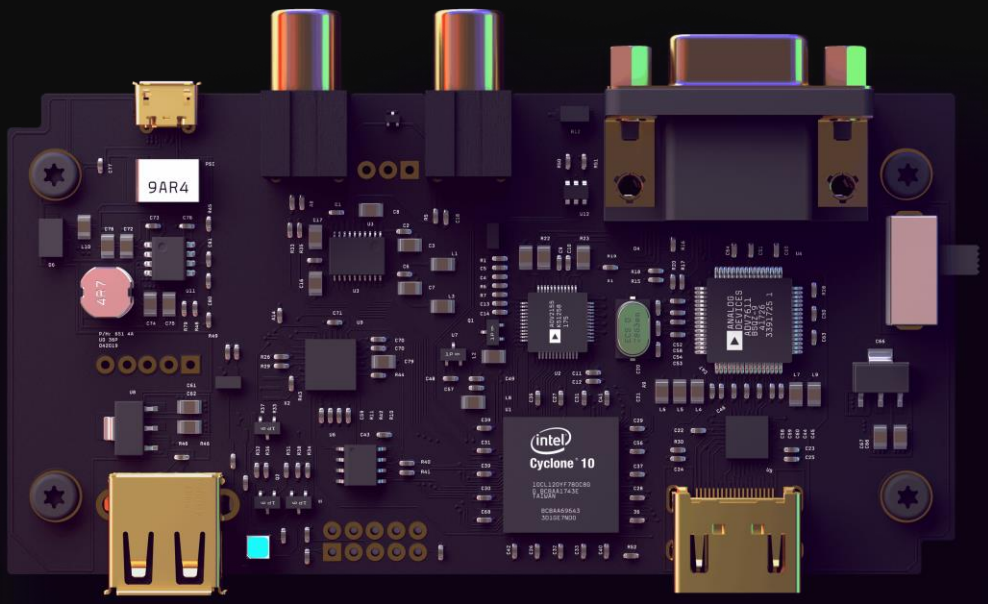
EC205

Analog Electronics Lab

Lab – 8



Utkarsh R Mahajan 201EC164

Sannan Ali 201EC159

Experiment 8: All-pass filter (Phase shifter)

Aim: To design μ based All-pass filter (phase Shifter)

Circuit Diagram:

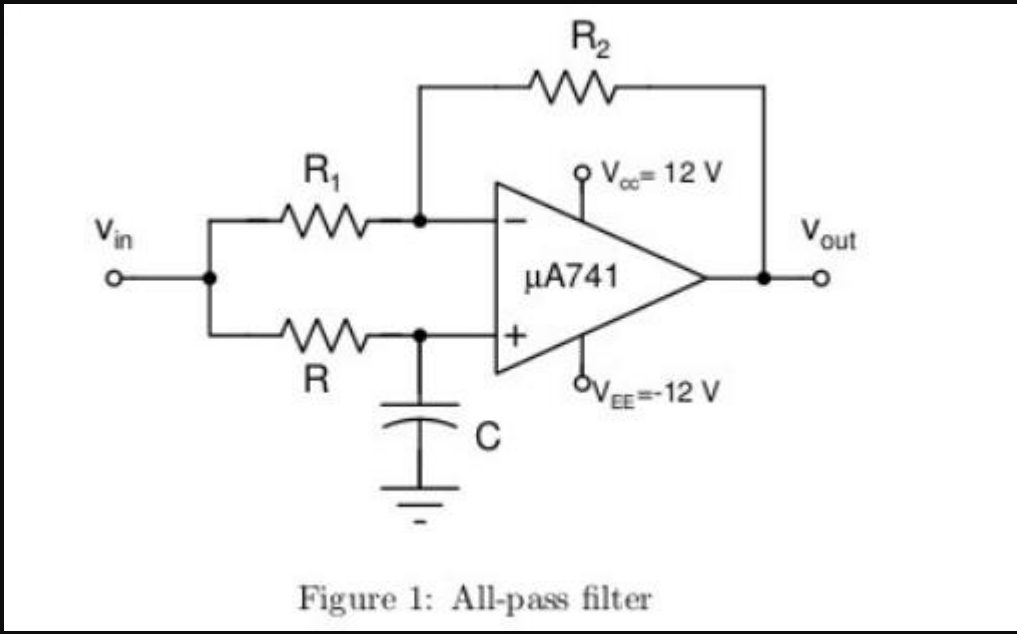


Figure 1: All-pass filter

1.The circuit shown is an All-pass filter. This is also called as Phase Lag circuit.

