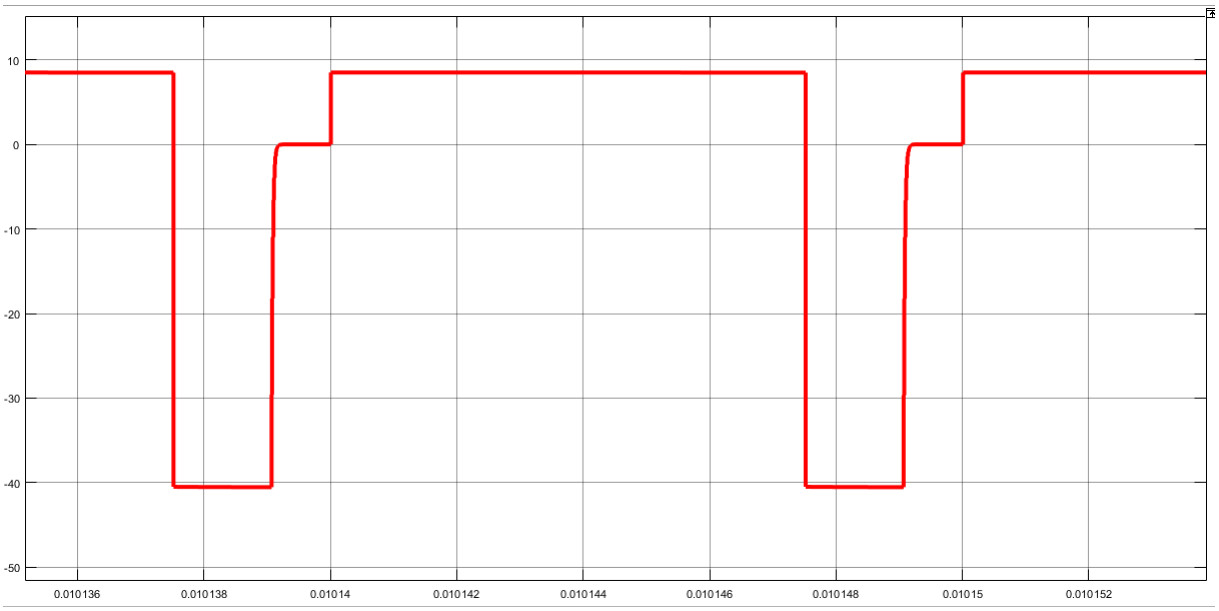

Figure 8: DCM Inductor Voltage Waveform

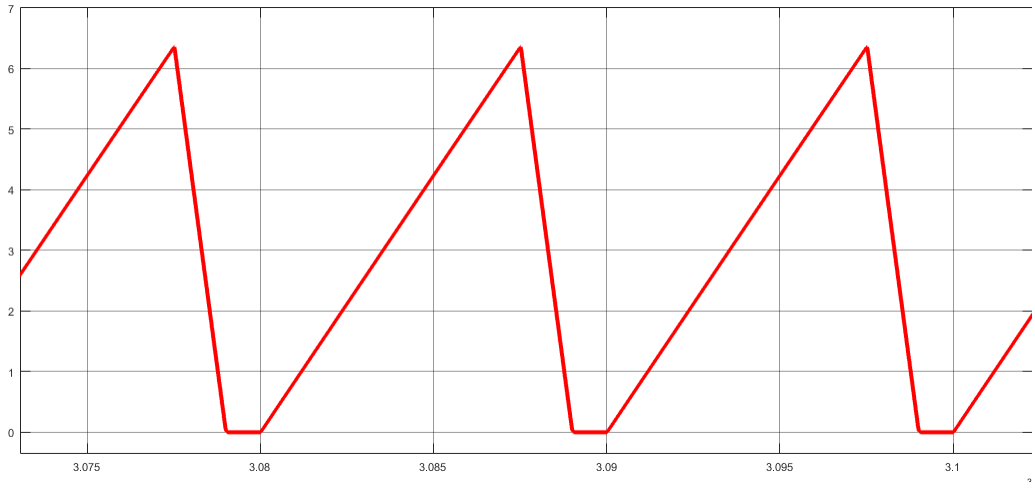

Figure 9: DCM Inductor Current Waveform

4 Question 4

