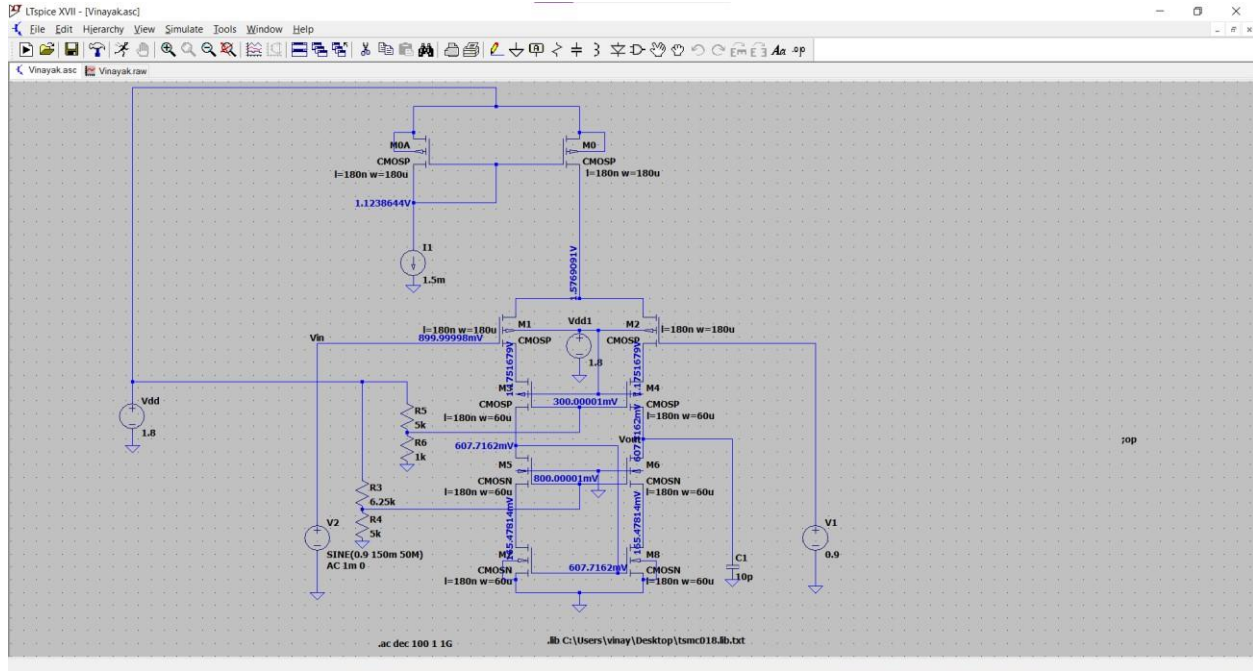
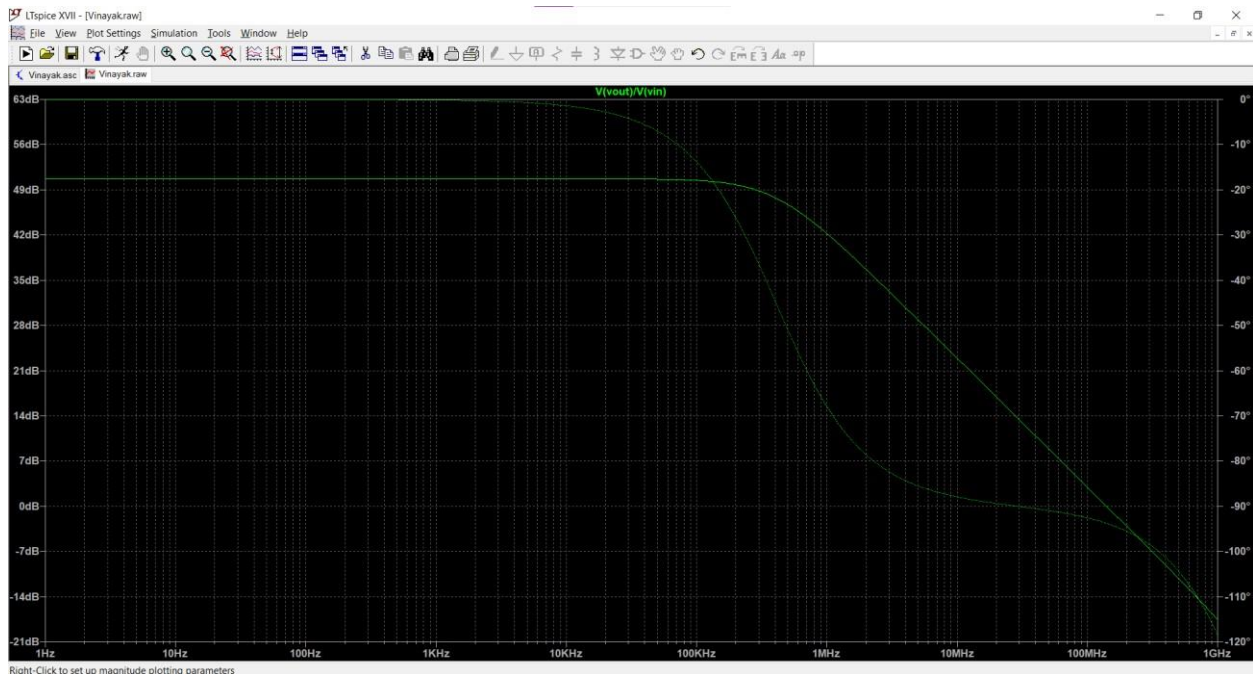


