EXPERIMENT 2: Study of BUCK Converter Designing

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Objective - To study input and output characteristics of a Buck 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 = 50e-6 seconds, Pulse width = 50%,
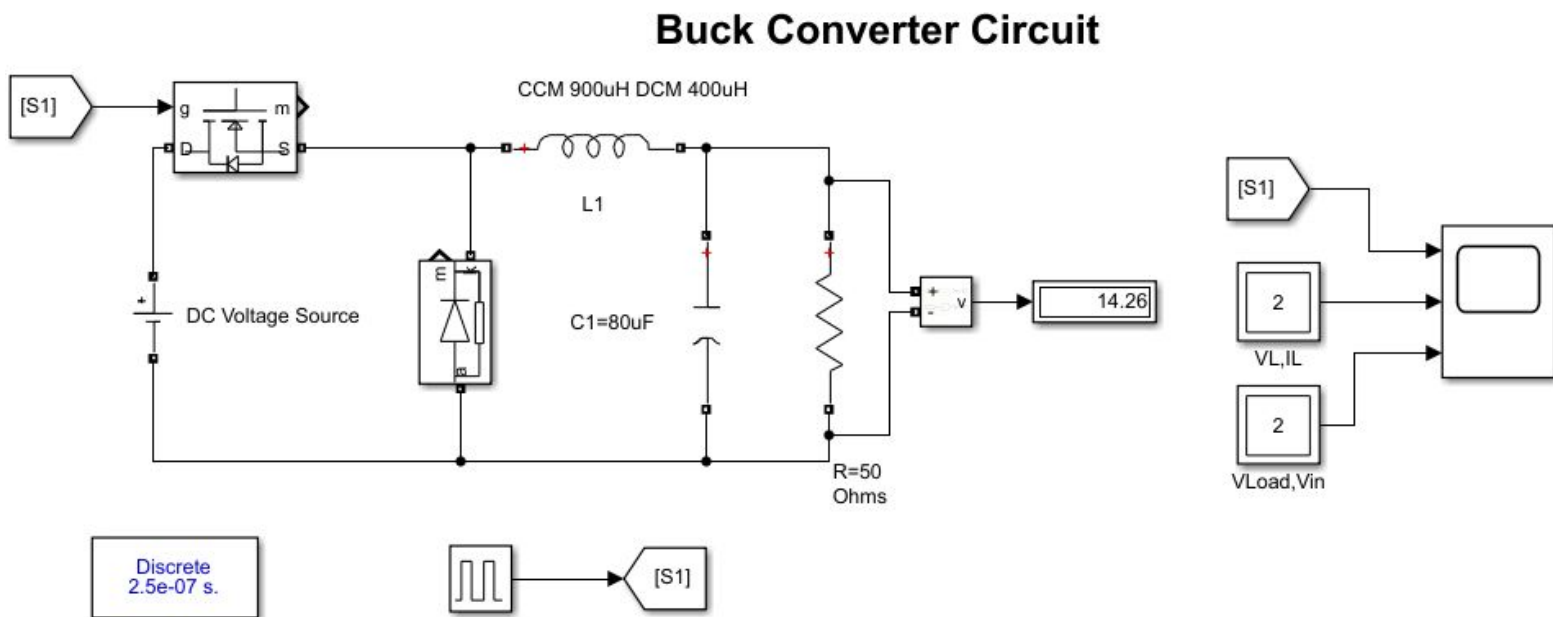
Phase delay = 0 sec

