

ECE2795 Homework Assignment #4

Due date: 03/19/2015

For all questions elaborate some few conclusions or comments about the results. For all questions with simulations include a graph with the used model. State all the assumptions considered in the simulations. Also for all simulations, the results should focus on the steady state, so the transient period may or may not be shown. You are free to do as many assumptions you consider appropriate.

- 1) Write down both the switched and fast-average dynamic equations for a Ćuk converter. Simulate both conditions assuming a switching frequency of 20 kHz, an input voltage of 24 V, an output voltage of 48 V, the load is a 2 Ω resistor, the output capacitance is 1500 μF , the center capacitance is 50 μF , and all inductances are 800 μH . Plot all the state variables (inductor currents and capacitor voltages). Calculate the input power factor.
- 2) Calculate the output capacitance for a single-phase full wave rectifier so the output voltage ripple is 5% of the peak input voltage. Assume that you have a 15 A load current and your input voltage is 120 Vrms. Consider both the cases of an input frequency of 60 Hz and 400 Hz. In both cases also estimate the input current THD and power factor.
- 3) Obtain the switching signal for one of the switches of a single-phase H-bridge inverter in which the switching frequency of a PWM controller is 27 times the input frequency and for the cases of a modulation index of 0.9 and 0.5. Plot the output voltage spectrum up to 2 times the switching frequency for a purely resistive load.