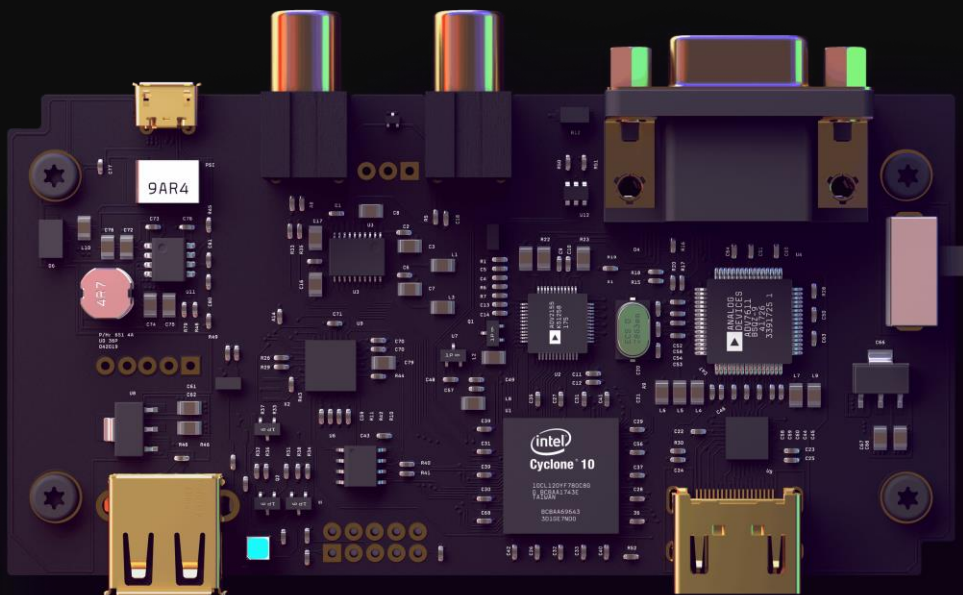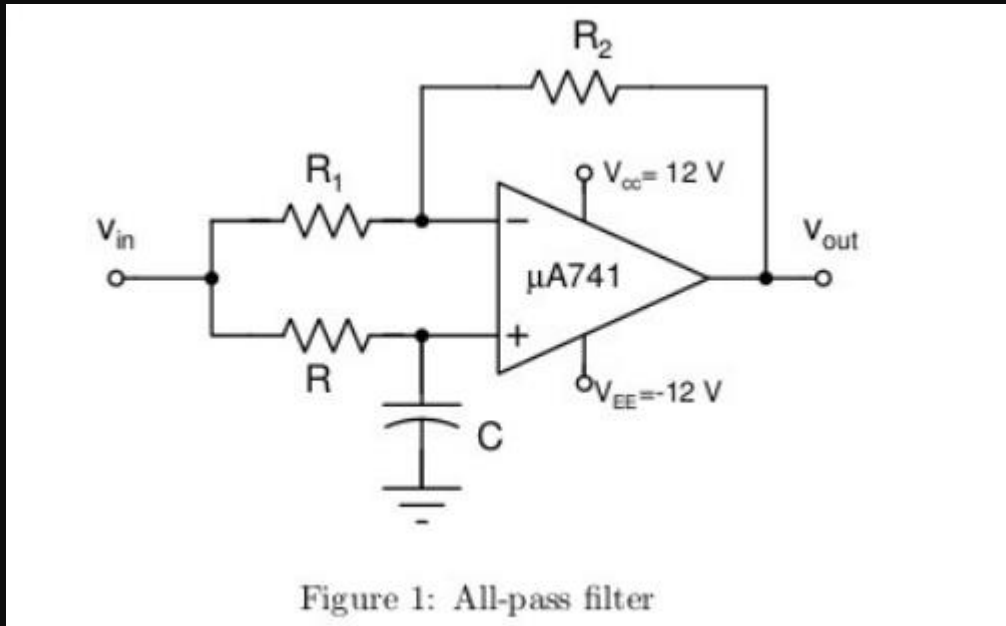# EC205
Analog Electronics Lab
Lab – 8

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°< Φ<0°

Given, $\angle H$ = -2tan$^{-1}(\omega RC)$ = -60°
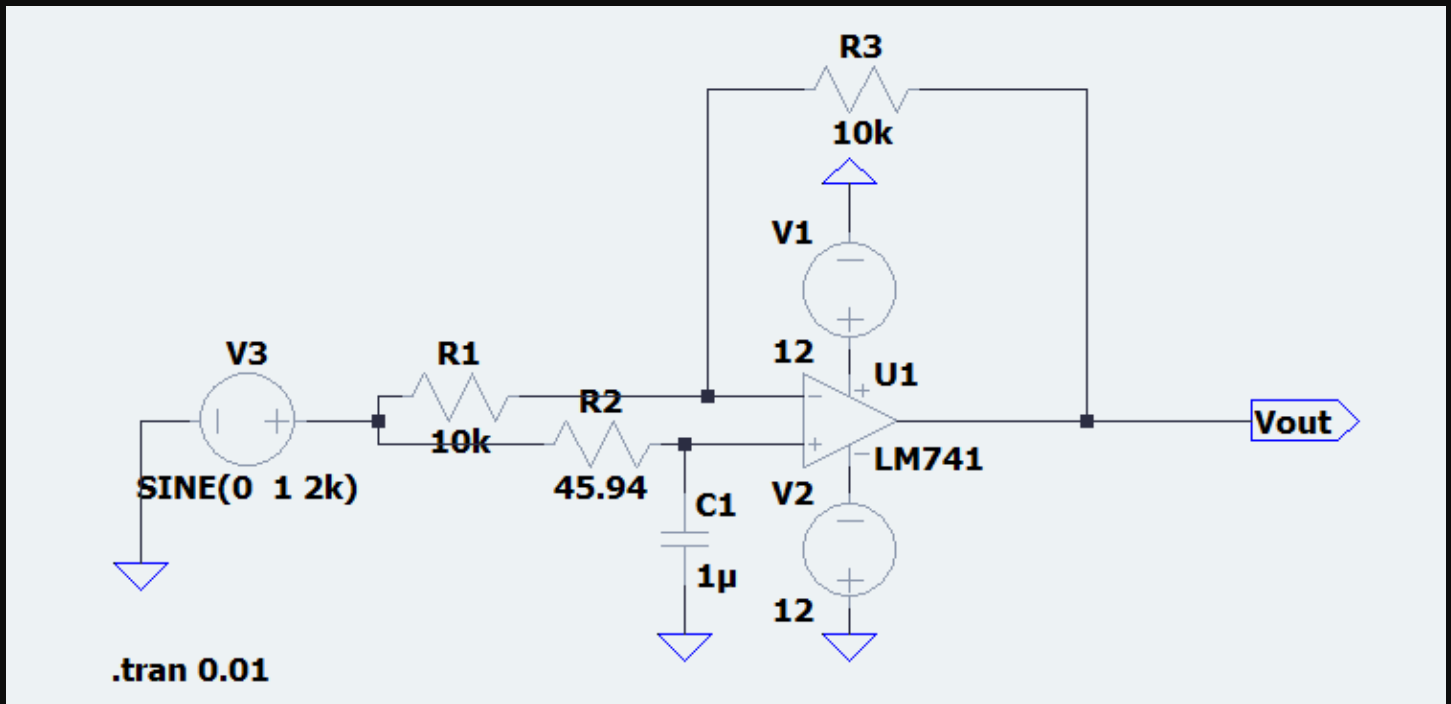
From the V equations we know that f=2k Hz ,

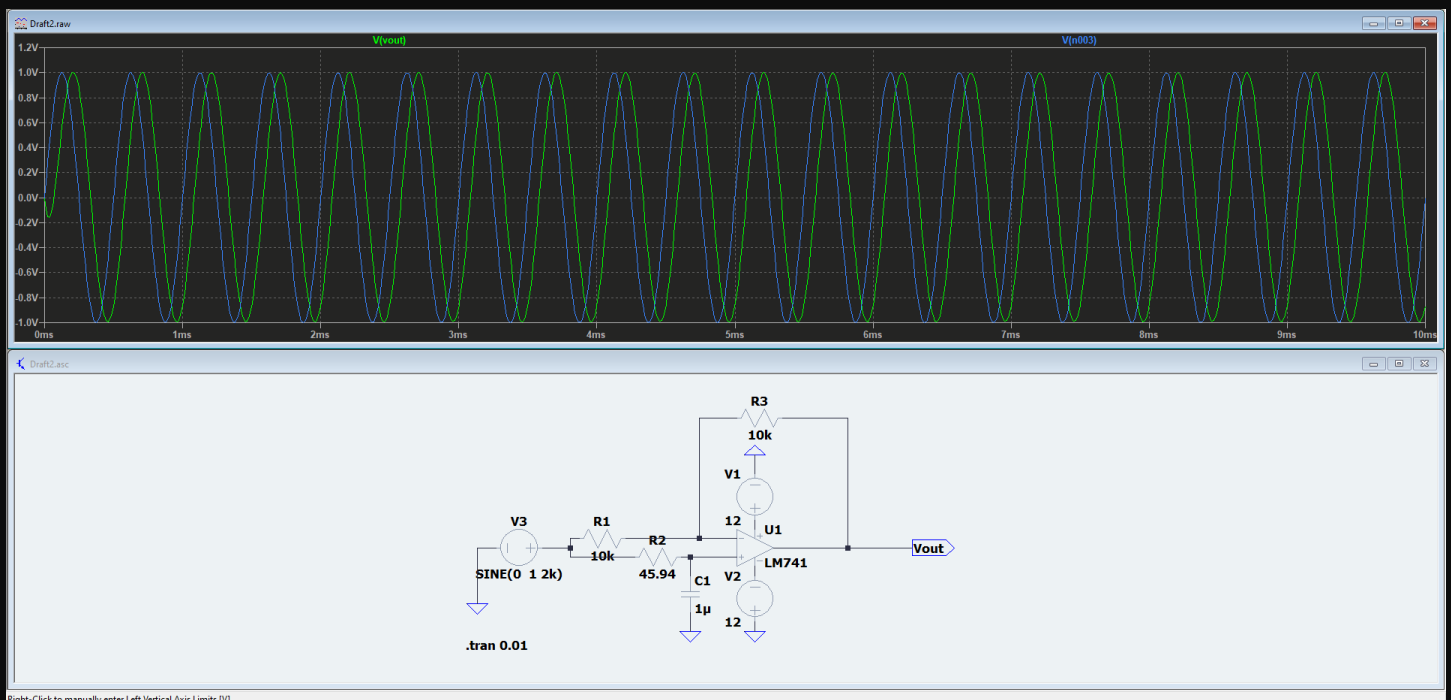Assuming, C=1μF and using it in the above equation, we get.

R=45.94Ω

3. Simulate the circuit and verify.

Circuit in LTspice:

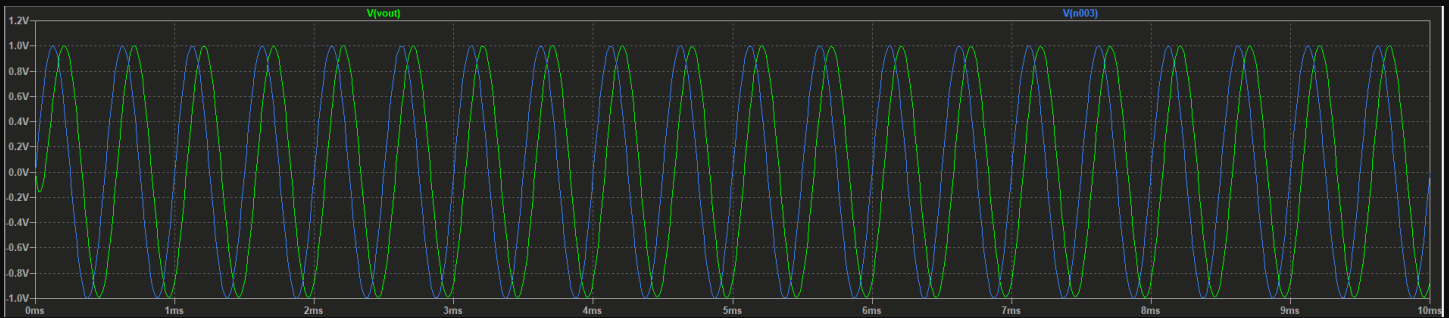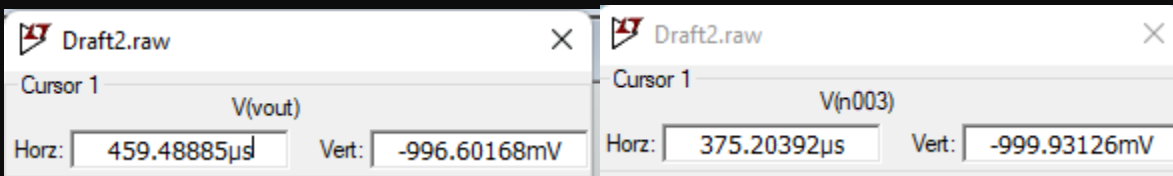
Simulation in LTspice:

Wave:

Observations:

Verification

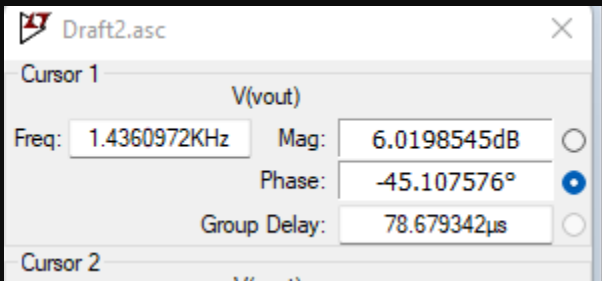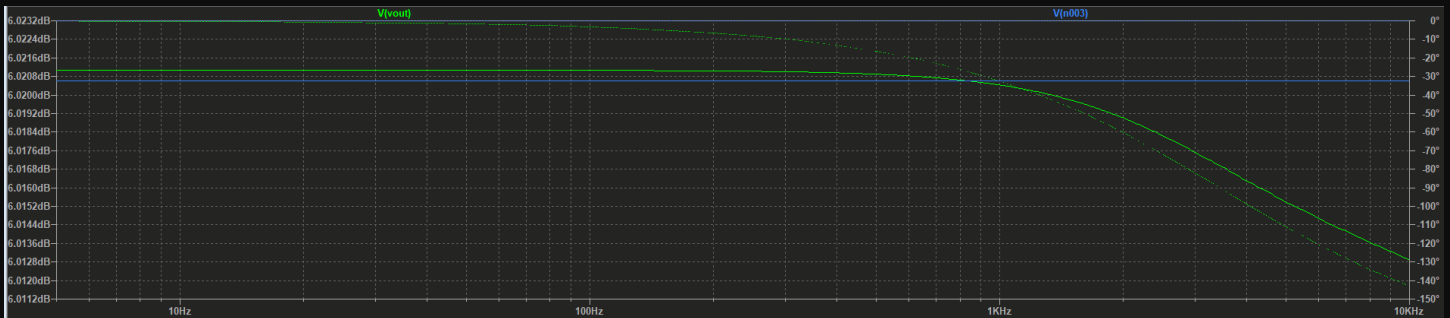Phase=Δt*f*360° =2π*2*10⁻³*(375.20392-459.48885) =-0.33713972 =-$\frac{\pi}{3}$

We can see that the results match our expected outputs.

