Lab 5

Treble and Bass: Part 1 Schematic, Simulation (multirun)

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Objectives

For this Lab we are tasked with build and simulating the treble and bass components of our system. This will start with us needing to pull in a new library with the parts that we need for this week. With the library in the right place, we then would start building the schematic for this week. The schematic will have to have both the right and left channel for the bass and the treble circuits. We will also need to build a 23-pin header that will connect all the components of the lab with net labels. We will also have to calculate the output of the treble and bass circuits. The last thing that we will have to do is simulate the design and make sure that it is functioning as expected and compare them to our calculated results.

Procedures

Equipment and Supplies

- Altium Designer

Procedures

To start this lab, we had to create a library package that will have the needed parts for both our treble and bass circuits that we will build the schematic for this week. To do this we have to replace the old library and then save the new library that we will be using to the server. After we had completed the new library process, we started building the schematic for our treble and bass circuit. For the start of the schematic, we built the 23-pin header which we will later connect all the inputs and outputs of the schematic to. After building the 23-pin header we started placing the components for our circuit. We first placed the op-amps, resistors, capacitors, and potentiometers on the schematic. After all the components were placed, we then wired everything together and connected everything to our 23-pin header. After we finished building the schematic we place the voltage sources so that we could simulate our schematic. The schematic and simulations of both the bass and treble can be seen below as “Figure 1, Schematic”, “Figure 2, Bass Simulation”, and “Figure 3, Treble Simulation”.

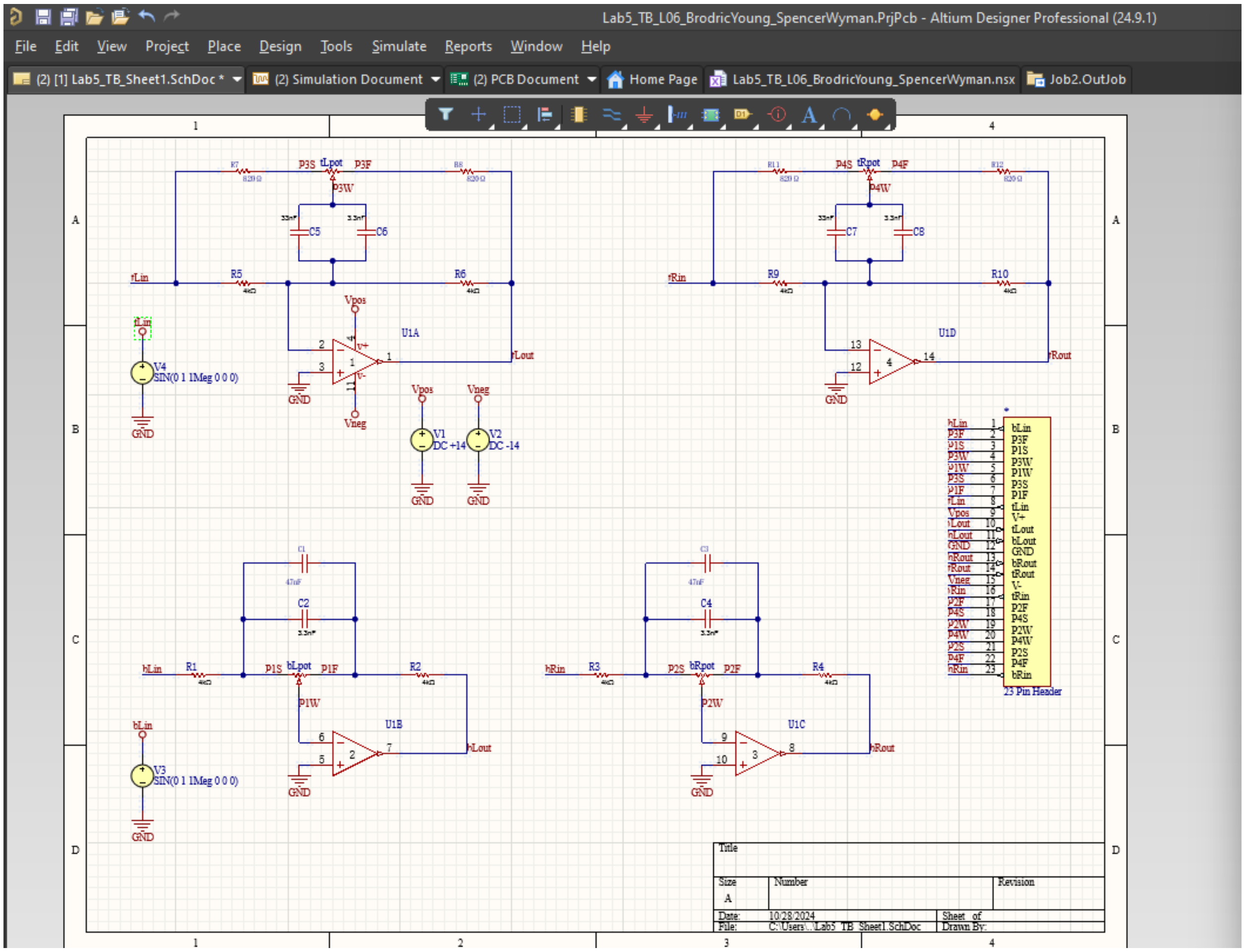

Figure 1, Schematic

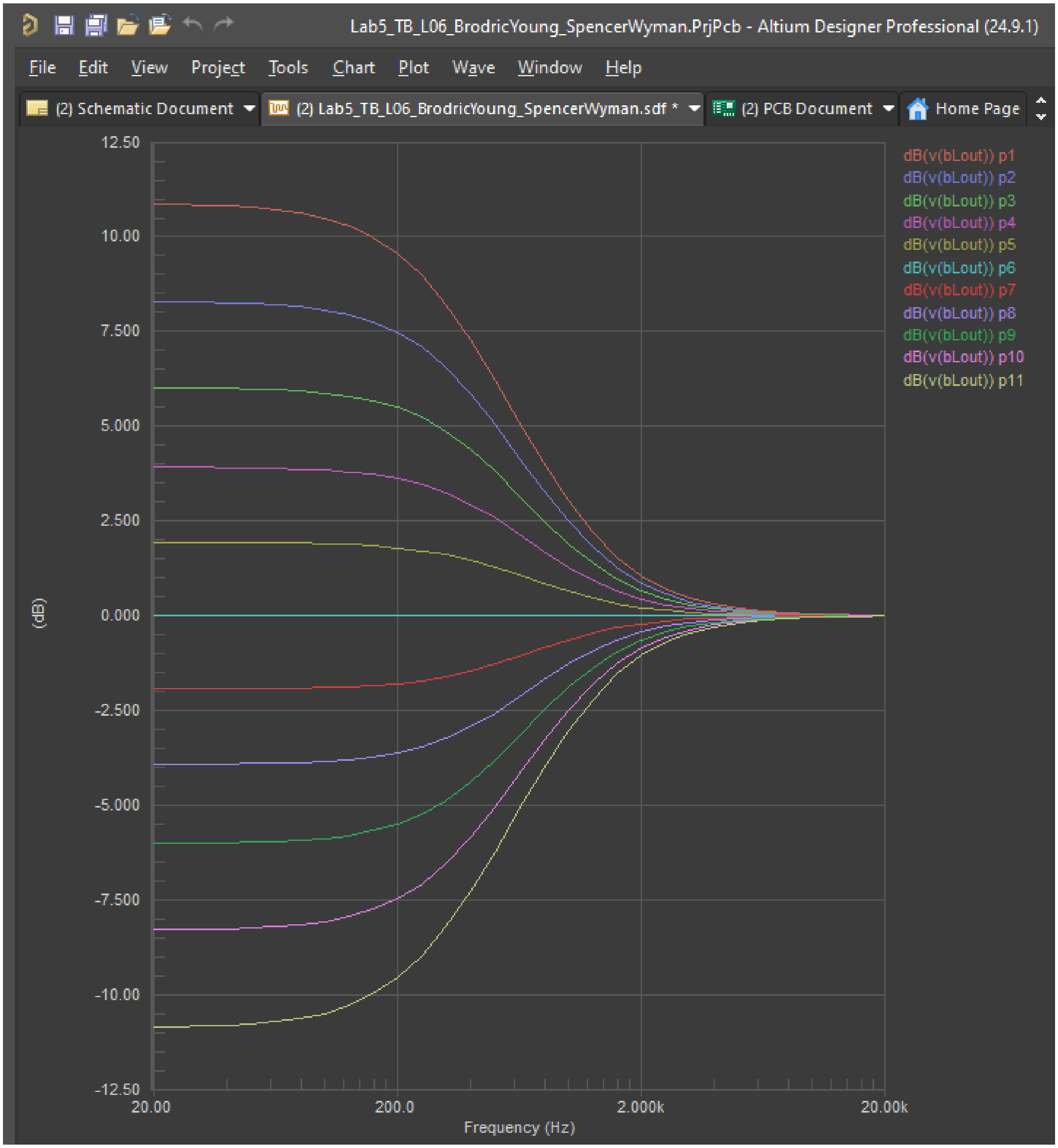

Figure 2, Bass Simulation

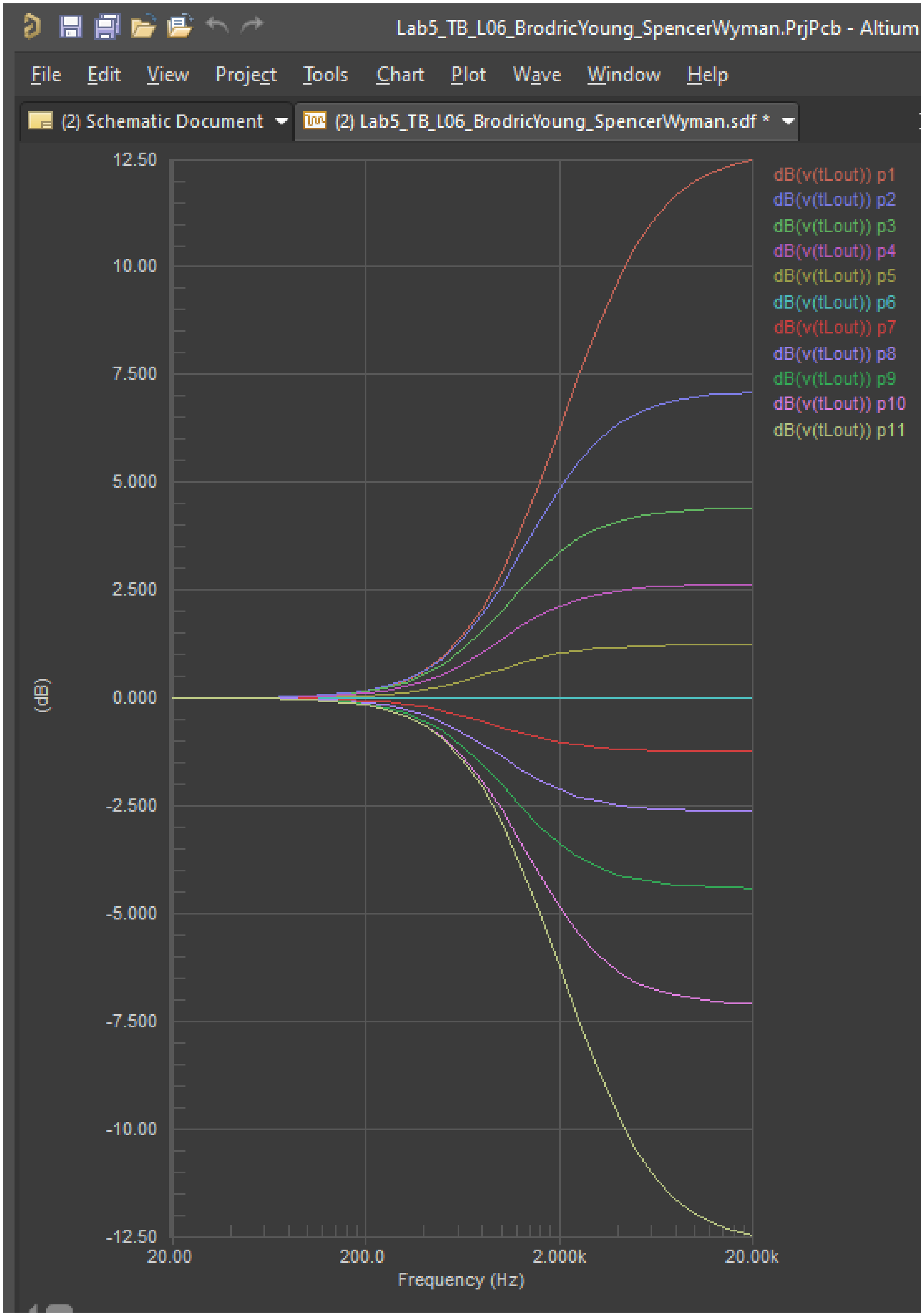

Figure 3, Treble Simulation

$\lvert H(j\omega)\rvert = \dfrac{\left\lvert 1 + \frac{j\omega}{\omega_n} \right\rvert}{\left\lvert 1 + \frac{j\omega}{\omega_d} \right\rvert} = \dfrac{\sqrt{1 + \left(\frac{\omega}{\omega_n}\right)^2}}{\sqrt{1 + \left(\frac{\omega}{\omega_d}\right)^2}}$	$\boldsymbol{\omega \to 0}$	$\boldsymbol{\omega \to \infty}$
$\boldsymbol{\alpha = 0}$	$\lvert H(j\omega)\rvert_{\alpha=0,\, \omega=0} = 1$	$\lvert H(j\omega)\rvert_{\alpha=0,\, \omega=\infty} = 0.078$
$\boldsymbol{\alpha = 1}$	$\lvert H(j\omega)\rvert_{\alpha=1,\, \omega=0} = 1$	$\lvert H(j\omega)\rvert_{\alpha=1,\, \omega=\infty} = 4.351$
$\boldsymbol{\lvert H(j\omega)\rvert_{dB} = 20\, log_{10} \lvert H(j\omega)\rvert}$	$\boldsymbol{\omega \to 0}$	$\boldsymbol{\omega \to \infty}$
$\boldsymbol{\alpha = 0}$	$\lvert H(j\omega)\rvert_{\mathrm{dB}} = 0$	$\lvert H(j\omega)\rvert_{\mathrm{dB}} = 22.158$ db
$\boldsymbol{\alpha = 1}$	$\lvert H(j\omega)\rvert_{\mathrm{dB}} = 0$	$\lvert H(j\omega)\rvert_{\mathrm{dB}} = 12.77$ db