

Filter + Amp

Summary

- Components

$$R_{IN} = 100\Omega$$

$$C_F = 16mF$$

$$R_F = 42k\Omega$$

$$C_F = 150nF$$

BP : 0.1 - 25Hz

$$G = 420$$

- Actions

Verify whether I have the capacitors

Build and validate the circuit in real life

Detail

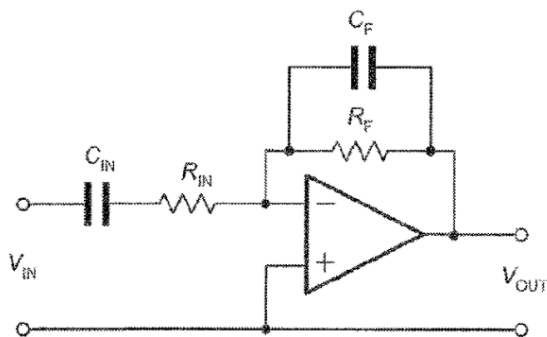


Figure 8.8 Adding capacitors to modify the frequency response of an inverting operational amplifier

(from perusal week 6 op amp)

Since only the frequency between 0.1 and 20Hz is related to eye movement, we will choose a bandpass between 0.1 to 25 Hz.

From ref[2], the typical signal is 50 to 3500 μV , and we want to amplify it to 0~1.5 V

So we need a gain of 428.6. If we choose $R_{IN} = 100\Omega$, $R_F = 42k\Omega$

Higher cutoff frequency :

$$R_F = 42k\Omega$$

$$F_H = \frac{1}{2\pi R_F C_F} = 25Hz$$

$$C_F = \frac{1}{2\pi R_F F_H} = 152nF$$

For simpler circuit, we choose

$$C_F = \frac{1}{2\pi R_F F_H} = 150nF$$

$$F_H = \frac{1}{2\pi R_F C_F} = 25.26Hz$$

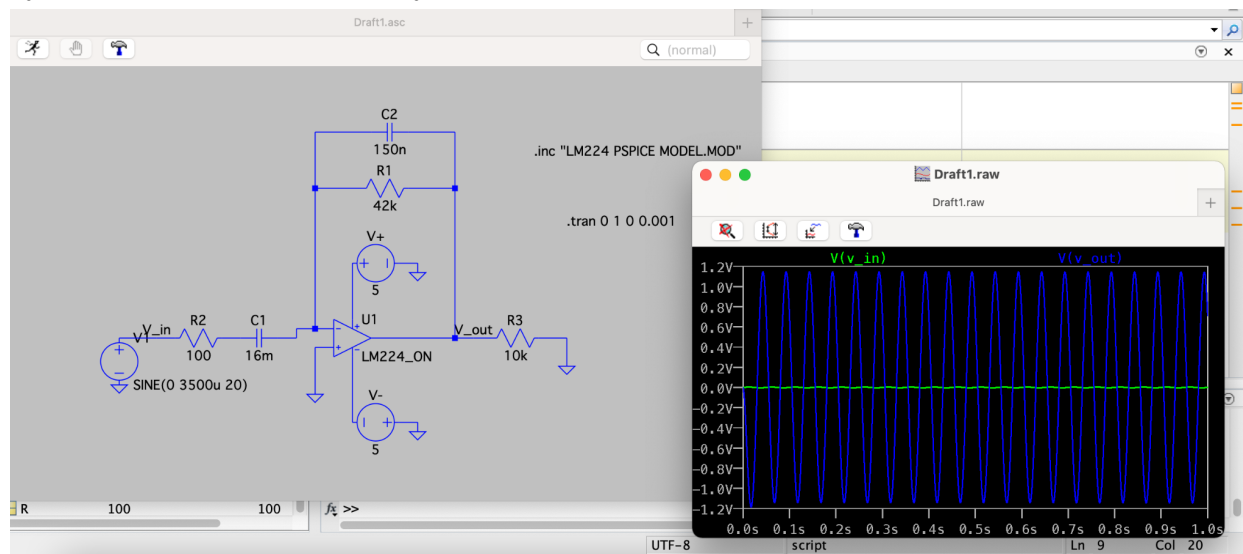
Lower cutoff frequency :

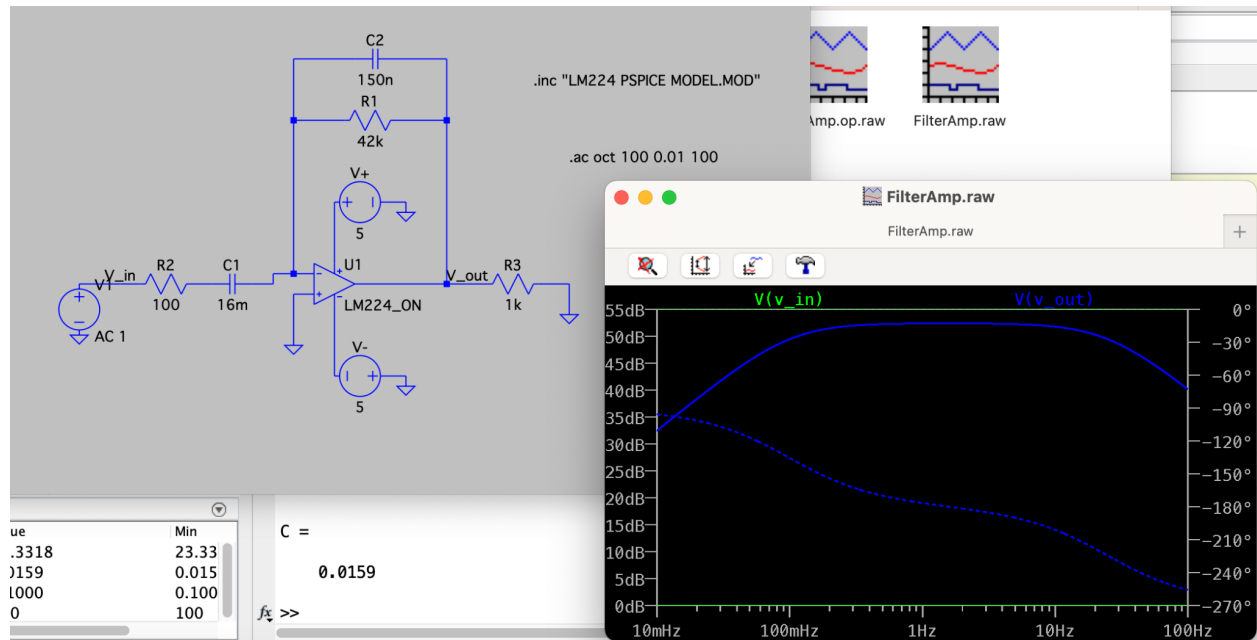
$$R_{IN} = 100\Omega$$

$$F_L = \frac{1}{2\pi R_{IN} C_{IN}} = 0.1Hz$$

$$C_F = \frac{1}{2\pi R_F F_H} = 16mF$$

By simulation, the result is pretty similar to what I expected





Ref

- [2] - Deng, L. Y., Hsu, C.-L., Lin, T.-C., Tuan, J.-S., Chang, S.-M. (2010). EOG-based Human–Computer Interface system development. *Expert Systems with Applications*, 37(4), 3337–3343. doi:10.1016/j.eswa.2009.10.017