

E 232  
Section A  
Group 4

# Cross Over Network



**STEVENS**  
INSTITUTE *of* TECHNOLOGY  
THE INNOVATION UNIVERSITY®

By Carlos Arce Sanchez,  
Eugene Kozlakov,  
and Sophia Turci

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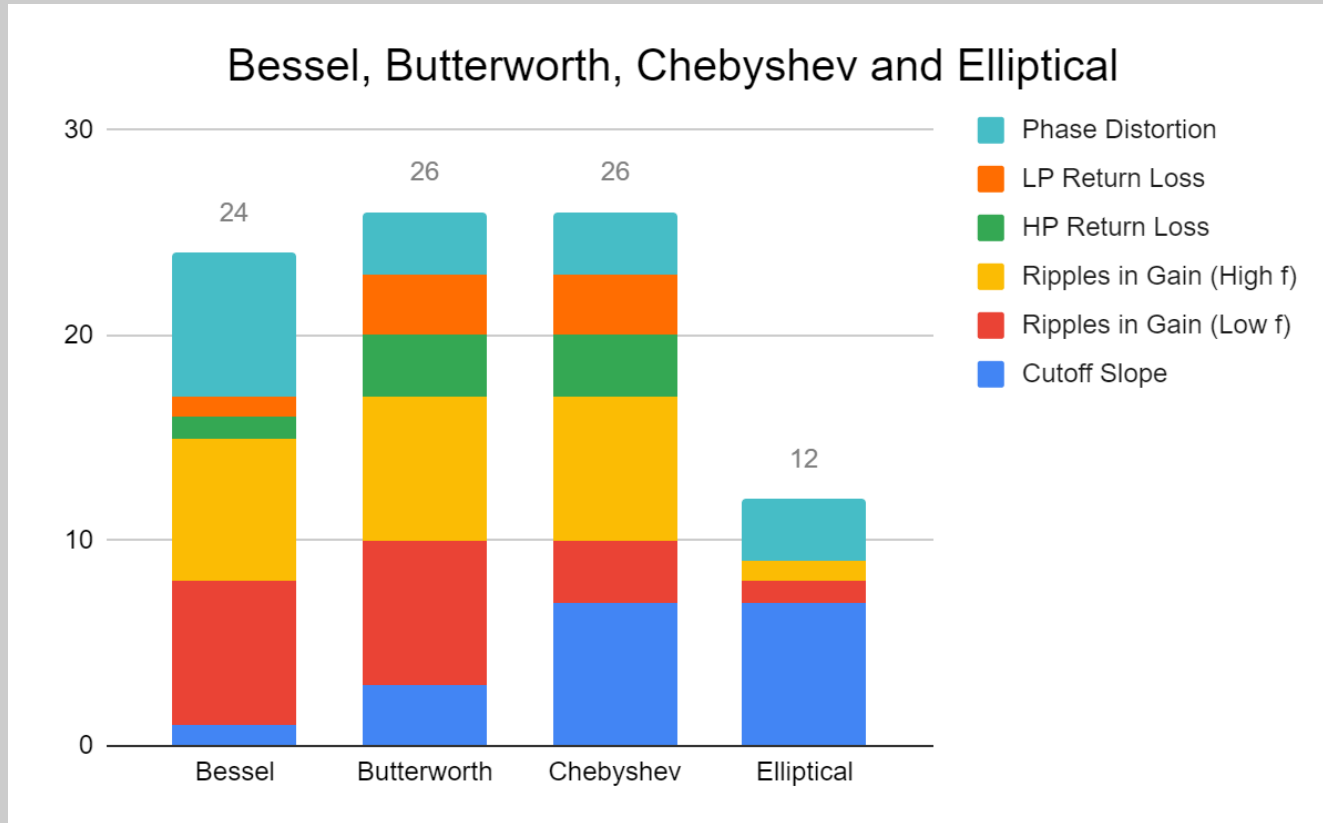
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# Problem Statement

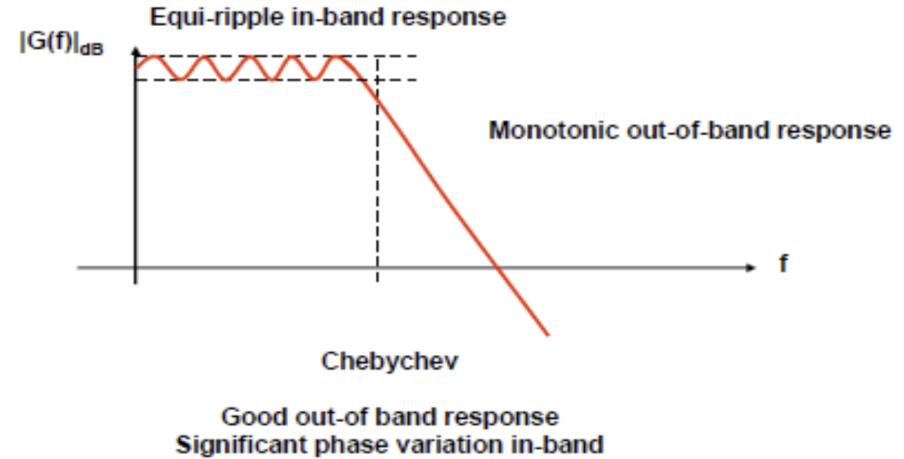
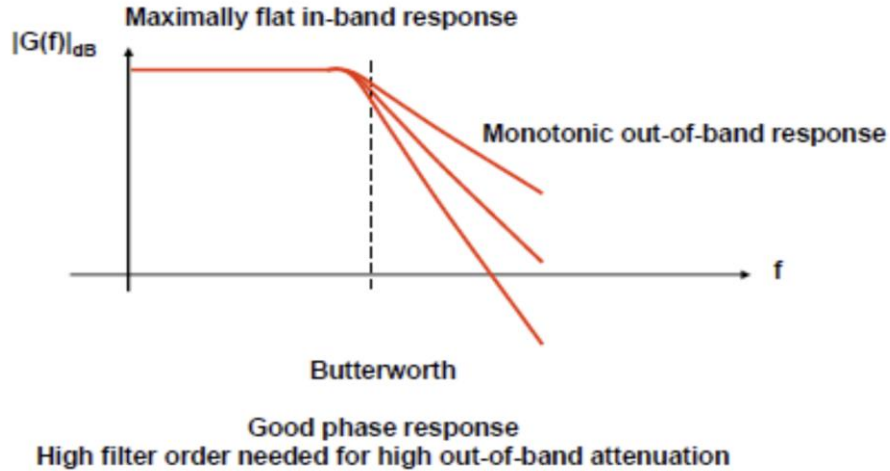
This Project Entails:

- The design and simulation of filter/amplifier circuits that optimize and equalize the performance of a speaker system consisting of a Woofer and Mid-Range.
- Crossover frequency: 100-125Hz
- Filter Slope: -12dB/octave minimum.
- Quality Functional Deployment: Cost not a priority.
- Woofer Resistance: 3.35 Ohms.
- Mid-Range Resistance: 4 Ohms.

# Quality Functional Deployment (QFD)



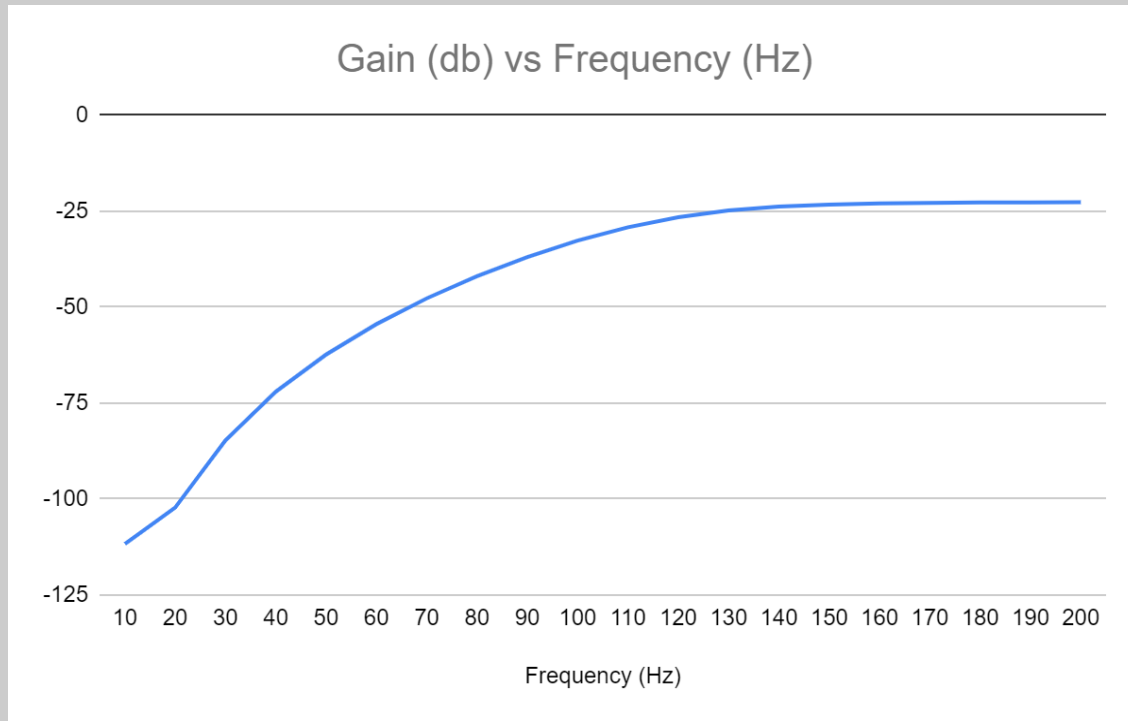
# Hypothesis



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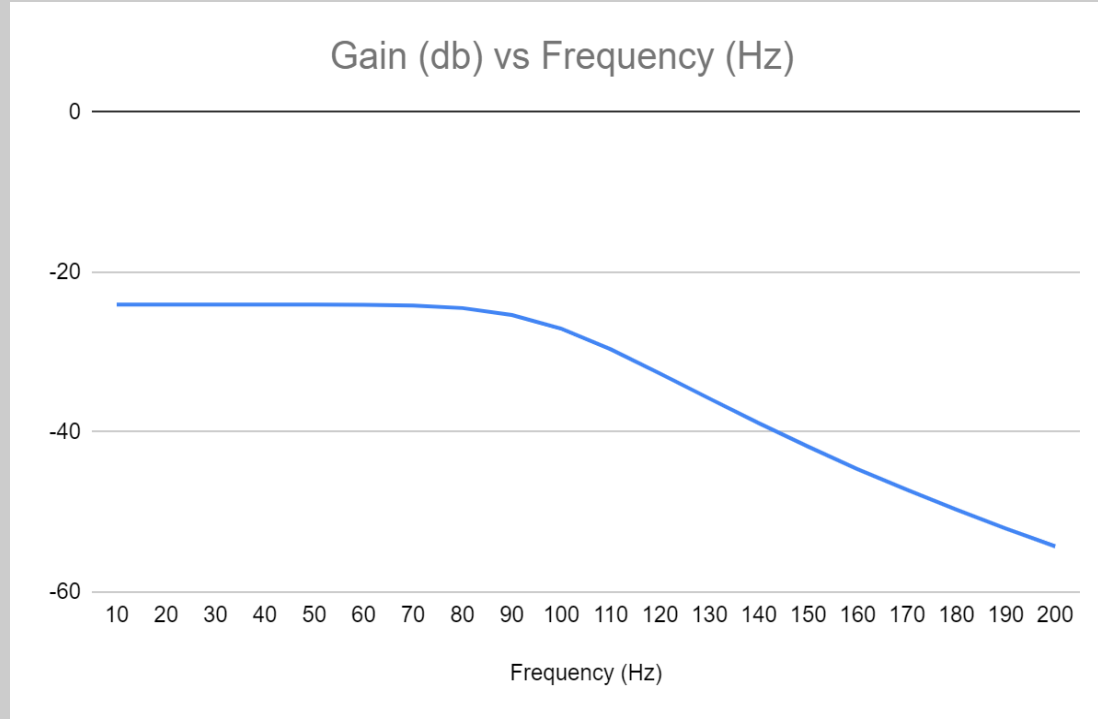
- Based on theory: Butterworth is well rounded to meet design needs
- Chebyshev is a strong second contender.

