ECE 214 - Lab #10
Thévenin Equivalent Circuits

11 April 2022

Introduction

In this lab, you will examine the Thévenin equivalent output impedance of the DC-DC Power Supply designed in Lab #9.

Pre-Lab

1. For the DC-DC Power Supply of Lab #9, derive the Thévenin equivalent circuit with respect to the output terminals of the DC-DC Power Supply. The Thévenin equivalnt impedance should be calculated for the two operating conditions below.
   (a) *Condition 1*: switch S1 in the boost converter is closed (the D and S terminals of the transistor are shorted) and switch S2 is open (there is no current through the diode).
   (b) *Condition 2*: switch S1 in the boost converter is open (the D and S terminals of the transistor are open) and switch S2 is closed (the diode is a short-circuit).
2. Plot the following on semi-log graphs.
   (a) The magnitude of the Thévenin equivalent output impedance as a function of frequency for frequencies between 1 Hz and 1 MHz for both operating conditions described in step 1.
   (b) The phase angle of the Thévenin equivalent output impedance as a function of frequency for frequencies between 1 Hz and 1 MHz for both operating conditions described in step 1.
   (c) The real part of the Thévenin equivalent output impedance as a function of frequency for frequencies between 1 Hz and 1 MHz for both operating conditions described in step 1.
   (d) The imaginary part of the Thévenin equivalent output impedance as a function of frequency for frequencies between 1 Hz and 1 MHz for both operating conditions described in step 1.

Lab Procedure

1. Deactivate the DC supply voltage from Lab #9 by removing the 12 V power brick and replacing it with a short circuit.
2. Remove the diode from the circuit of Lab #9. This produces *Condition 1* described in Pre-Lab step 1a.
3. Using the network analyzier function of the Analog Discovery 2, measure the magnitude and phase of the Thèvenin equivalent output impedance of the power supply as a function of frequency for frequencies between 1 Hz and 1 MHz.

4. Replace the diode with a short circuit and remove the transistor. This produces *Condition 2* described in Pre-Lab step 1b. Measure the magnitude and phase of the Thèvenin equivalent output impedance of the power supply as a function of frequency for frequencies between 1 Hz and 1 MHz.

Post-Lab

Compare the calculated and measured Thèvenin equivalent outout impedance of the power supply. Discuss the results of this analysis in your technical report.