2.Choose the component values such that for an input $V_{in}(t)=2\sin(4000\pi t)$, the output is $V_{out}(t)=2\sin(4000\pi t-\frac{\pi}{3})$.

We know that the Transfer function for the circuit is,

$H(jw) = \frac{1-j\omega rc}{1+j\omega rc}$,

considering R1 = R2 =10kΩ. We get a magnitude gain of 1.

$|H| = 1$ & $-180° < \Phi < 0°$

Given, $\angle H = -2\tan^{-1}(\omega RC) = -60°$

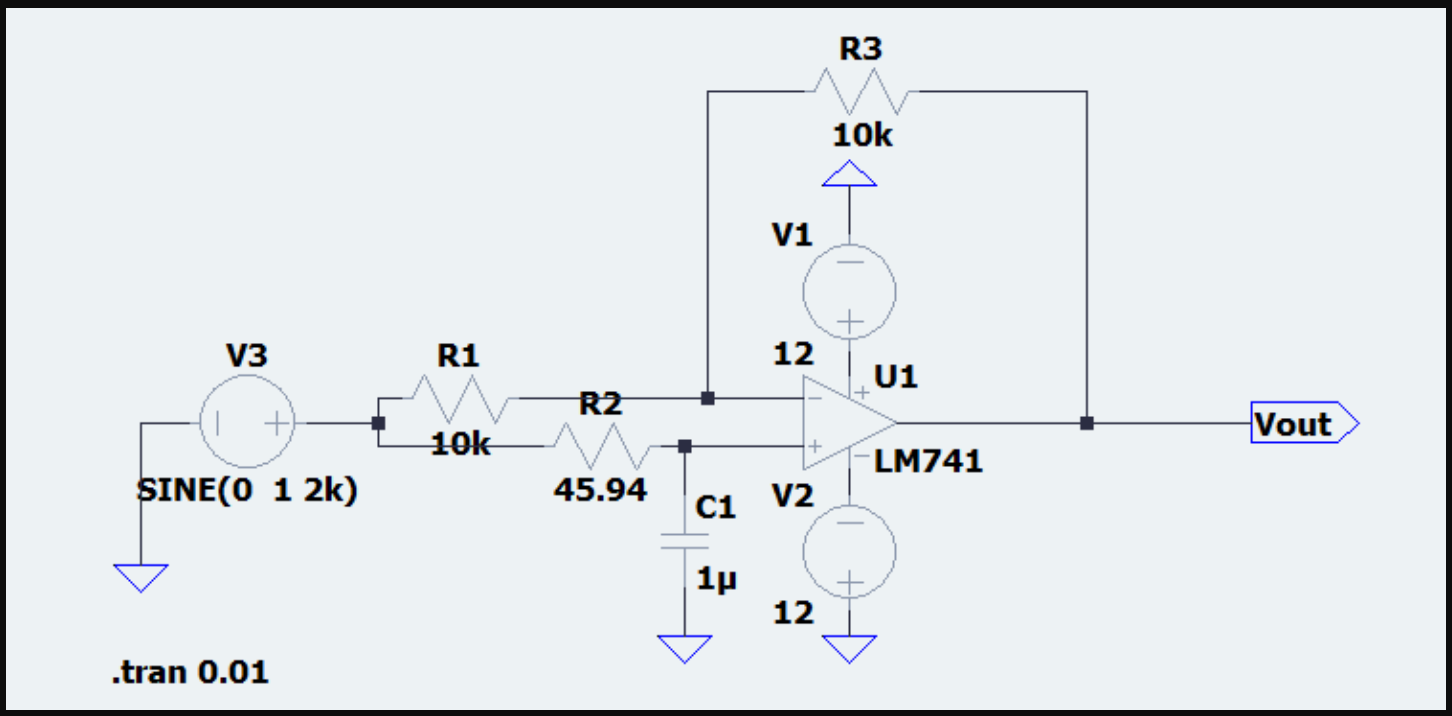
From the V equations we know that f=2k Hz ,

Assuming, C=1μF and using it in the above equation, we get.

