EE-522 Project Premodeling

Andrew Jefferson 825333113

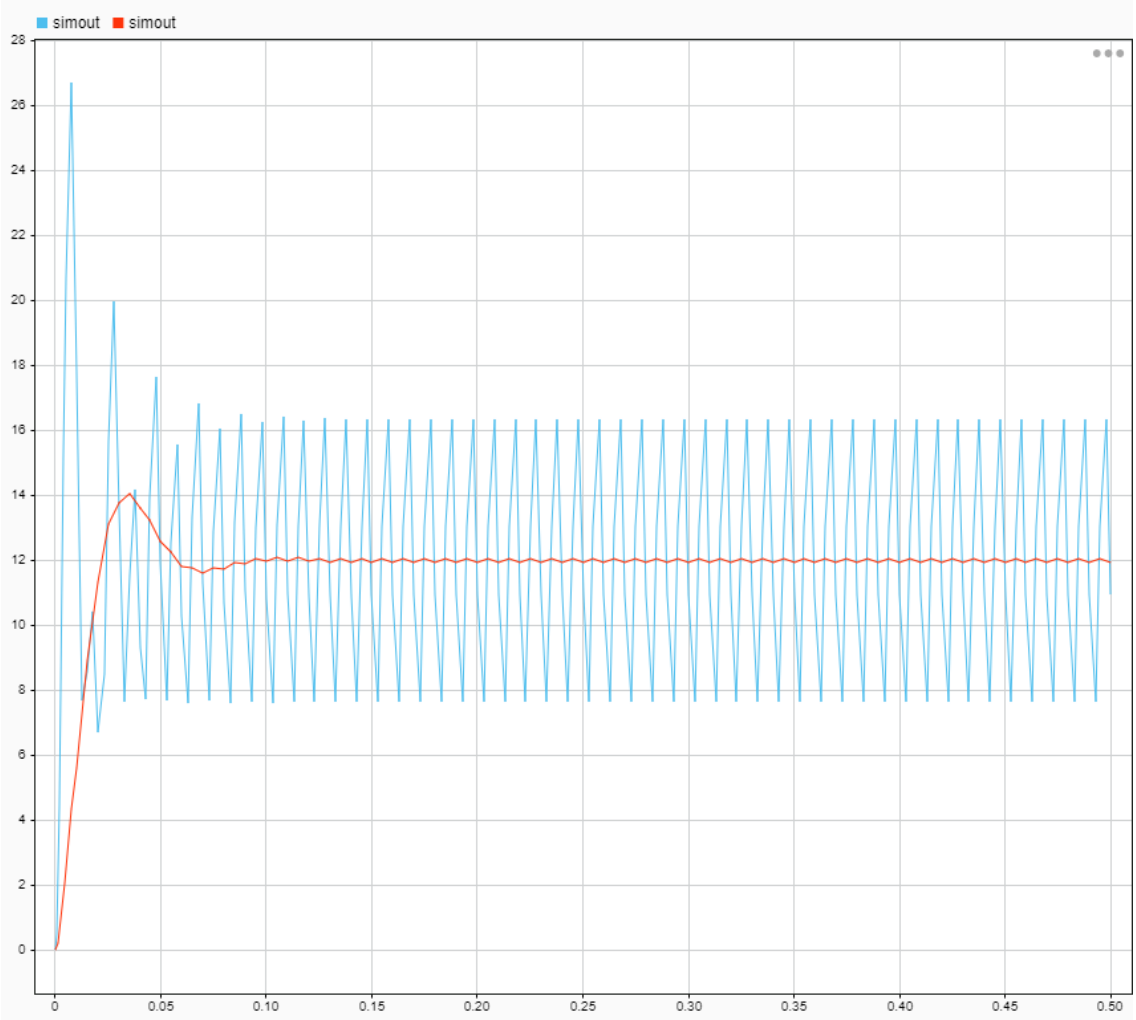
Spring 2022

Buck Converter Averaged Model Using Simulink Blocks

This model uses a pulse generator, state space, and outputs the voltage to the matlab workspace. The duty cycle is set to 50% with a period of 0.01s for these tests.

