

# Electronics Lab 04: Operational Amplifiers - Frequency vs. Gain

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Abstract

Not Requested

## I. PURPOSE

Not Requested

## II. CONCLUSIONS

Not Requested

## III. THEORY

Not Requested

## IV. DATA

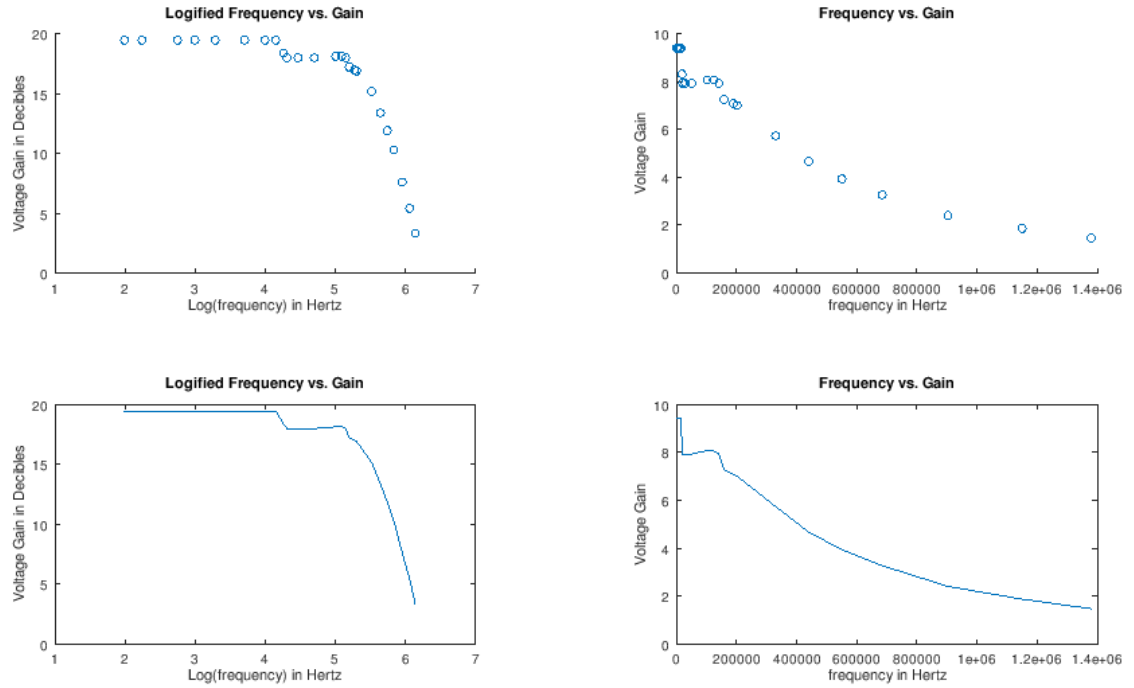


FIG. 1. Frequency and Gain Voltages

The trend we are looking for in the Frequency vs. Gain is much easier to see when we logify both axes. If we also multiply the log of gain by 20 it conveniently becomes unit

decibels. Above you can see the graphs both logified and pure. The left shows us the logified data that we expect to be similar to the Bode plot in the datasheet as seen below.

We do indeed see a similar curve but we ended up with two 'knees' in our data, instead of the one we expected. This could be due in part to a lack of data density around that location, but it seems that what data is there still shows the two bends. Perhaps this is a flaw within the op amp I used, a malfunction with my test equipment, or even human error in data recording.

One of the knees seems to fall around  $\log(f) = 4.2$  and the other closer to  $\log(f) = 5$ . That puts these bends at roughly  $f_{b1} = 15850$ , and  $f_{b2} = 100000$  respectively.

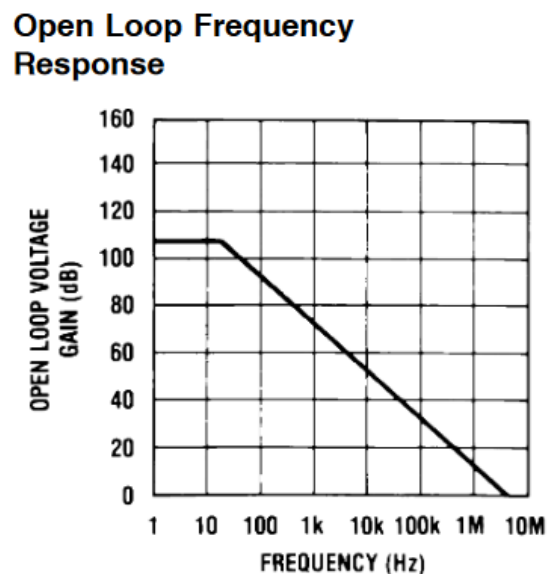


FIG. 2. LF411 Open Loop Frequency Response Graph taken from LF411 Datasheet

We can see in our logified graph that the second knee falls at around 17dB, which is 3db lower than our designed gain of 20dB. This much does match our expectations but I don't think it matches the Open Loop Frequency Response graph of the datasheet. If we follow our  $f_{b1}$  and  $f_{b2}$  up to find their respective  $A_{OL}$  we find them to be roughly 30dB and 43dB. As stated earlier our design was meant to be a 20dB amplifier, so something isn't adding up here.

I'm not sure if I'm misunderstanding something, misinterpreting the graphs or data, created errors in either my math or data collection, didn't set up the amplifier correctly in the first place, or something entirely different, but I expected the bend to fall around 800kHz-1MHz, but I believe my data is showing it falling much sooner.

I did compare my data to others that also completed the experiment and while most only had one bend, the data mostly matched. This makes me think the experiment was likely not what went wrong.

## **V. ANALYSIS**

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