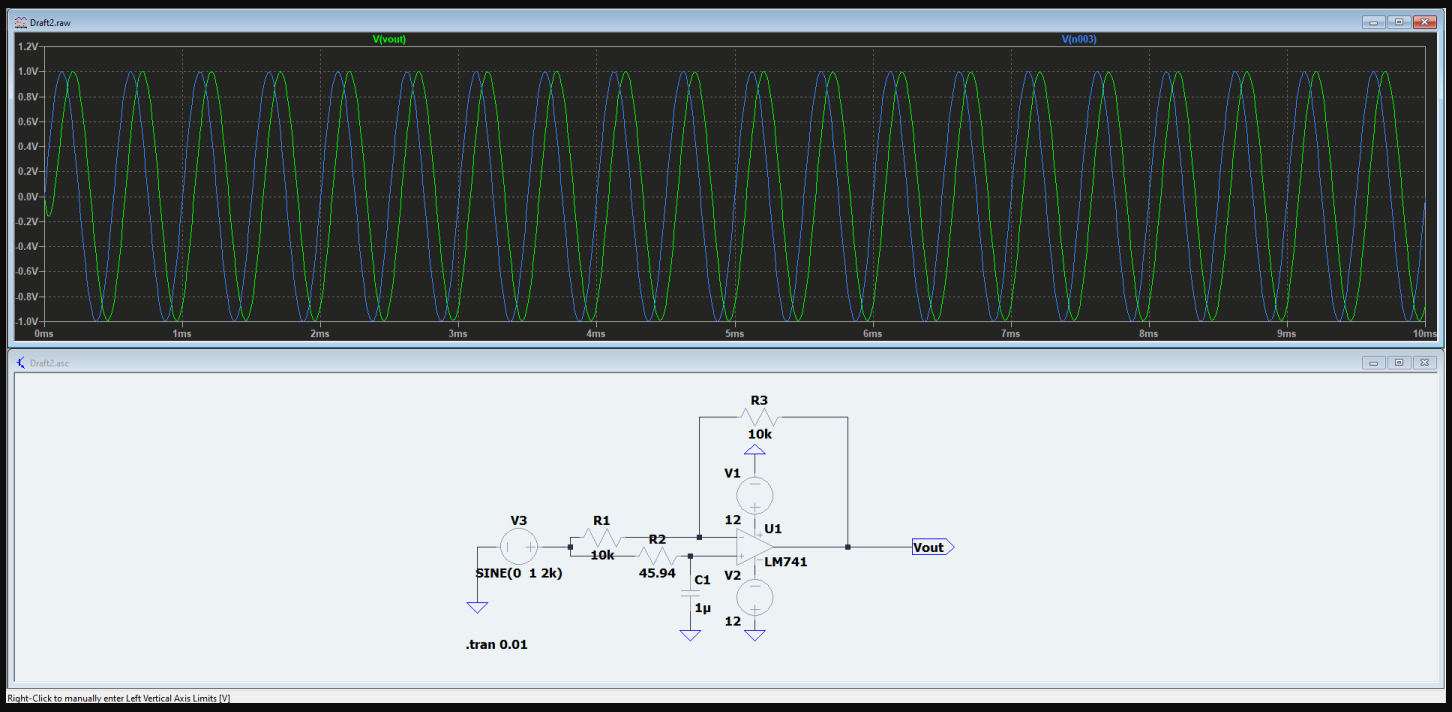
R=45.94KΩ

3. Simulate the circuit and verify.

Circuit in LTspice:

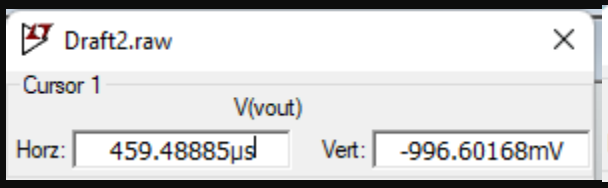


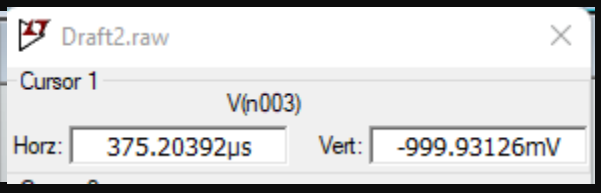
Simulation in LTspice:



Wave:

Observations:





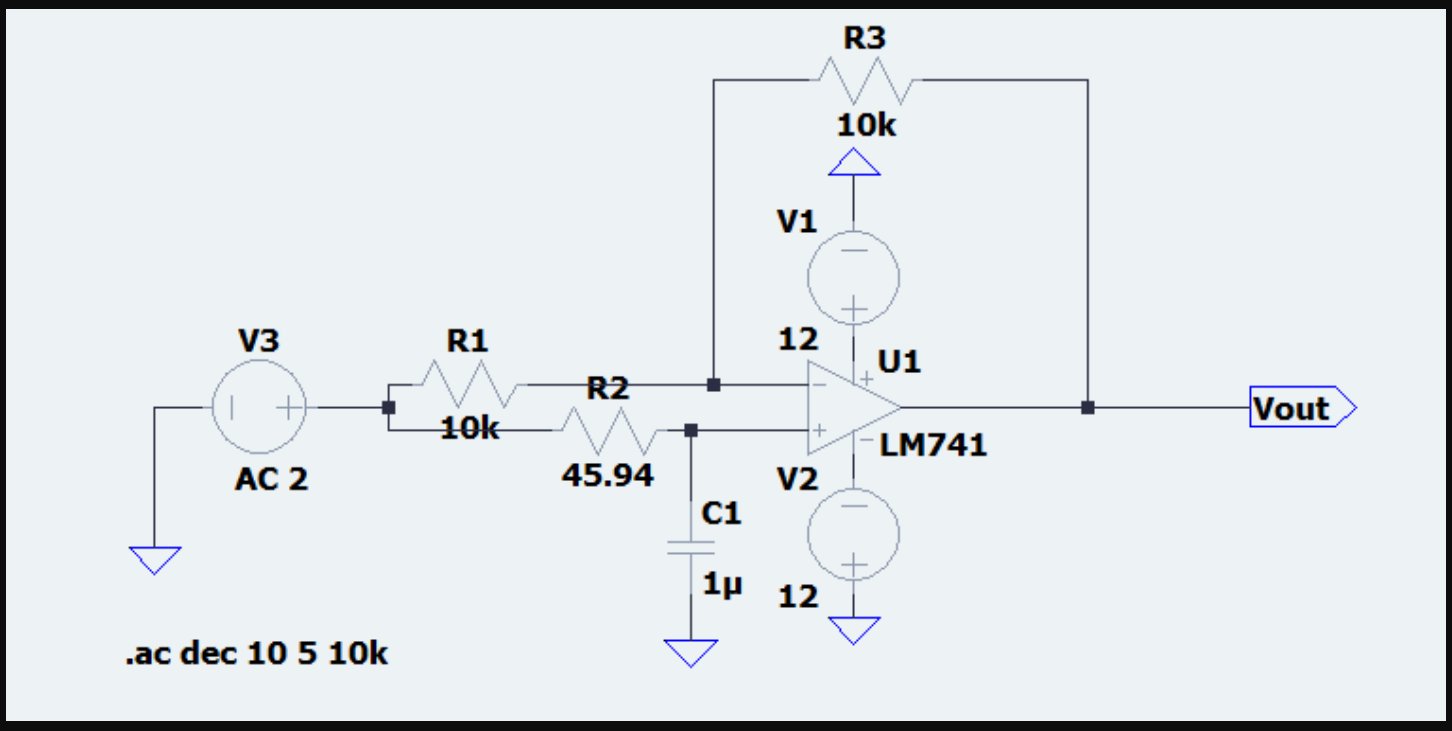
Verification

Phase=$\Delta t*f*360° = 2\pi*2*10^{-3}*(375.20392-459.48885) = -0.33713972 = -\frac{\pi}{3}$