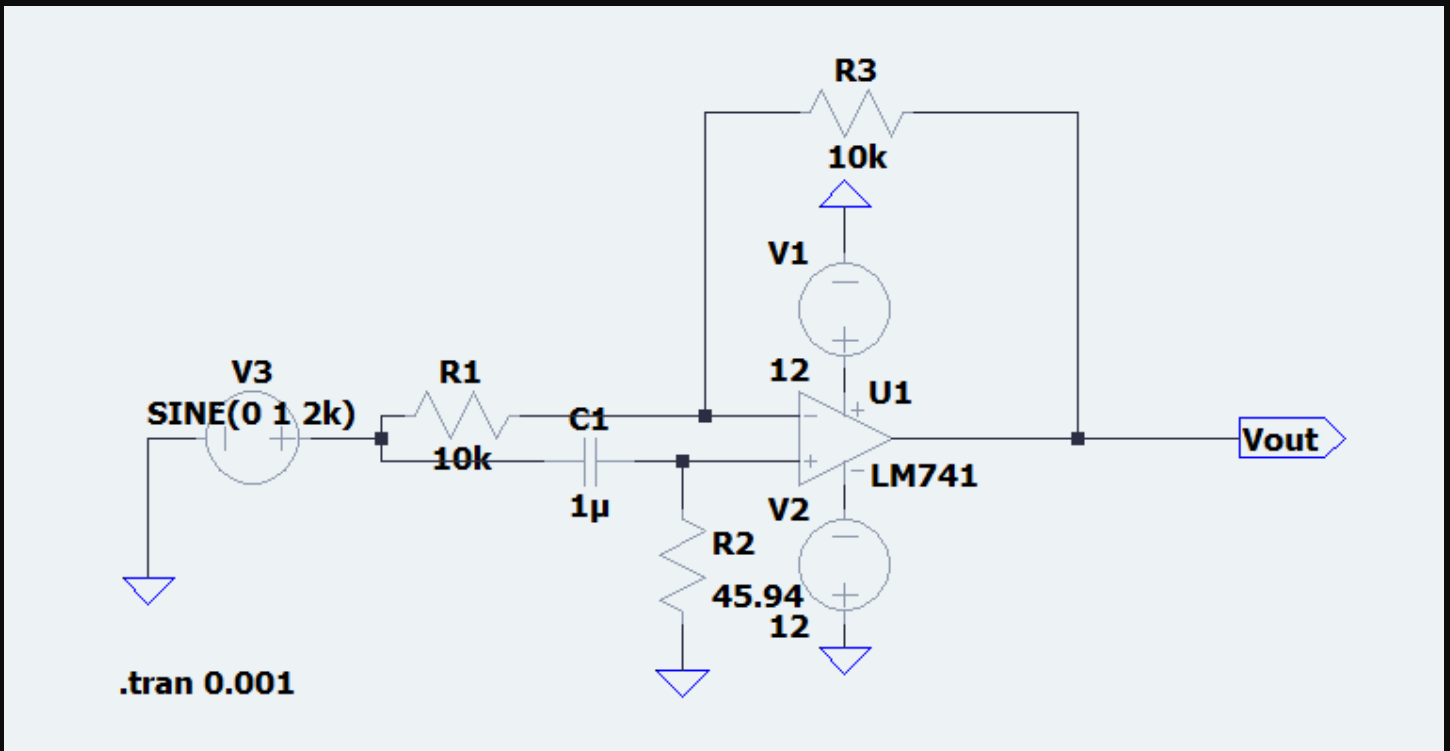## 4. Also obtain the frequency response of the filter.

Circuit in LTspice:
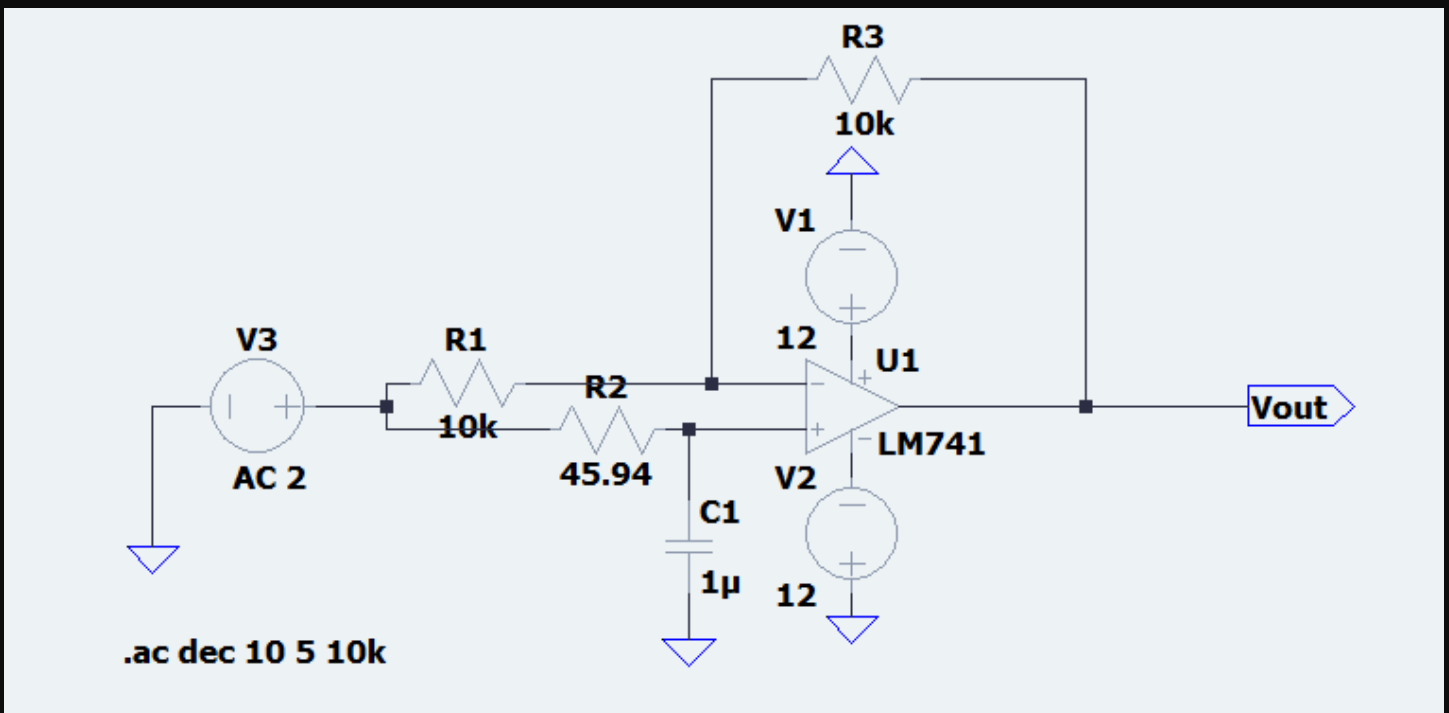
Observations:

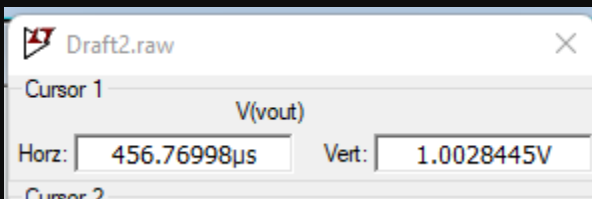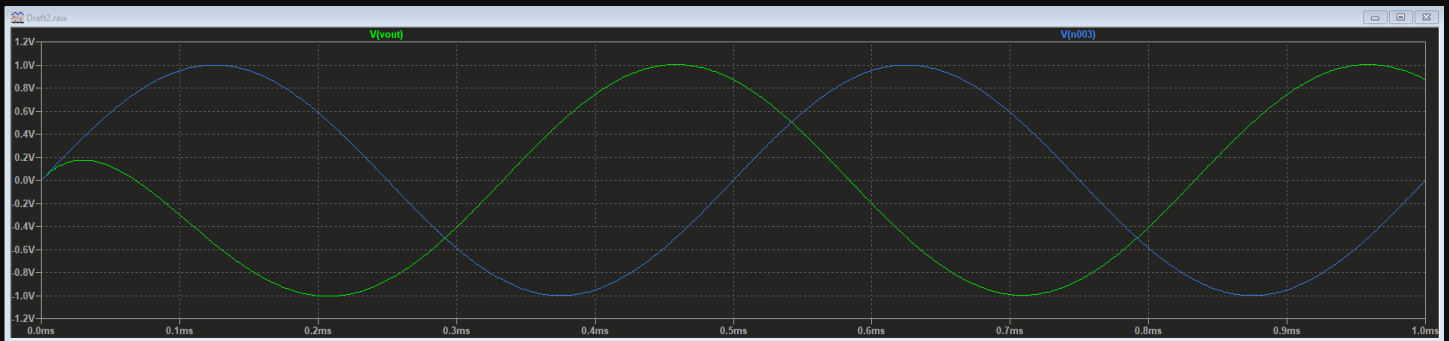5.Modify the circuit to behave as an All-pass filter that introduces a leading phase. Verify its salient features.

It can be simply done by switching the resistor R with Capacitor C.
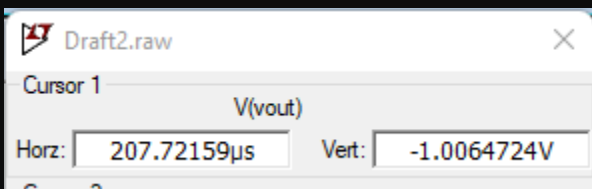
Circuit in LTspice:

Observations:

Wave:

Verification:

Frequency Response:

Circuit in LTspice:

Observation:

Draft2.asc

Cursor 1

V(vout)

Freq: 8.2256279KHz   Mag: 6.0266786dB   ○

Phase: 45.042686°   ●

Group Delay: 14.616169µs   ○

Cursor 2