

ECE 214 - Lab #10
Thévenin Equivalent Impedance
11 April 2024

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 on a log-log graph the following as a function of frequency, for frequencies between 10 Hz and 100 kHz.
 - (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](#), measure the Thévenin equivalent output impedance as a function of frequency for the two operating conditions described above. See [Using the Impedance Analyzer](#) tool in the Analog Discovery II for instructions. Make sure to use a reference resistor and set the correct reference resistor topology.
 - (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 impedance on each of the graphs generated in [Pre-Lab step 2](#).

Post-Lab

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