A = [0 -1/L; 1/C -1/RC] B = [Vin/L; 0] C = [0 1] D = 0

Simulation Output

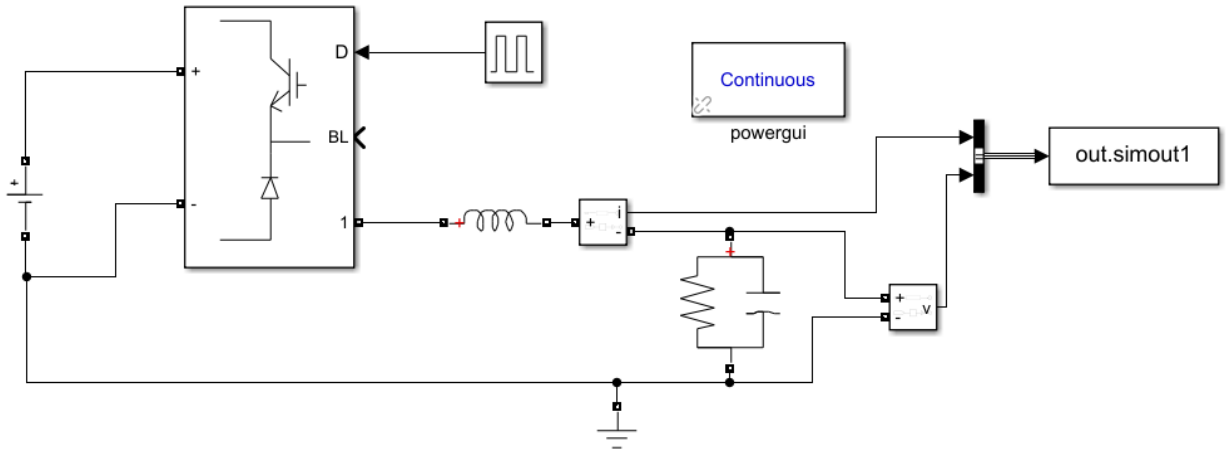


The simulation time was set to 0.5s

	Vin	L	R	C
Blue	24V	100.8mH	100Ω	100uF
Red	24V	1.008H	100Ω	100uF

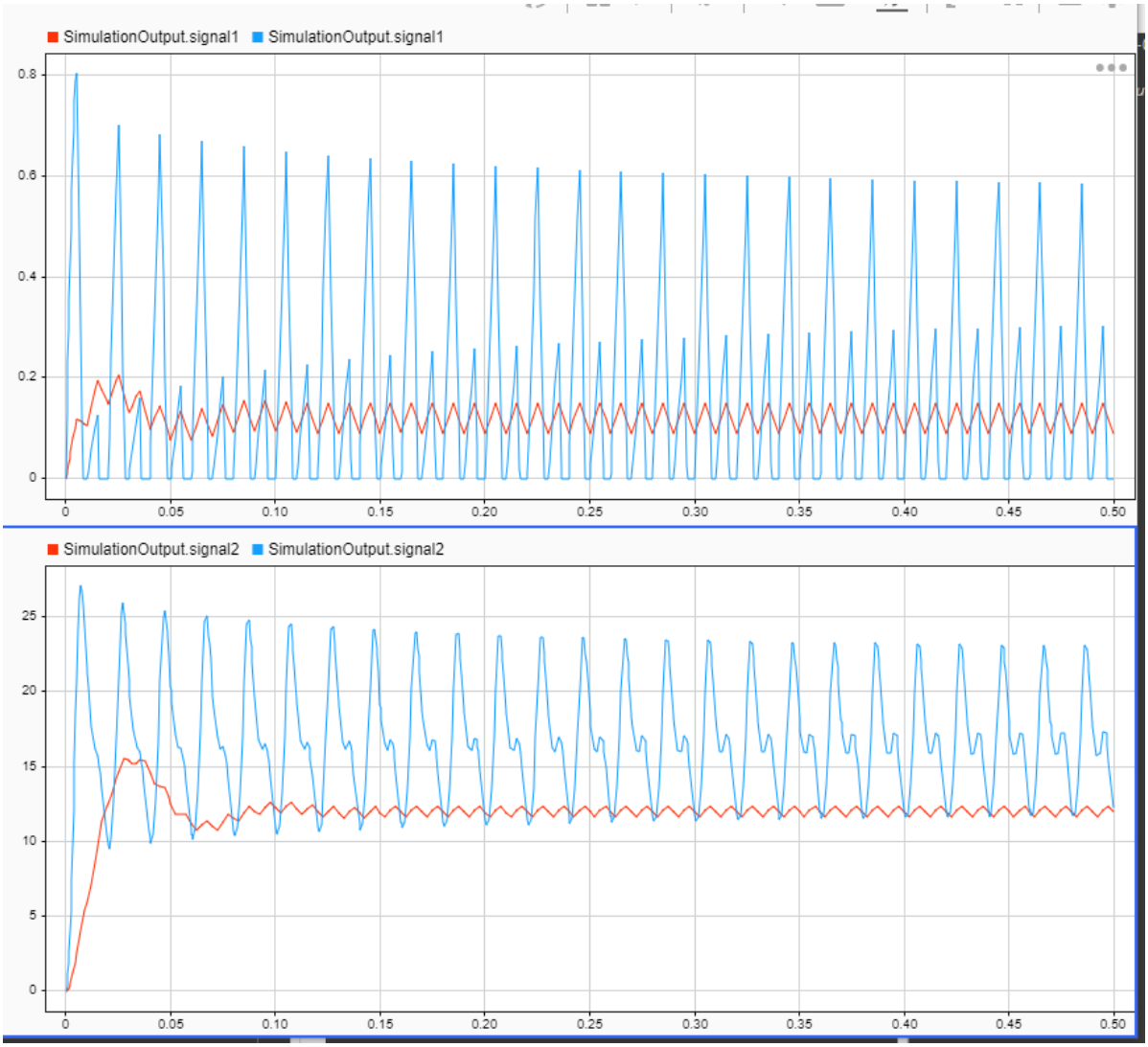
Buck Converter Average Model using Simscape Blocks

This model uses the blocks from Simscape to simulate the circuit physically. The Buck Converter block from Simscape was set up to act as an average model and the pulse generator was set up the same as before, 50% duty cycle at a 0.01s period. The simulation output this time includes the current output as well as the voltage.



The simulation uses the same component parameters as the previous simulation.

Simulation Output

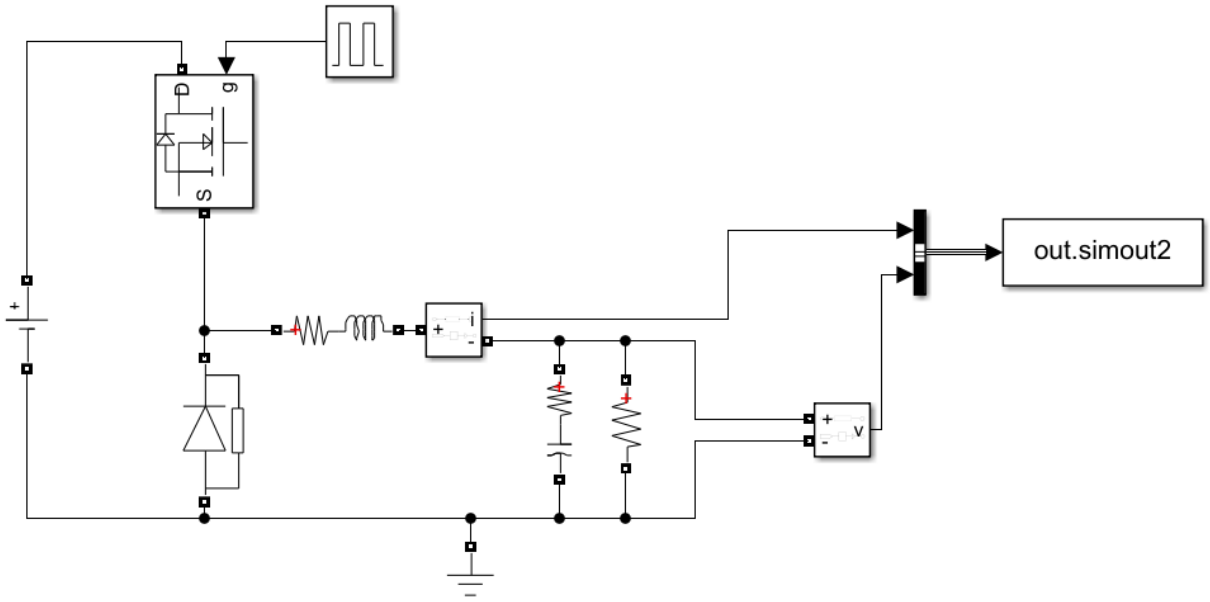


The Inductor current is on the top plot and the load voltage is on the bottom plot.

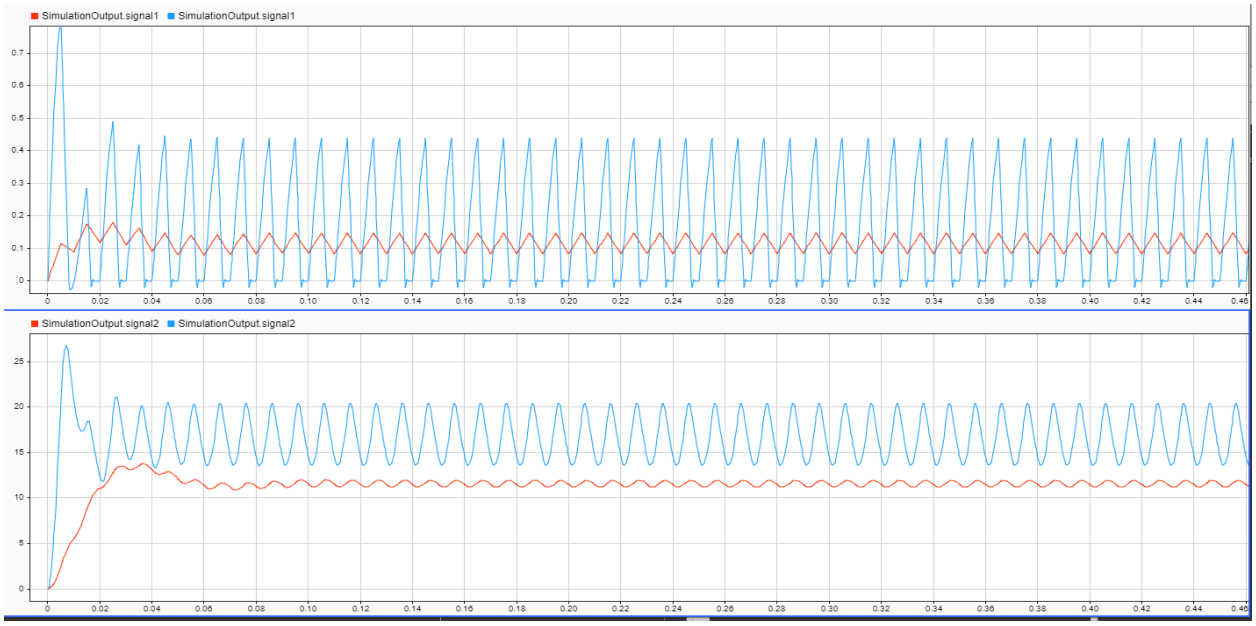
This simulation plot was interesting because it shows the effects of maintaining continuous current mode and its effect on the output voltage regulation.

Buck Converter Full Model

This simulation is the full model of the buck converter using a MOSFET and a diode. The set up is the same as before but this time an 150mΩ series resistance was added to the inductor and a 20mΩ series resistance was added to the capacitor.