Bypass Capacitor = 80uF

Powergui = 2.5e-7 s (Discrete)
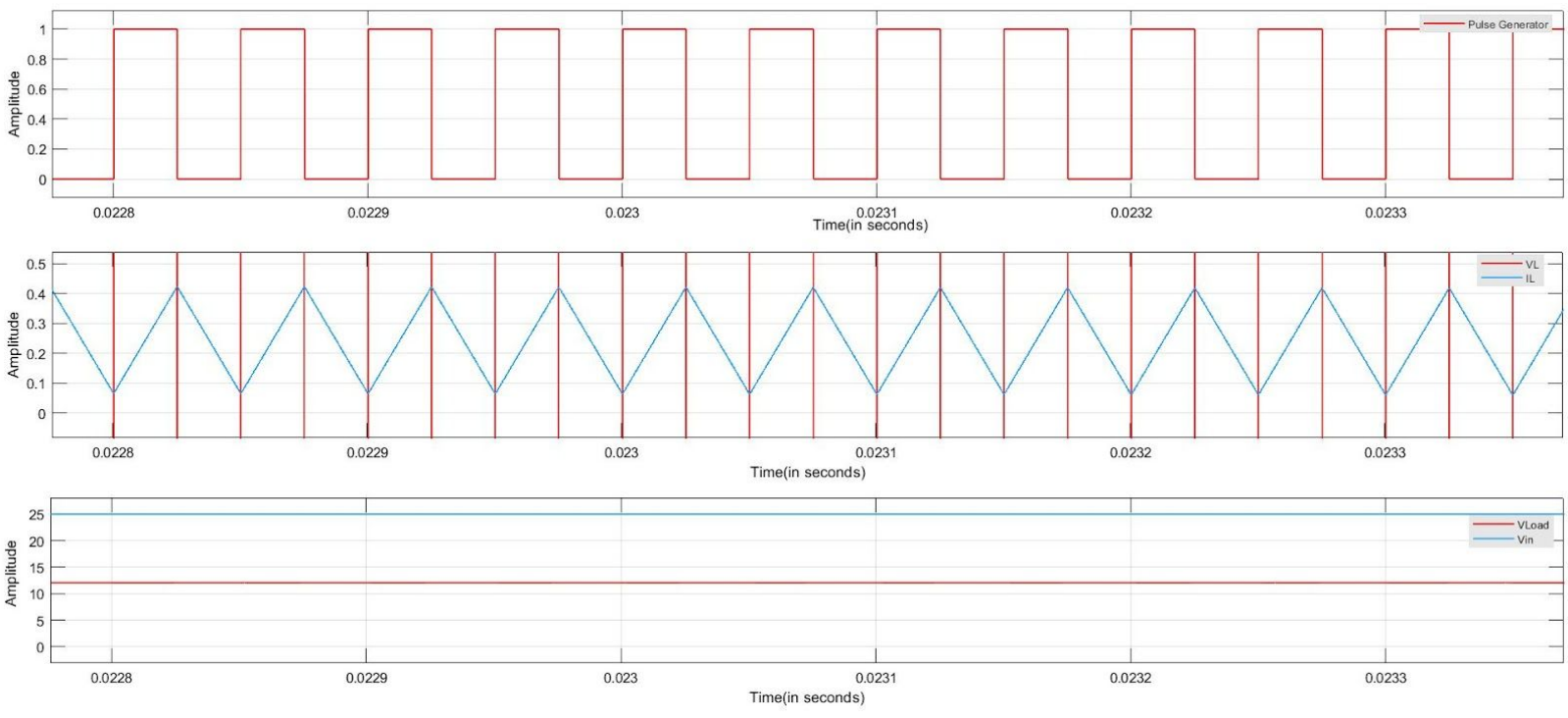
Calculation for L (of low pass filter):

Comparing K_crticial = 1-D and K = 2L/RTs, we arrive at the following assumed values of L:

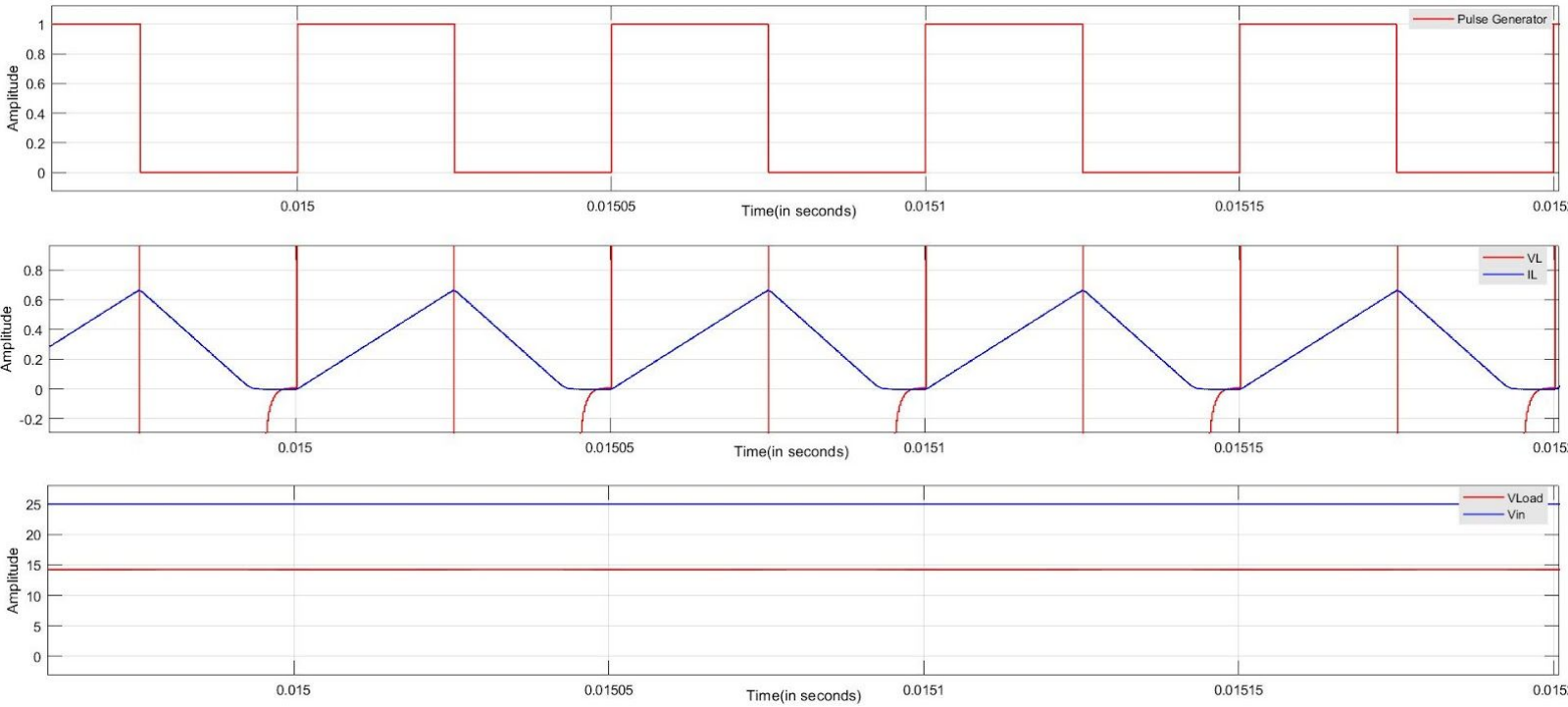   1) For DCM mode of operation, k<k_crticial, hence, L = 400uH

    2) For CCM mode of operation, k>K_crticial, hence, L = 900uH

Schematic Diagram:

Buck Converter Circuit

Observations Graphs:

CCM graph

DCM graph

Results and Conclusions:

1) The model was simulated in Simulink using Simscape library
2) Output Voltage for DCM mode was approximately 14.26V, thus, the Voltage step-down ratio was 0.57
3) Output Voltage for CCM was approximately 12.09V, thus, the Voltage step-down ratio was 0.48
4) CCM mode offered a better Step-down ratio as compared to DCM mode.