# Butterworth Highpass Filter Analysis (5th Order)



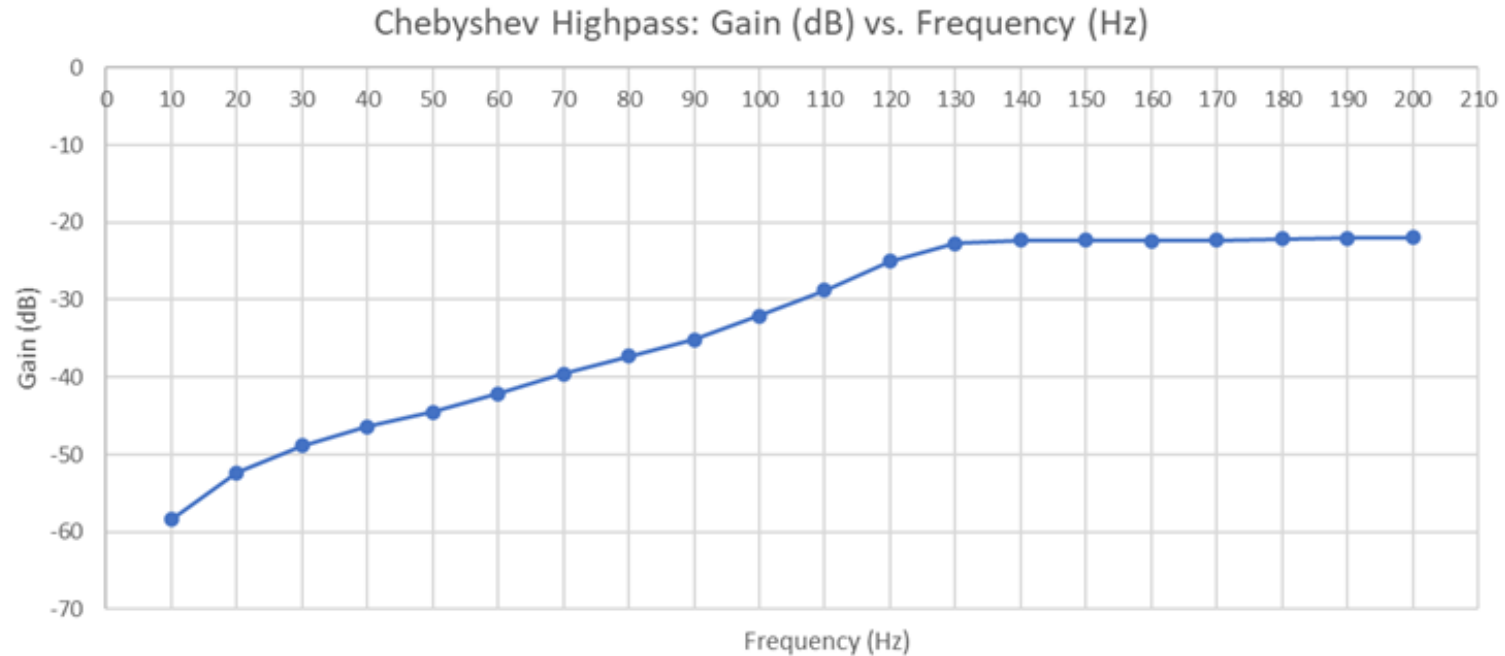
*The Gain vs. Frequency graph above has a slope of approximately: 10.1 dB/Octave in the stopband.*

# Butterworth Lowpass Filter Analysis (5th Order)



*The Gain vs. Frequency graph above has a slope of approximately: -27.2 dB/Octave in the stopband.*

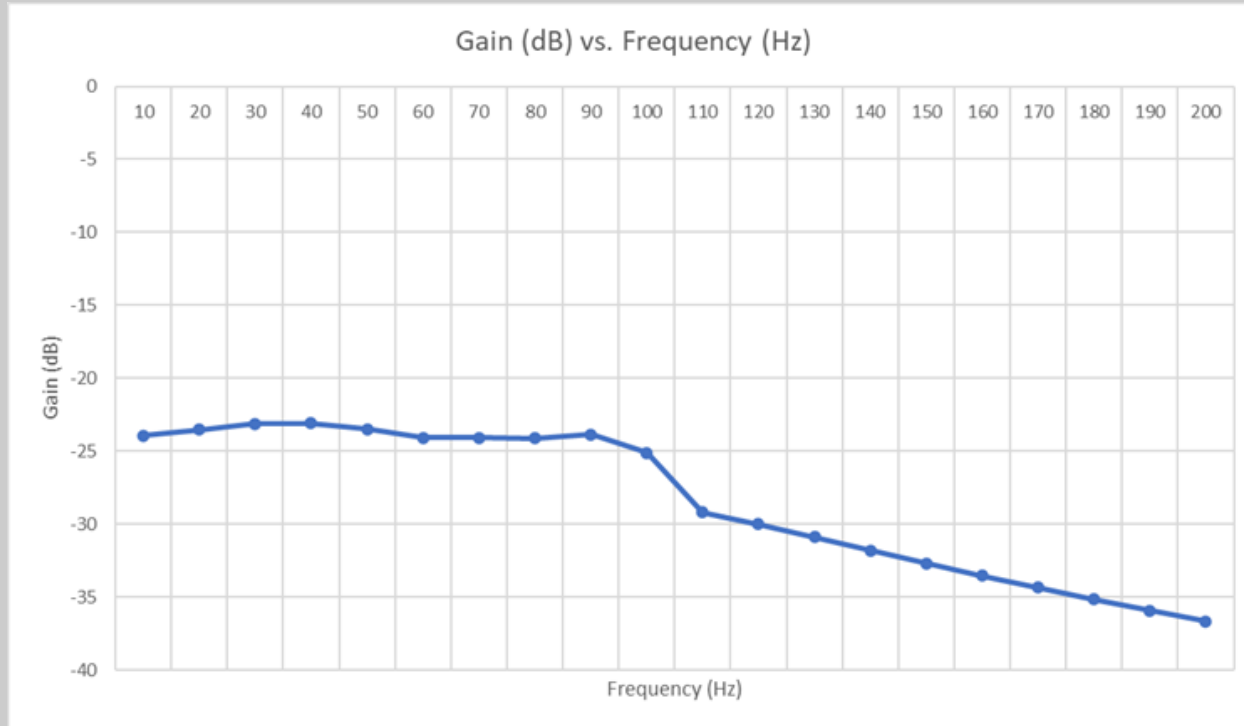
# Chebyshev Highpass Filter Analysis (5th Order)



*The Gain vs. Frequency graph above has a slope of approximately: 17.93 dB/Octave in the stopband.*

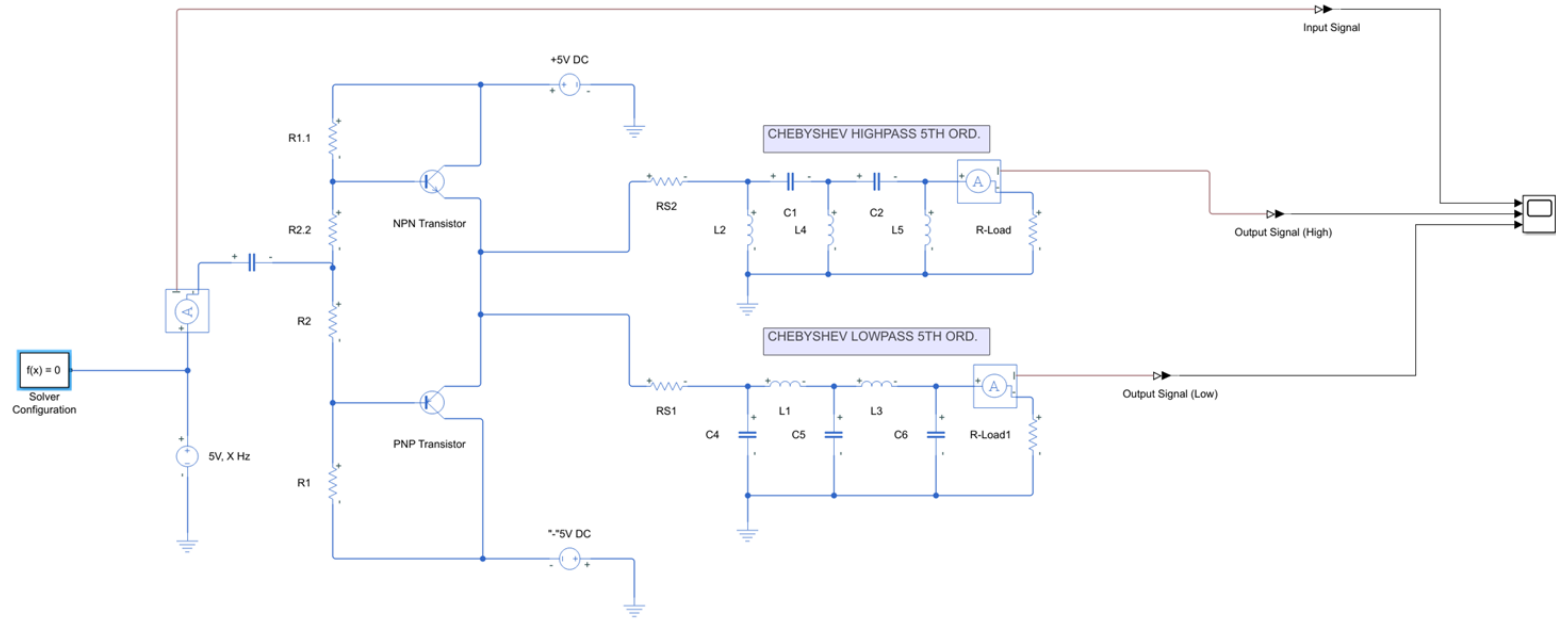


# Chebyshev Lowpass Filter Analysis (5th Order)

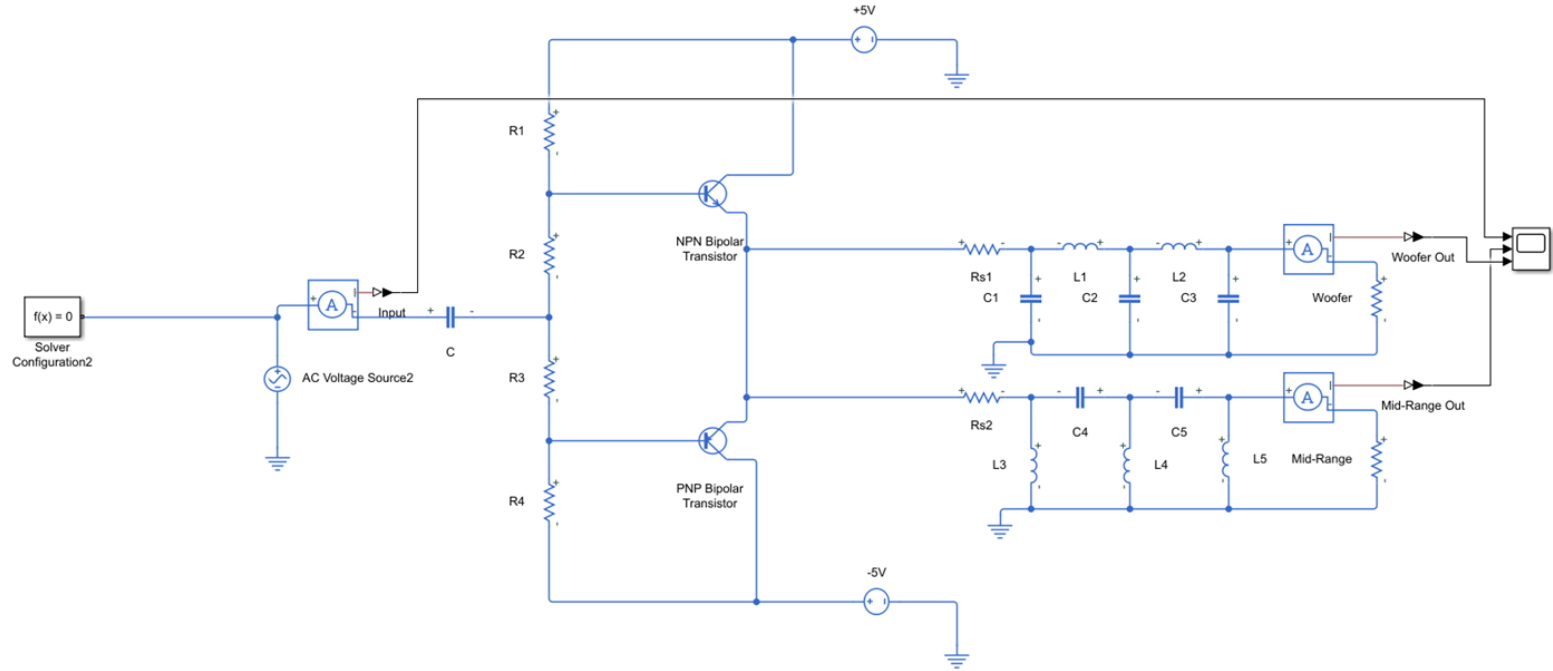


*The Gain vs. Frequency graph above has a slope of approximately: -11.54 dB/Octave in the stopband.*