Simulation Results

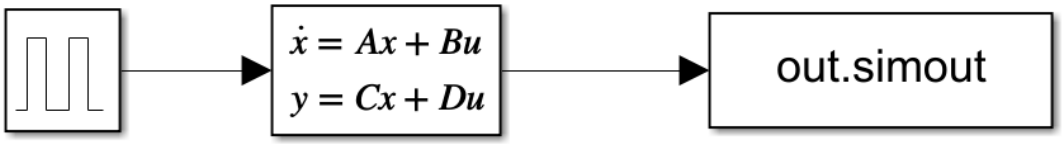


Similar results were achieved although the voltage of the blue simulation was not able to get down to the target of 12V.

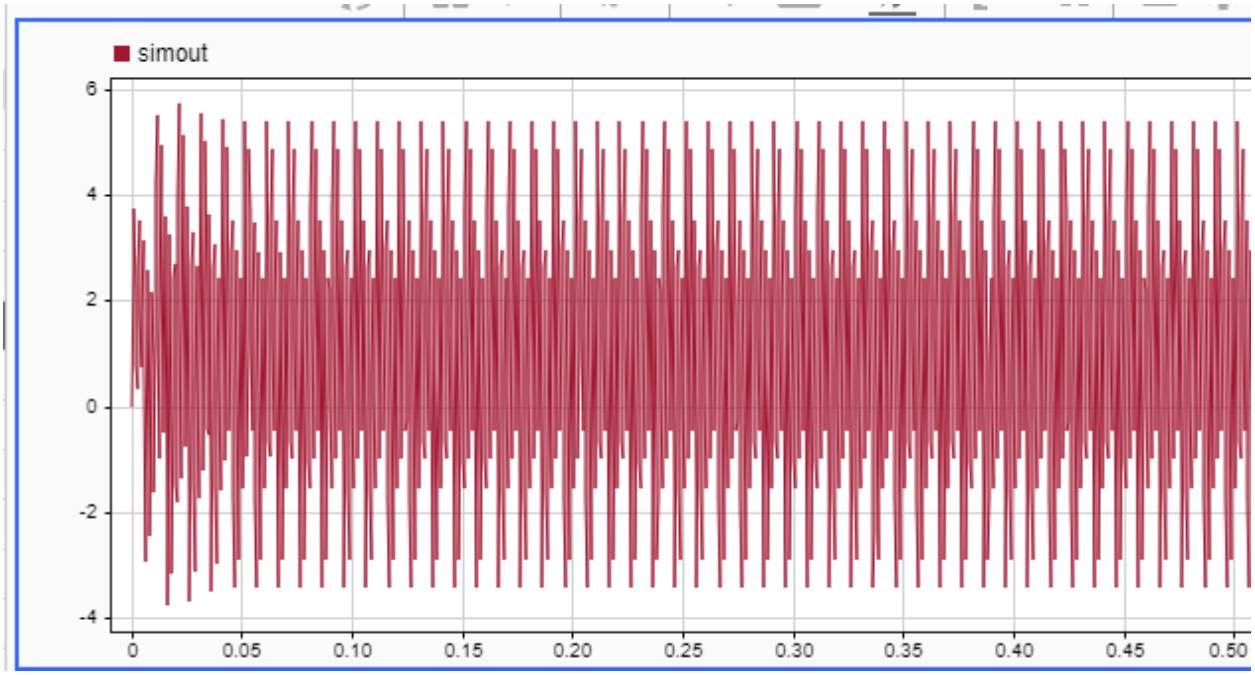
Average Model of Boost Converter using Simulink Blocks

This is the Simulink average model that was set up for the boost converter. The state space model was set up with…

A = [0 -(1-d)/L; (1-d)/C -1/RC] B = [1/L; 0] C = [0 1] D = 0



I used the value from the project description and I wasn't able to get the boost converter working correctly.



Average Model for Boost Converter using Simscape Blocks

For this model I used a similar setup to the Buck Converter. I was also unable to get this one working.