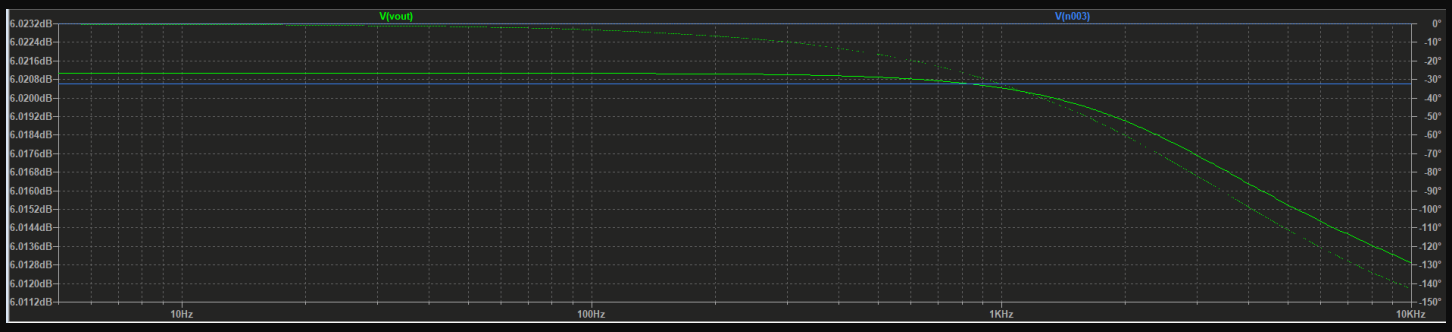
We can see that the results match our expected outputs.

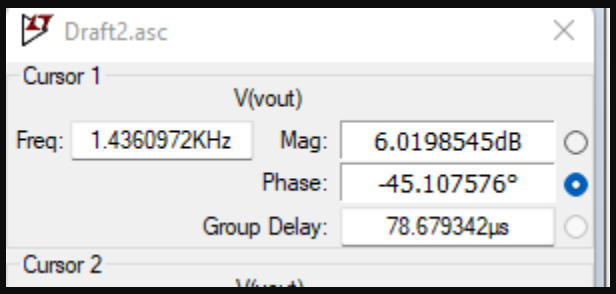
4. Also obtain the frequency response of the filter.

Circuit in LTspice:



Observations:

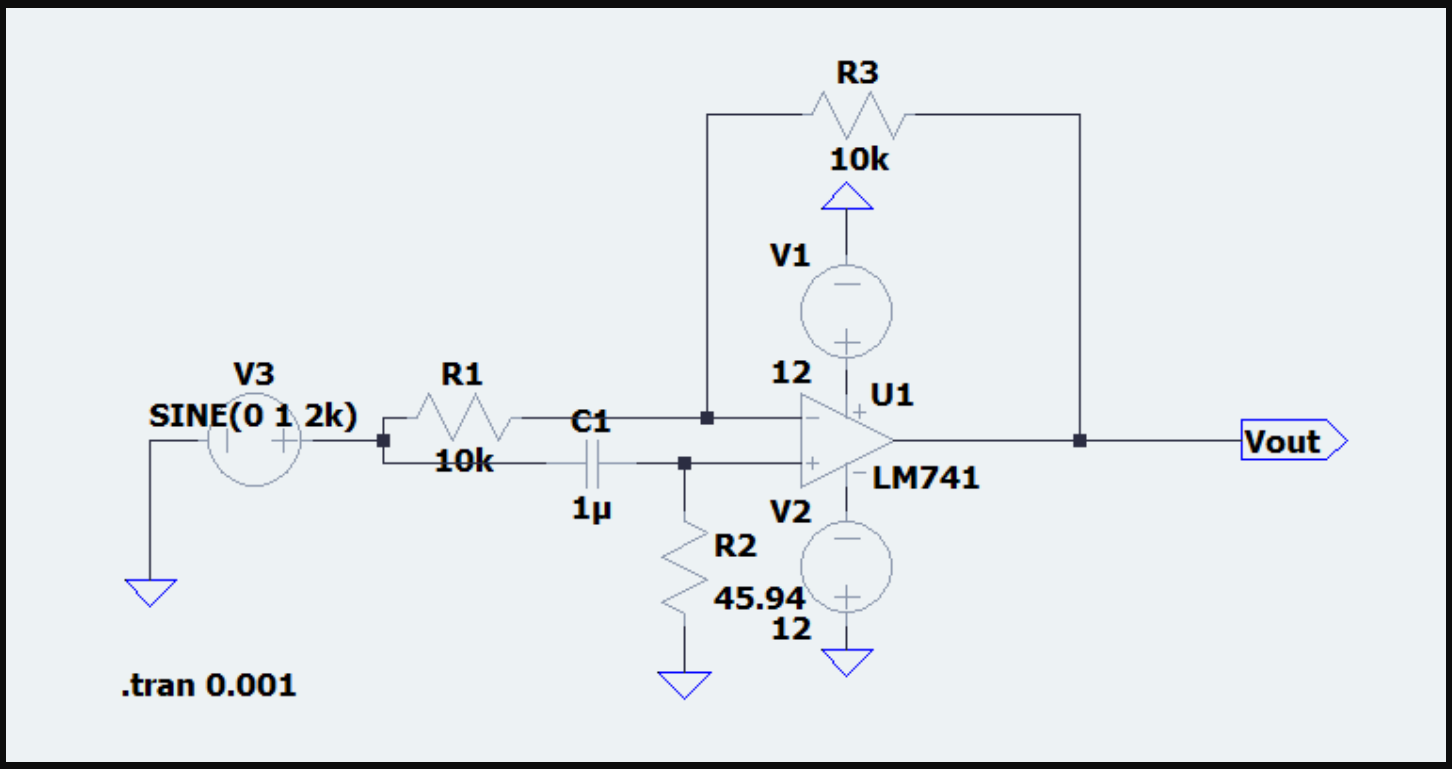




5.Modify the circuit to behave as an All-pass filter that introduces a leading phase. Verify its salient features.

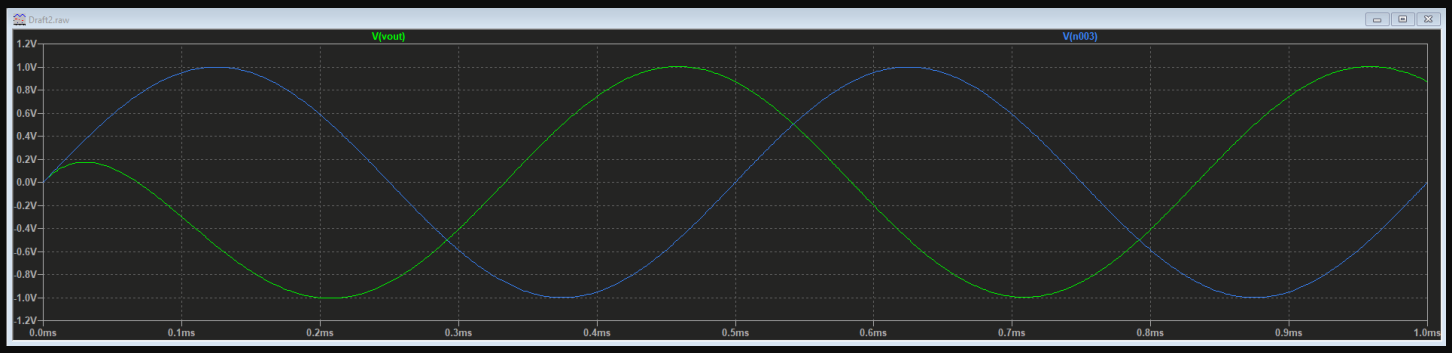
It can be simply done by switching the resistor R with Capacitor C.