# Chebyshev-Amplifier Setup



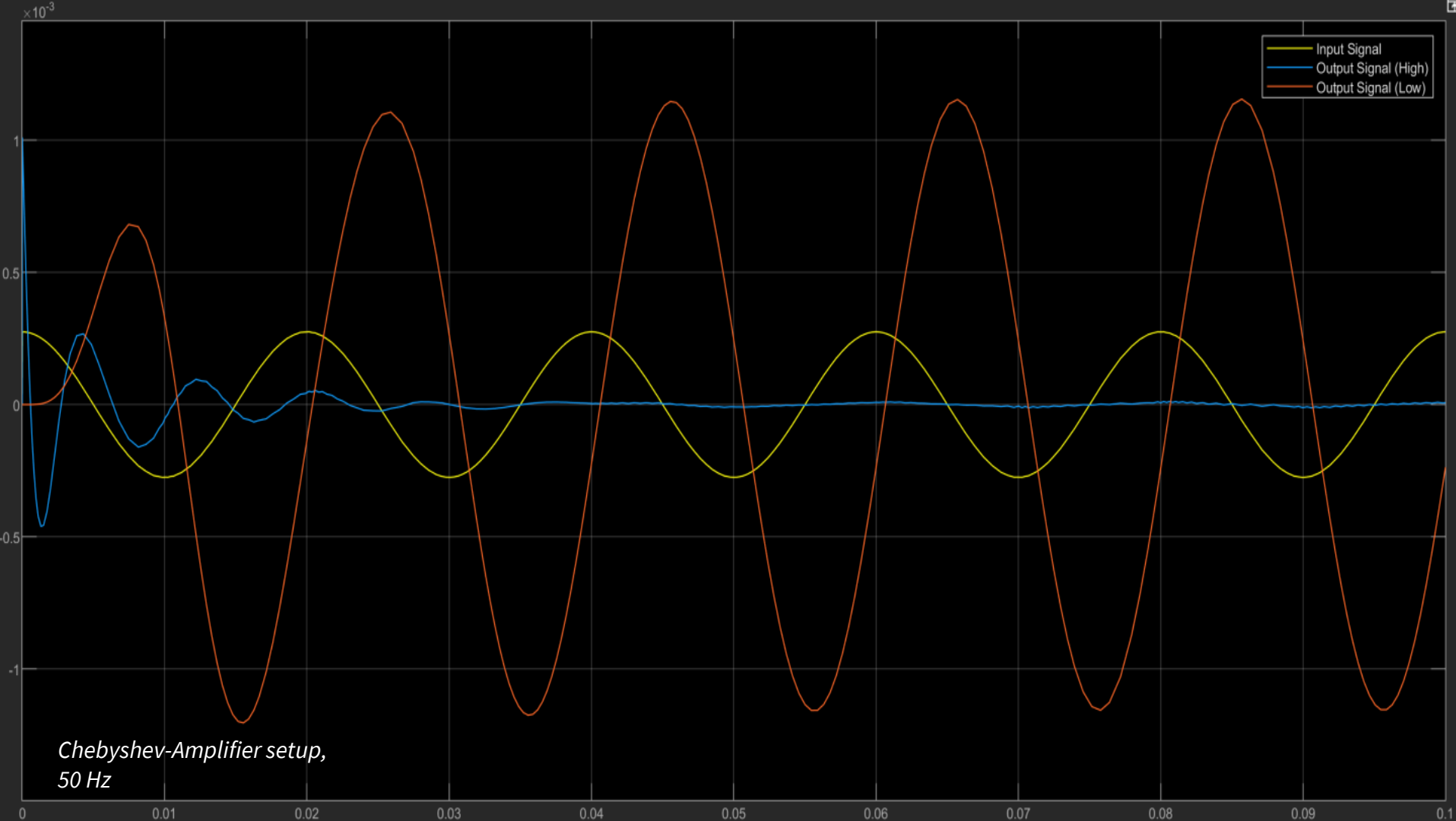
# Butterworth-Amplifier Setup

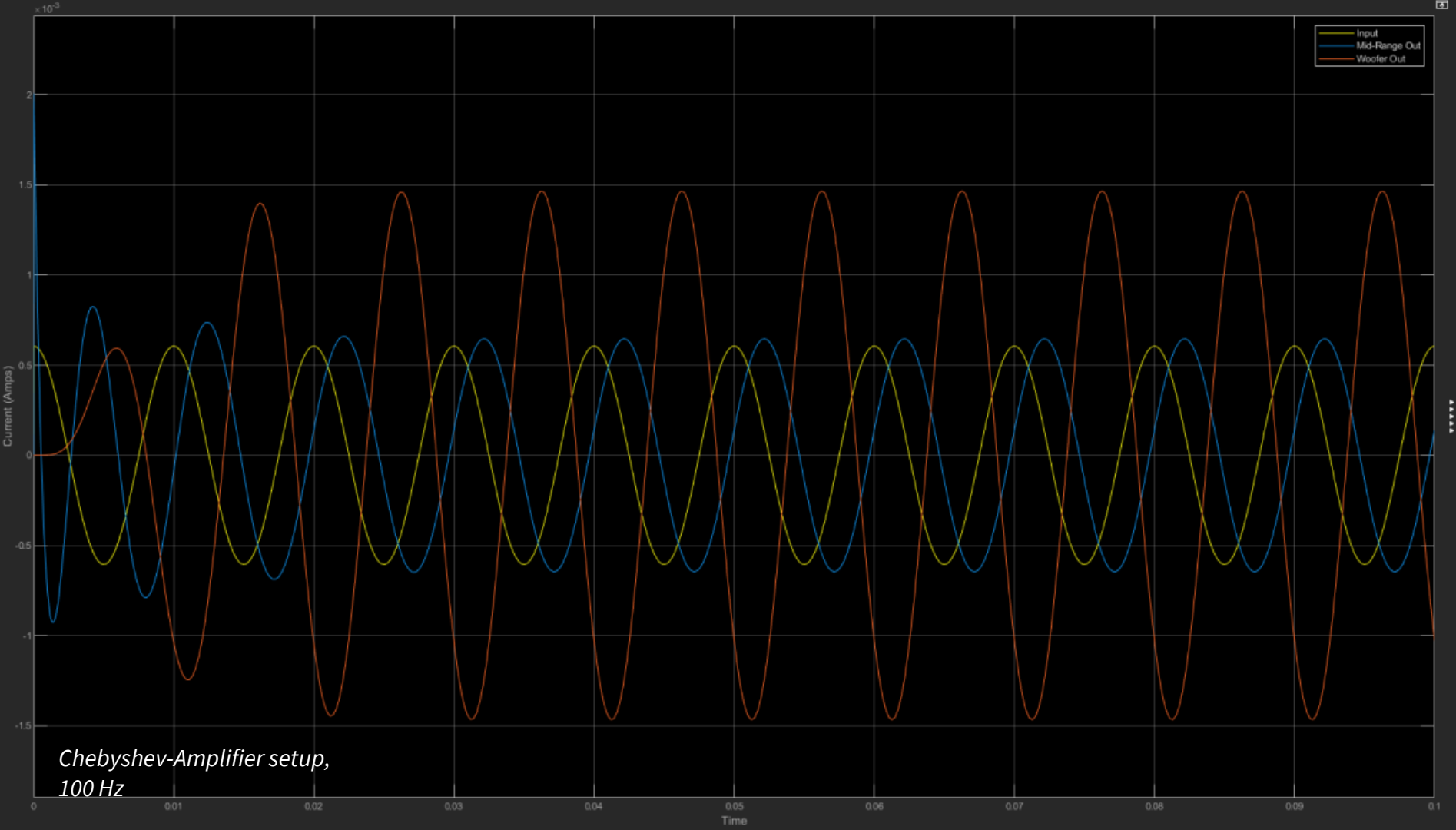


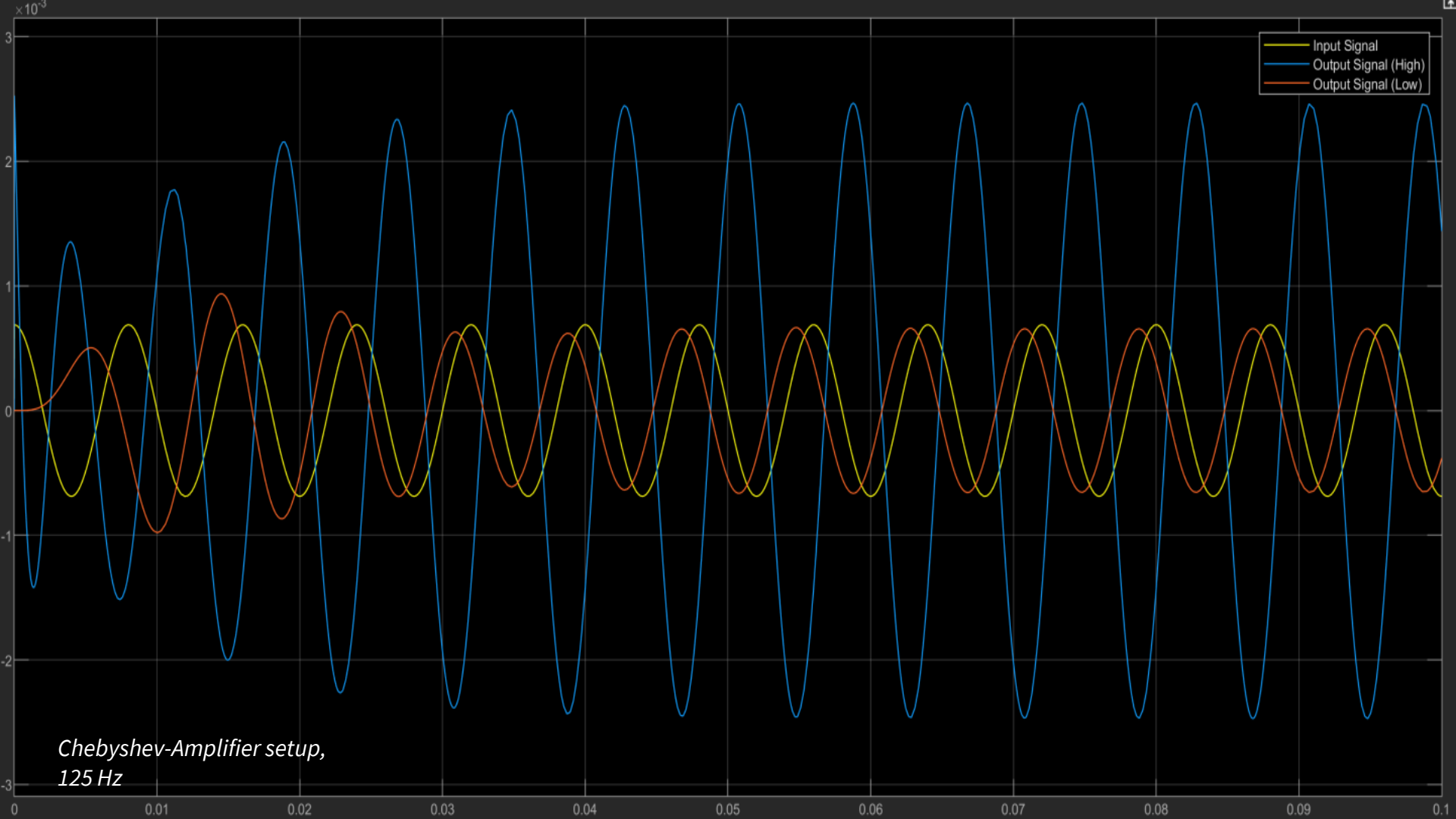
# Biassing Resistor Load Choices

R2	R1	Req	C (microFarads)
10	80.90909	181.8182	0.043767609
20	161.8182	363.6364	0.021883805
30	242.7273	545.4545	0.014589203
40	323.6364	727.2727	0.010941902
50	404.5455	909.0909	0.008753522
55	445	1000	0.007957747

