ECE 214 - Lab #10
Thévenin Equivalent Impedance

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Introduction

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

Pre-Lab

1. For the DC-DC Power Supply of Lab #9, derive the Thévenin equivalent output impedance as a function of frequency. Calculate the Thévenin equivalent impedance 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. For each operating condition described in step 1, plot the following as a function of frequency, for frequencies between 10 Hz and 100 kHz, on semi-log graphs.
   (a) The magnitude of the Thévenin equivalent output impedance.
   (b) The phase angle of the Thévenin equivalent output impedance.
   (c) The real part of the Thévenin equivalent output impedance.
   (d) The imaginary part of the Thévenin equivalent output impedance.

Lab Procedure

1. For the DC-DC Power Supply of Lab #9, use the impedance analyzer in the Analog Discovery II to measure the Thévenin equivalent output impedance as a function of frequency for the two operating conditions described above.
   (a) Deactivate the DC supply voltage from Lab #9 by removing the 12 V power brick and replacing it with a short circuit.
   (b) To create *Condition 1* described in Pre-Lab step 1a, remove the diode from the boost-converter circuit.
   (c) To create *Condition 2*, replace the diode in the boost-converter circuit with a short circuit.
2. Plot the measured output impedances as described in Pre-Lab step 2.

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.