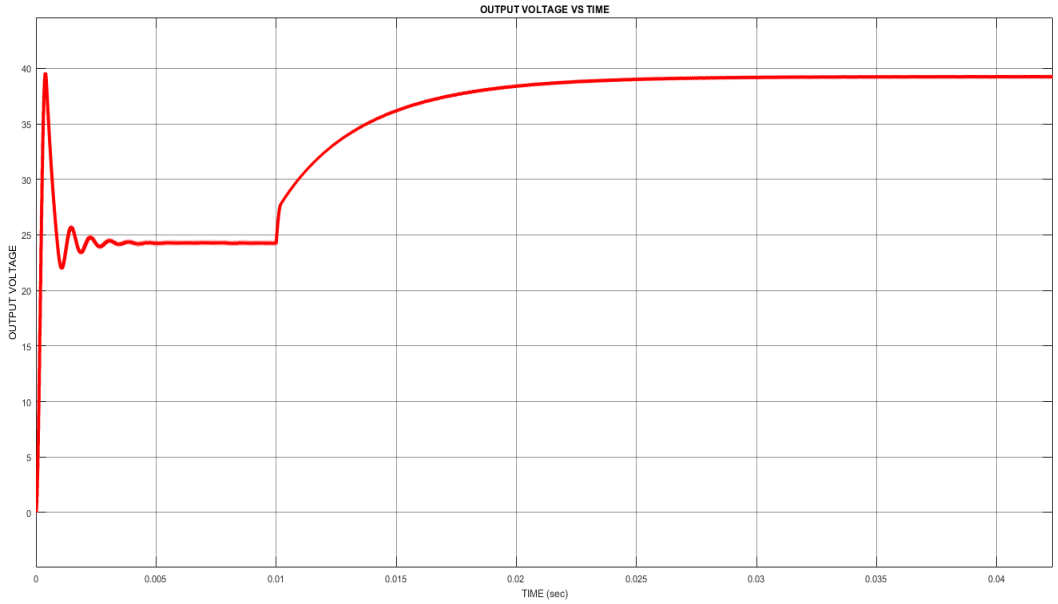

Figure 10: CCM to DCM Output Voltage (Open Loop Operation)

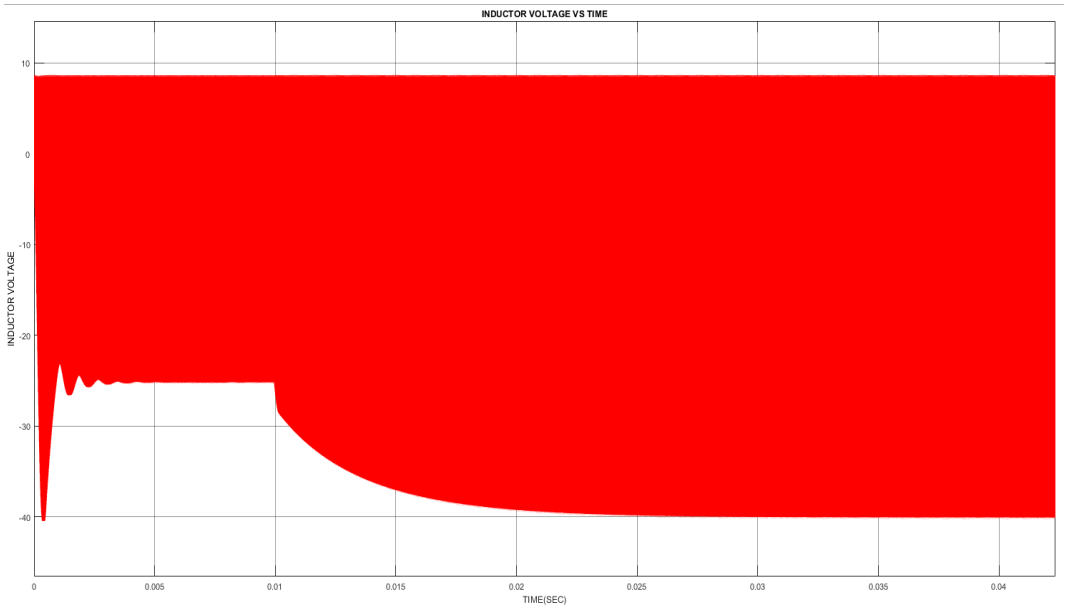

Figure 11: CCM to DCM Inductor Voltage (Open Loop Operation)

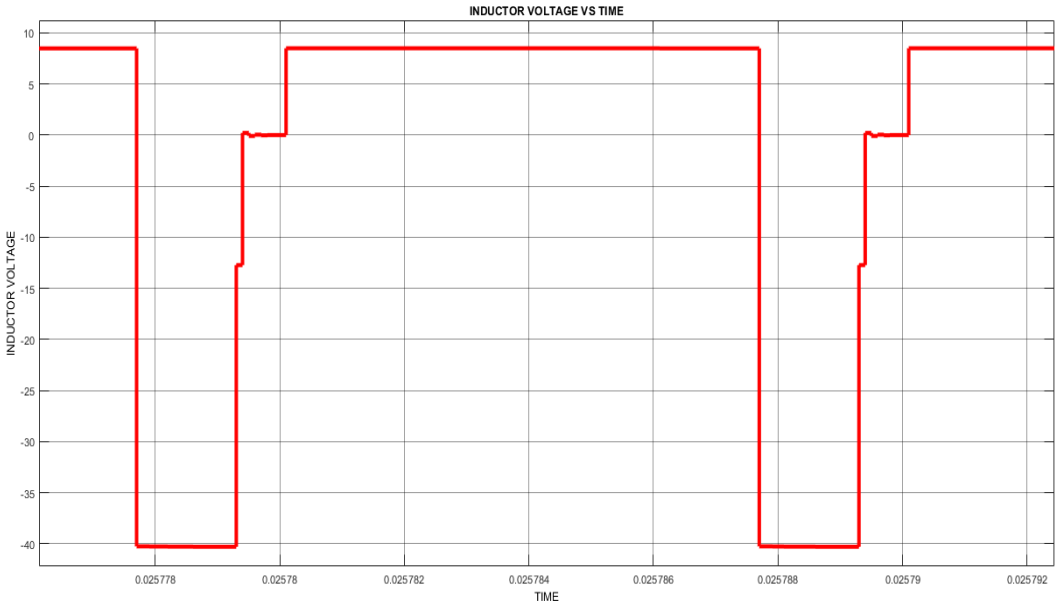

Figure 12: CCM to DCM Inductor Voltage Zoomed (Open Loop Operation)

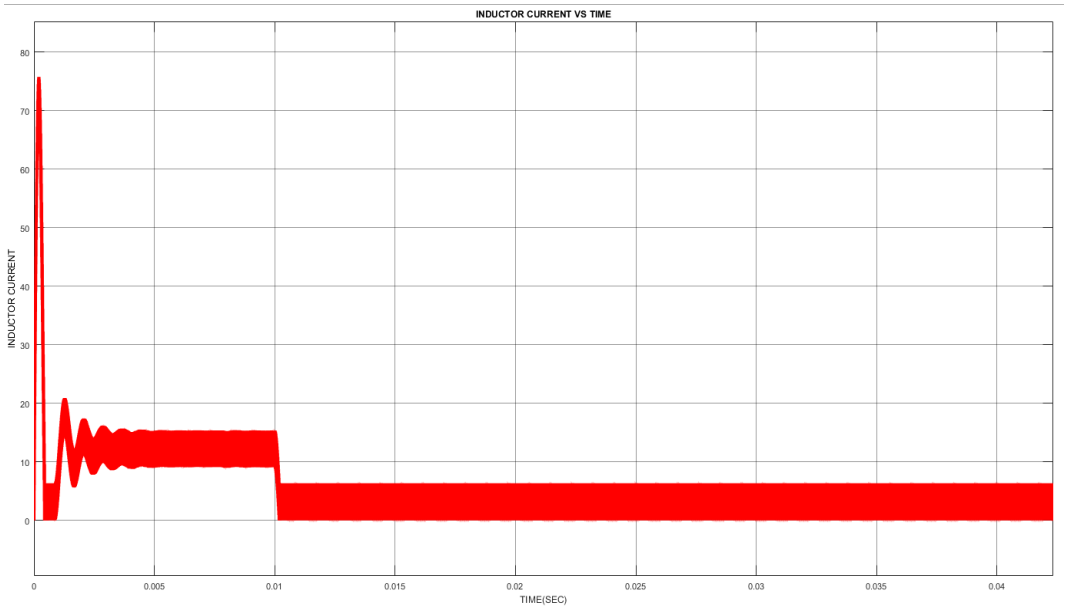

Figure 13: CCM to DCM Inductor Current (Open Loop Operation)

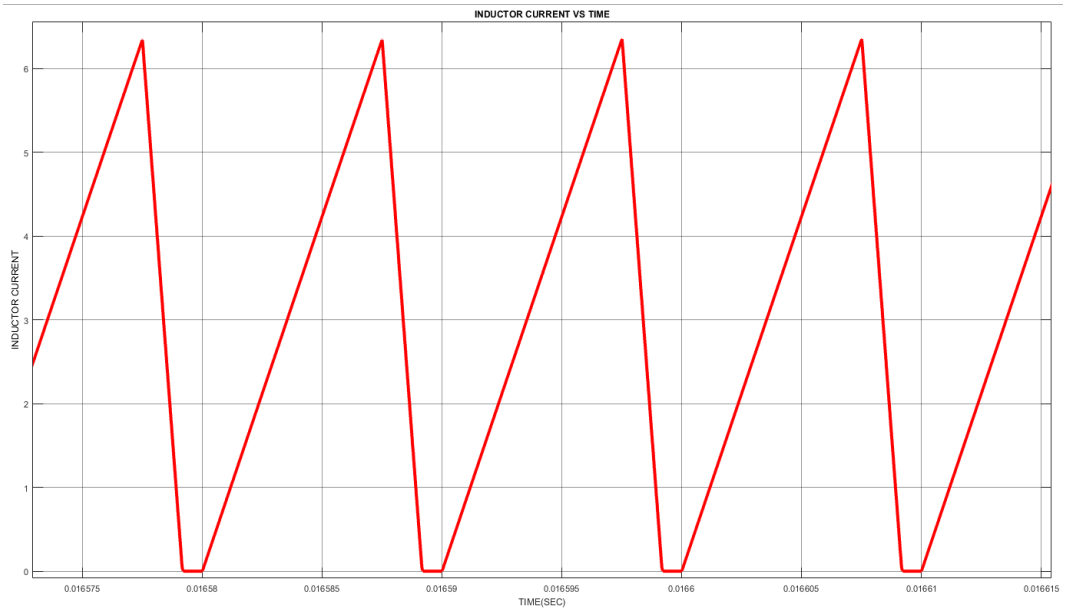

Figure 14: CCM to DCM Inductor Current Zoomed(Open Loop Operation)

5 Question 5

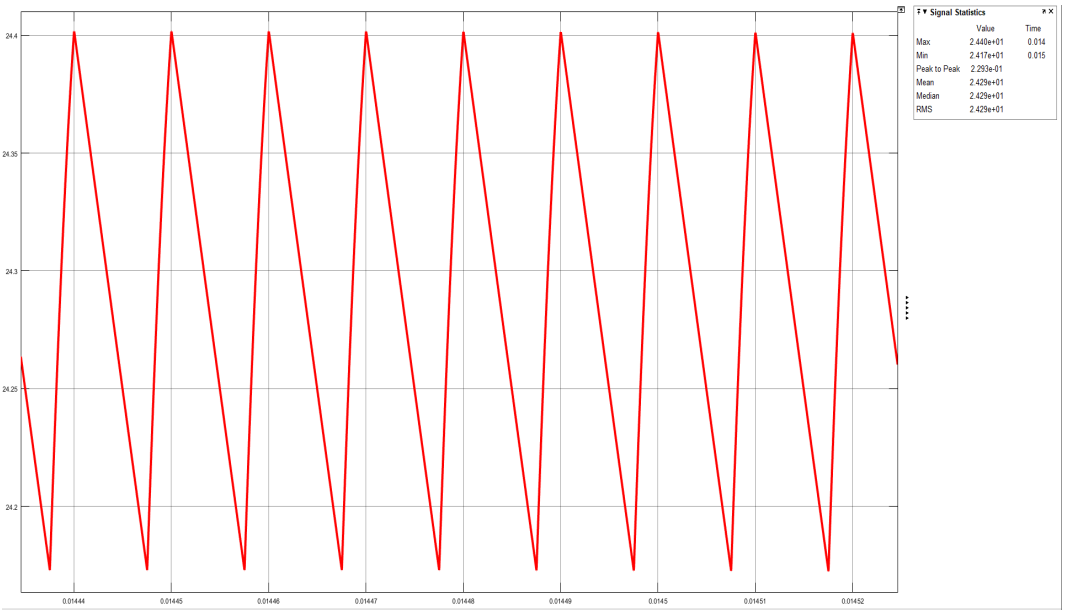

Figure 15: Output Voltage in Steady State

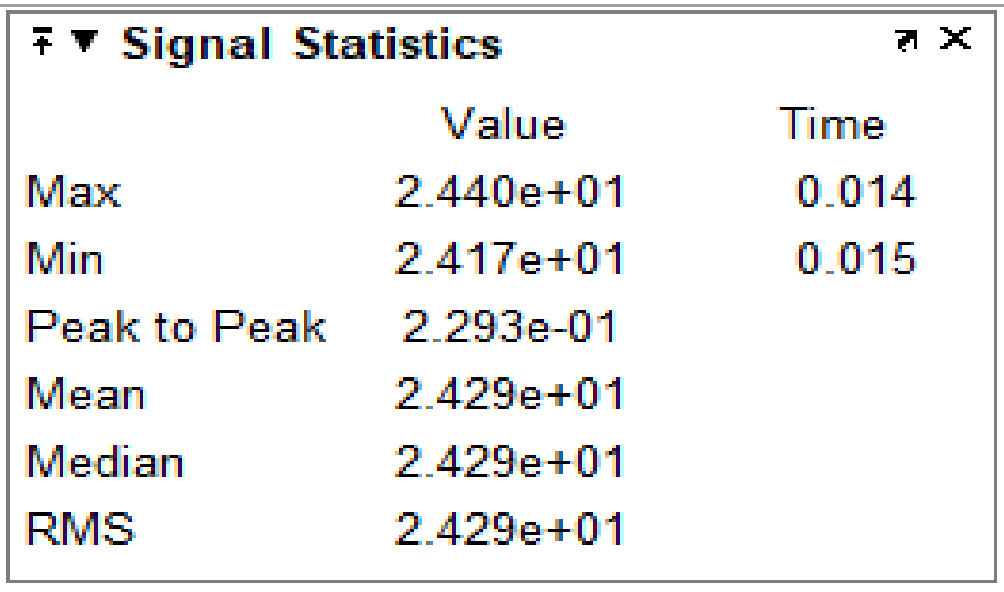

Figure 16: Waveform information of Output Voltage in Steady State

The peak-to-peak voltage is found to be 0.23 V from Figure 16.

6 Question 6

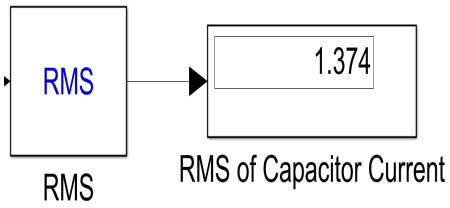

Figure 17: RMS calculation of Capacitor Current in CCM

$$\frac{I_{c,rms}}{I_{out}} = \frac{1.374}{3.18} = 0.43 \tag{1}$$