EE394J-11 Homework Assignment #1

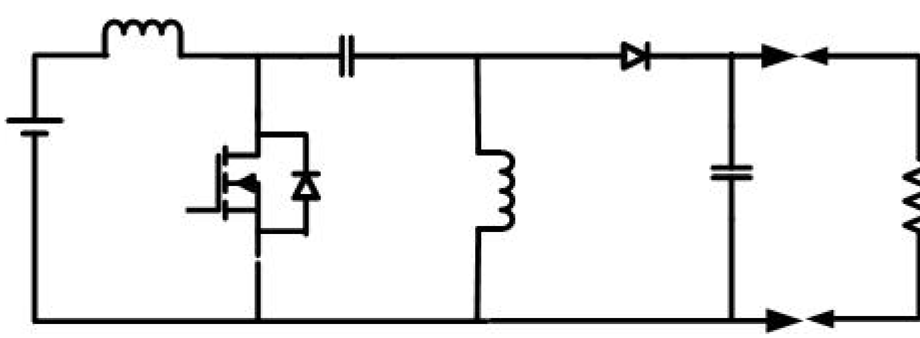
Due date: 9/30/2013

Consider a buck-boost converter with L = 500 μH, C = 1 mF, R = 10 Ω, E = 30 V. For all questions write some few conclusions or comments about the results.

1) Write the dynamic equations for the switched model, the fast average model, and the linear model. For the switched model and the fast average model simulate the converter for a duty cycle of 0.4 and switching frequencies of 100 Hz and 20 kHz. Plot the state variables in time domain and on a phase portrait.
2) Find the equilibrium points for the switched model and sketch the trajectories (i.e. on a phase portrait) for the two circuit configurations (when the switch is on and when it is off).
3) For the average model, find the relationship between input and output voltage in steady state. On a phase portrait, plot the curve representing the various equilibrium points for different duty ratios. Please do this plot on the same plot that you used to answer question #2.

Now consider the SEPIC converter in the next figure. Circuit parameters are E = 48 V, all inductors 400 μH, output capacitance equal to 1000 μF, R = 10 Ω and center capacitance equal to 50 μF.

4) Write the dynamic equations for the switched model, the fast average model, and the linear model. For the switched model and the fast average model simulate the converter for a duty cycle of 0.4 and switching frequencies of 100 Hz and 25 kHz. Plot these state variables in a time domain figure.
5) Find the equilibrium points for the switched model considering the two circuit configurations (when the switch is on and when it is off).
6) For the average model, find the relationship between input and output voltage (in steady state).
7) Finally, replace the output inductor for a pair of coupled inductors and write down the same equations than in question #4 but now for the new circuit configuration. Also repeat question #6.



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