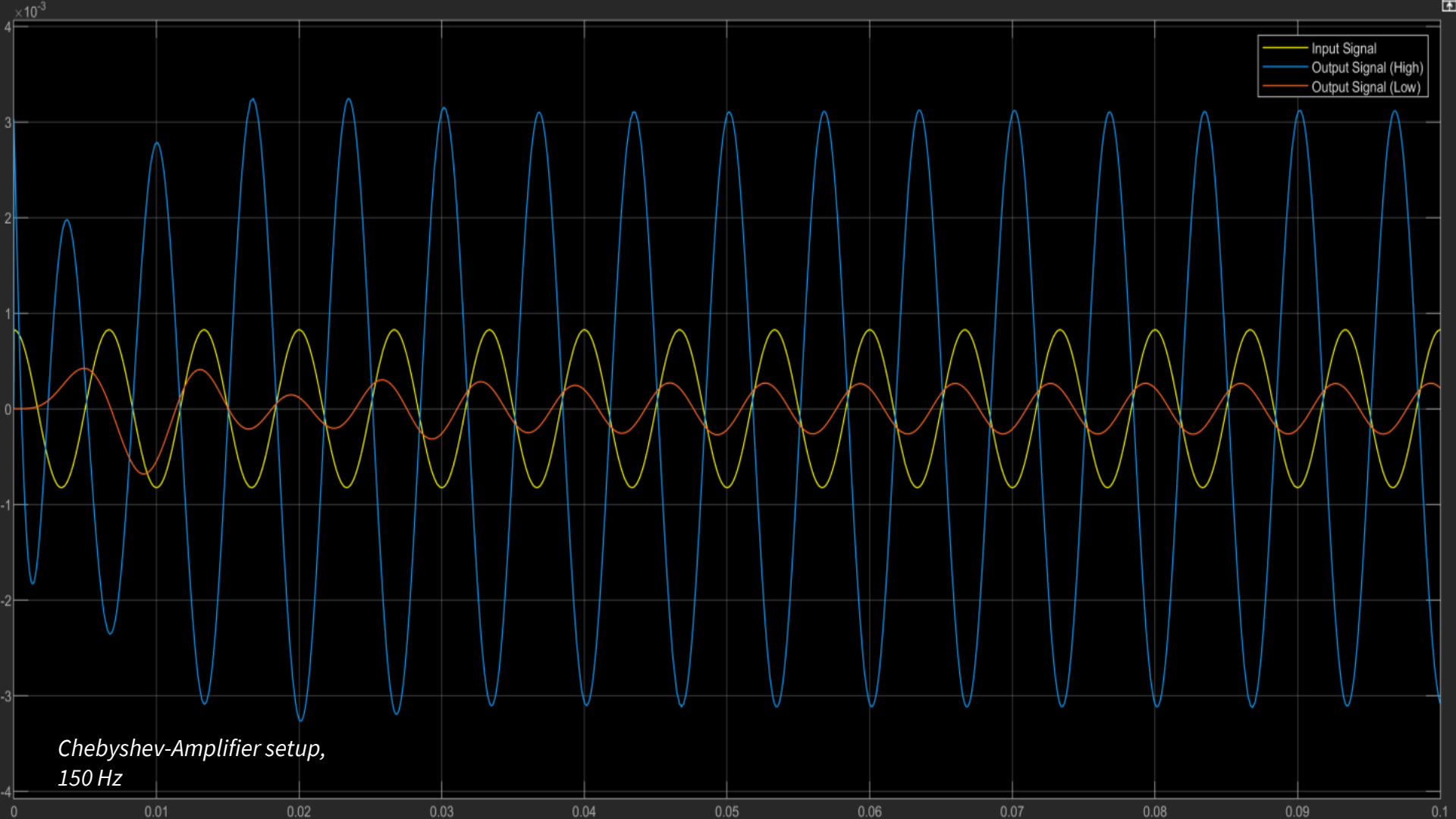
# Test Results

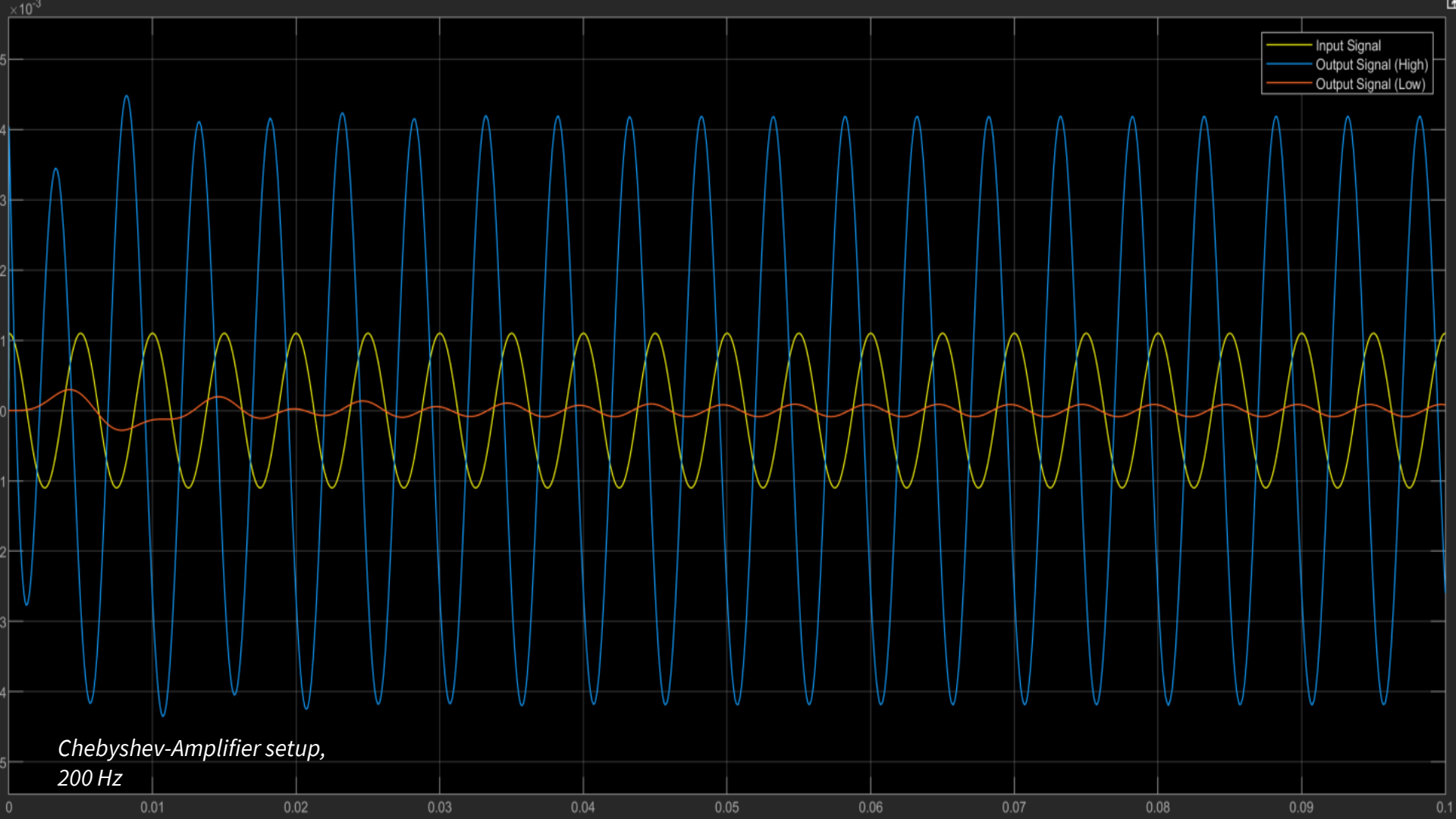












# Final Test Summary Data

## Butterworth-Amplifier

- High Pass Current Gain (200 Hz): 10.937 dB
- High Pass Attenuation (200 Hz): -11.626 dB
- Low Pass Current Gain (50 Hz): 10.74 dB
- Low Pass Attenuation (50 Hz): -30.543 dB

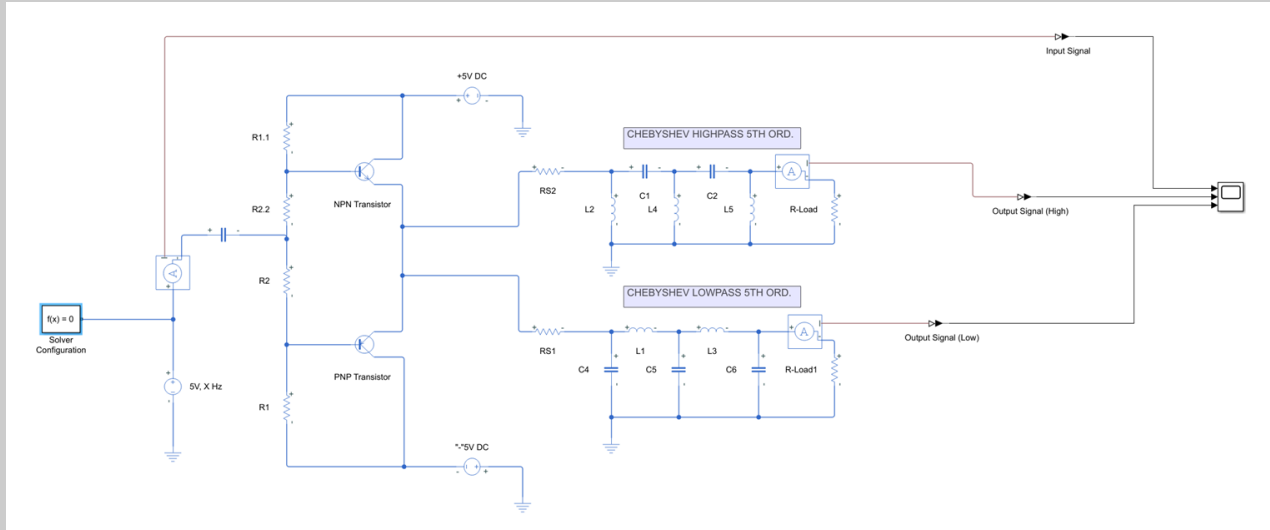
## Chebyshev-Amplifier

- High Pass Current Gain (200 Hz): 11.609 dB
- High Pass Attenuation (200 Hz): -22.237 dB
- Low Pass Current Gain (50 Hz): 12.640 dB
- Low Pass Attenuation (50 Hz): -29.293 dB

# Final Conclusion

As you can see, the Chebyshev system provides overall better Gain, and decent attenuation of unwanted frequencies when compared to the Butterworth.

Thus, the team sides with the Chebyshev crossover network.



**Questions?**  
**Comments?**