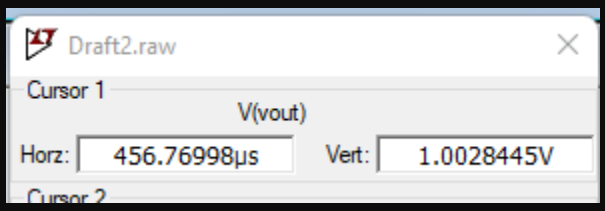
Circuit in LTspice:



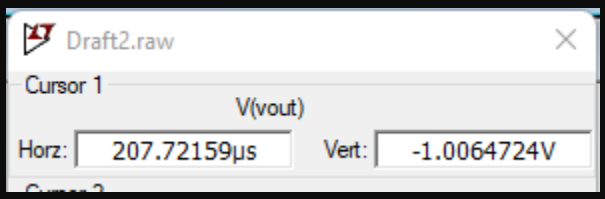
Observations:

Wave:



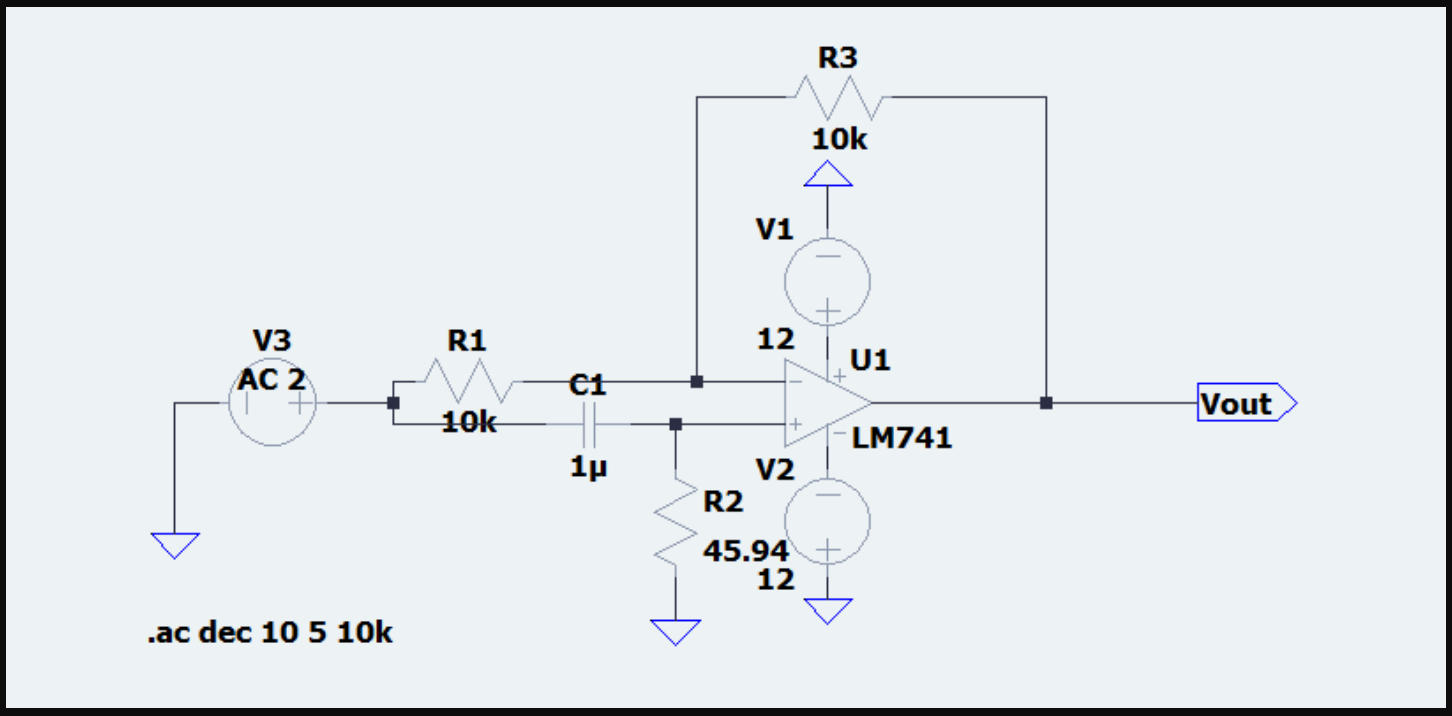


Verification:



Frequency Response:

Circuit in LTspice:



Observation: