

## UTA EE6375 PhD Diagnosis Exam (Fall 2011) Power Electronics Engineering

**Instructions:**

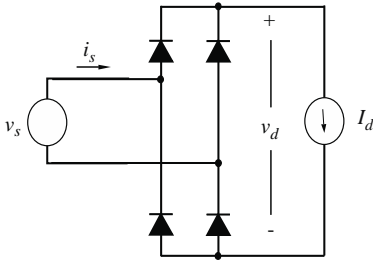
- Verify that your exam contains 7 pages (including the cover sheet).
- Some space is provided for you to show your work. Only if more space is needed, you may show your work on the back of the exam sheet.
- The point values listed on this exam serve only as a guideline. The Department reserves the right to make modifications to the weighting of the problems.
- You may use a calculator.

**I Choose to work on Problems \_\_\_\_\_ and \_\_\_\_\_ (Choose only 2 from the 3 problems).**

Problem	Possible Points	Scores
1	50	
2	50	
3	50	
Total Score (Choose 2 Problems)	100	

1- Consider an ideal diode bridge rectifier with a dc current source,  $I_d$ , at the output stage. The input voltage source is  $v_s(t) = \sqrt{2}V_s \sin(\omega t)$ . Find the following quantities:

- a) The dc magnitude of the output voltage,  $v_d$ .
- b) The total harmonic distortion of the input line current,  $i_s$ .

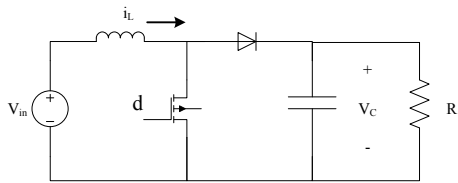




- 2- Find the value of load resistance,  $R$ , for which the boost converter is in the boundary between the continuous and discontinuous conduction modes. The load value,  $R$ , should be function of circuit components ( $L, C$ ), switching interval  $T_s$ , and the control variable,  $D$ .

Hint:

In the boundary conduction mode, the dc value of the inductor current,  $I_L$ , and its ripple magnitude,  $\Delta i_L$ , are equal.





3- Following ideal boost converter is working with an open control loop, and associated waveforms have constant nominal values in steady state. This converter is in discontinuous conduction mode and, thus, there are three subintervals in a prototypical switching cycle. Find the duty cycle for the second subinterval,  $d_2$ , also known as the duty ratio constraint. Find  $d_2$  for two following two models:

a) **Reduced-order** model, where the  $d_2$  is a function of the average value of the **slow** state variable,  $\overline{v_C}$ .

b) **Full-order** model, where the  $d_2$  is a function of the average value of the **fast** state variable,  $\overline{i_L}$ .