Gm Calculations:

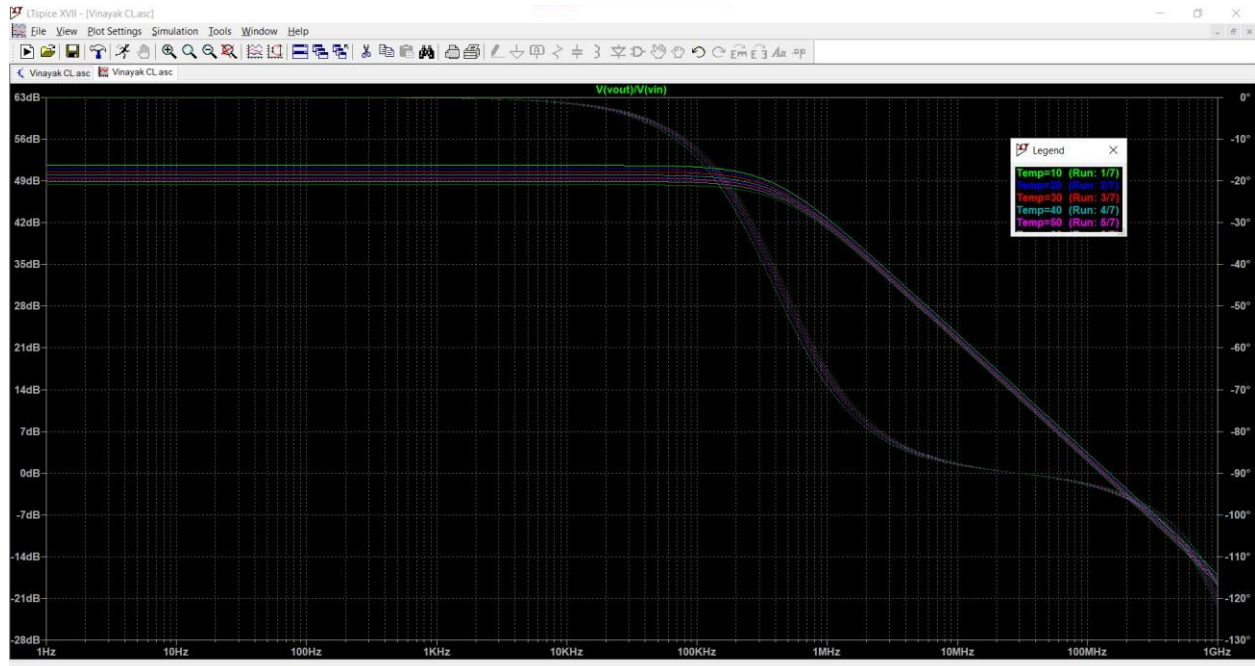
1. Open loop schematic diagram:



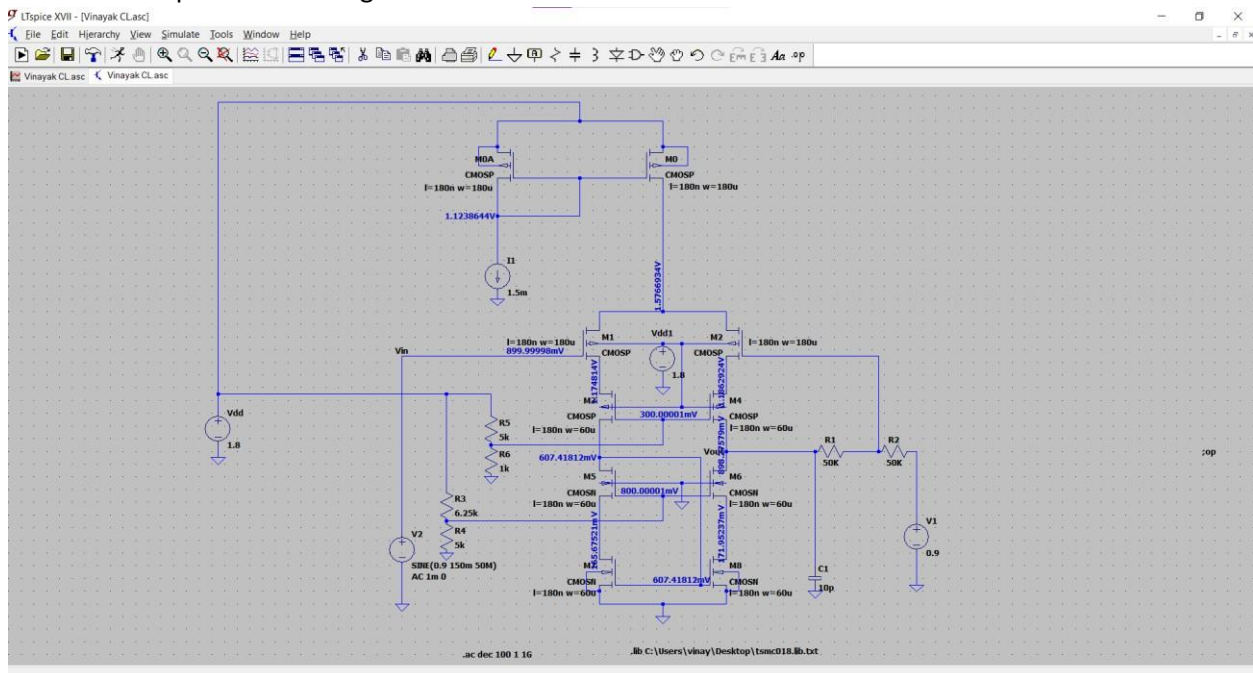
2. Open Loop Bode plot:



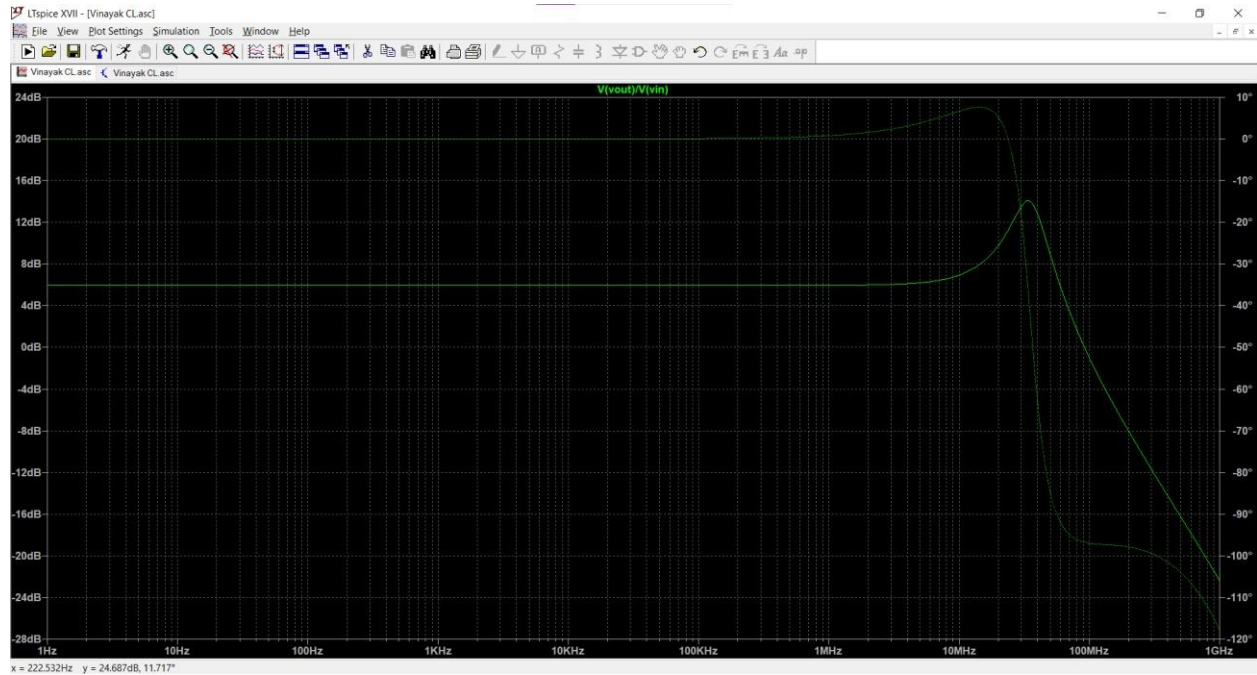
3. Open Loop Bode Plot Variation for temperature sweep of 0°C to 70°C:



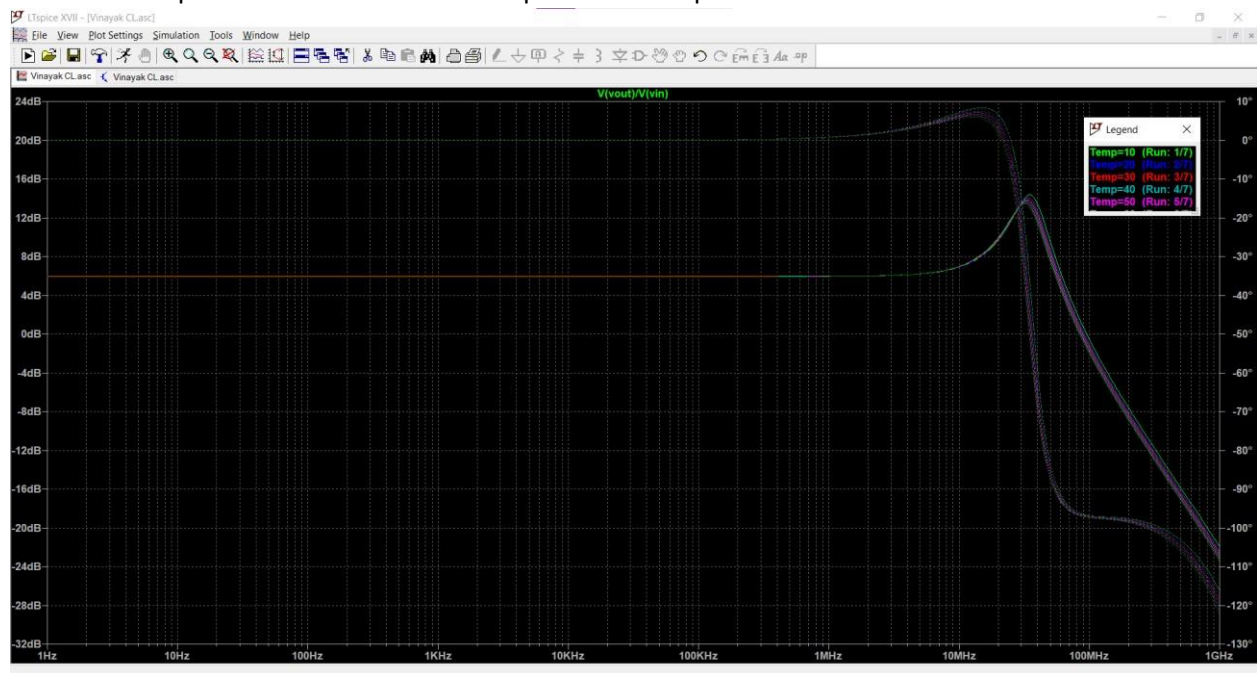
4. Closed Loop schematic diagram:



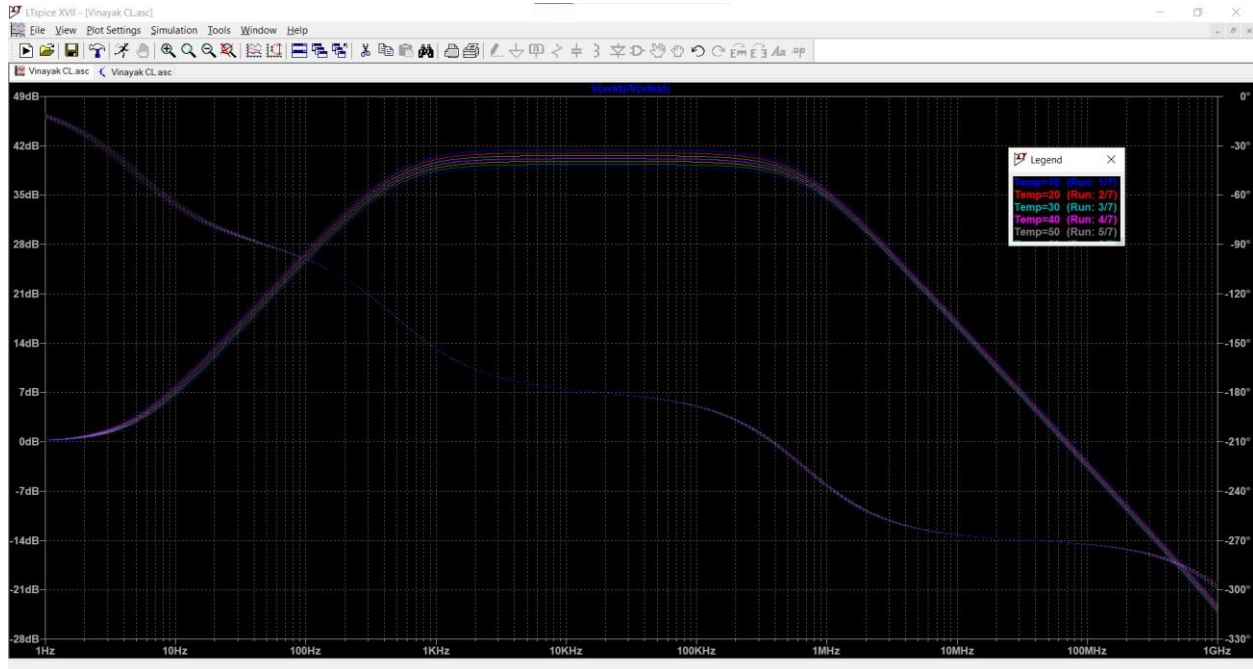
5. Closed Loop Bode Plot:



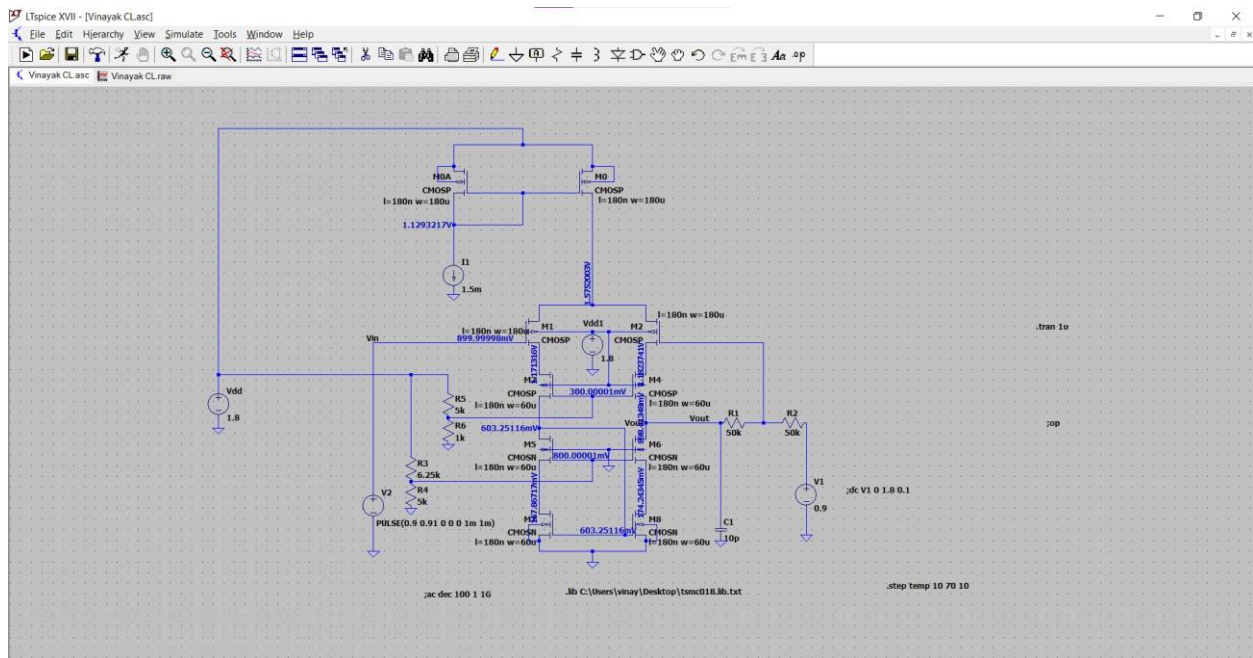
6. Closed Loop Bode Plot Variation for temperature sweep of 0°C to 70°C:



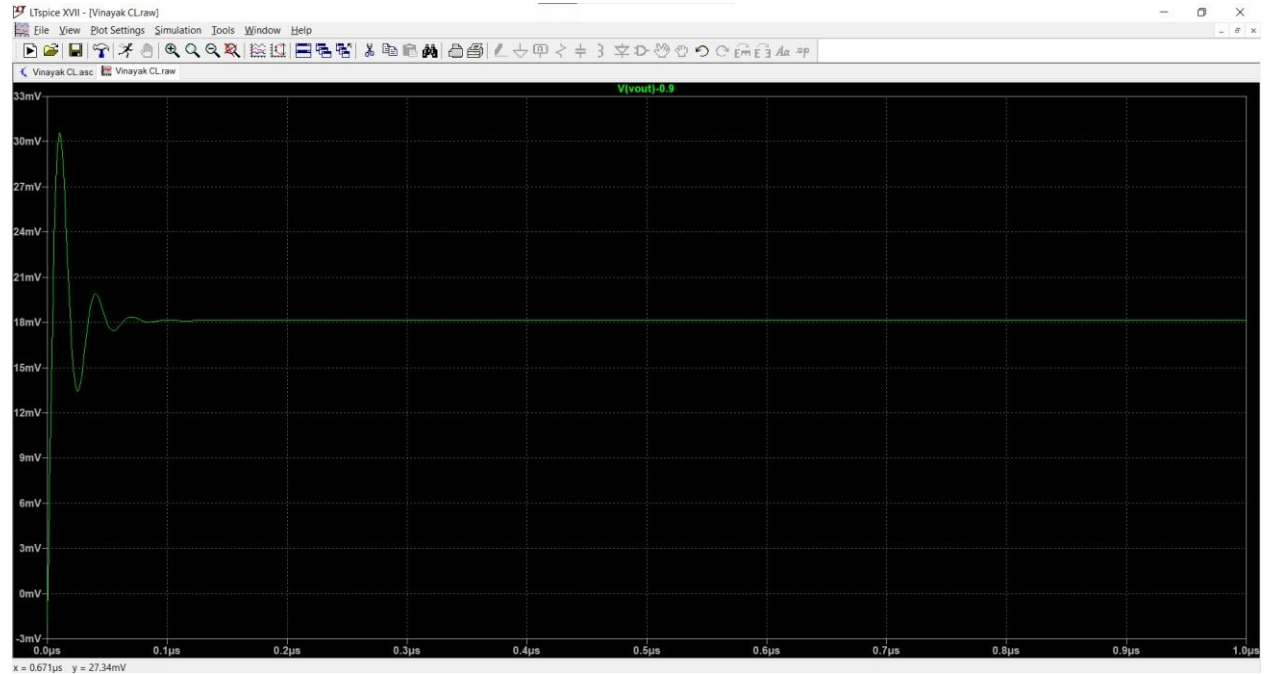
7. Loop Gain schematic diagram:



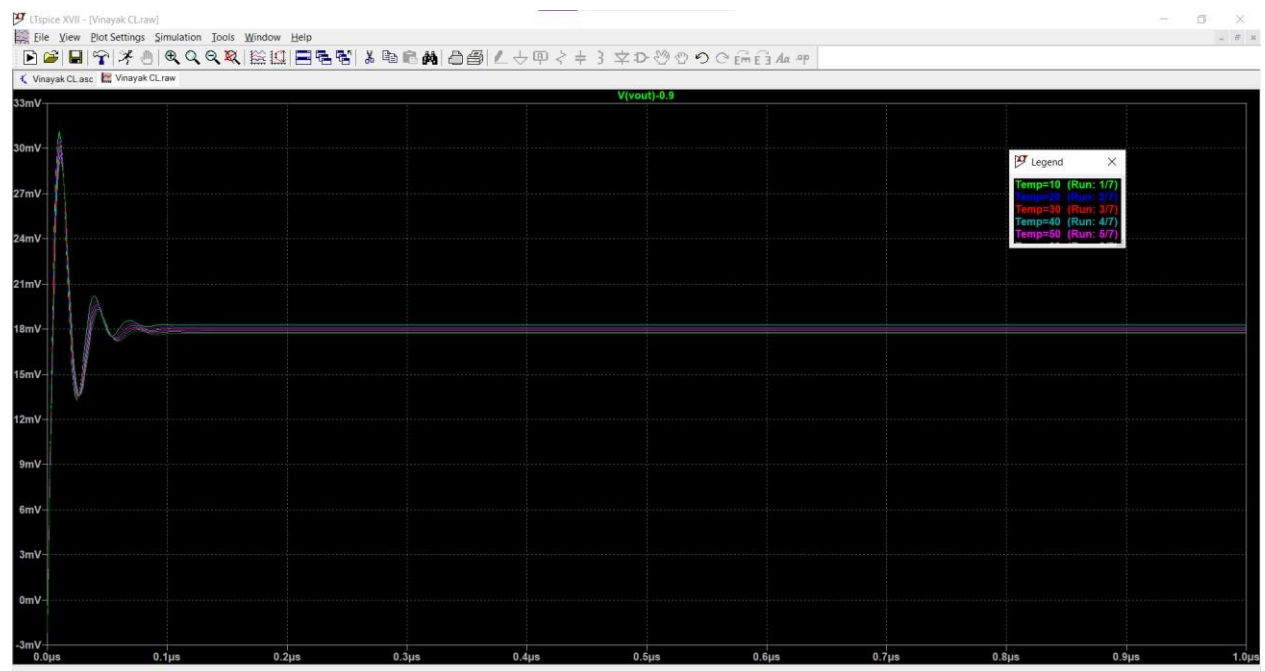
10. Schematic for Transient analysis for step input of 0.01V:



11. Transient response for step input of 0.01V:



12. Transient analysis for step input of 0.01V for temperature sweep of 0°C to 70°C:



Steady State Error Calculation:

Steady state error calculation →

$$\frac{V_o}{V_i} = \frac{1}{H} \left(\frac{G_H}{1+G_H} \right)$$

$$H = \frac{1}{2}$$

$$\therefore \frac{V_o}{V_i} = (2) \left(\frac{g_m R}{1+g_m R} \right) = 2 \times \left(\frac{6.28 \text{ m} \times 50 \text{ k}}{1+6.28 \text{ m} \times 50 \text{ k}} \right)$$

$$V_o = 2 \times \frac{6.28 \times 50}{1+6.28 \times 50} \times 0.01 = 19.93 \text{ mV}$$

$$N_{o \text{ Total}} = V_o + N_o = 0.9 + 19.93 \text{ mV} = 0.9193 \text{ V}$$

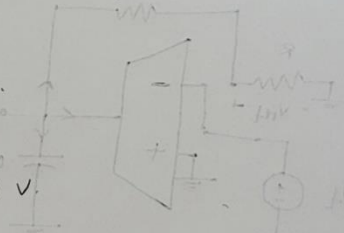
Error →

From Transient response for step inputs

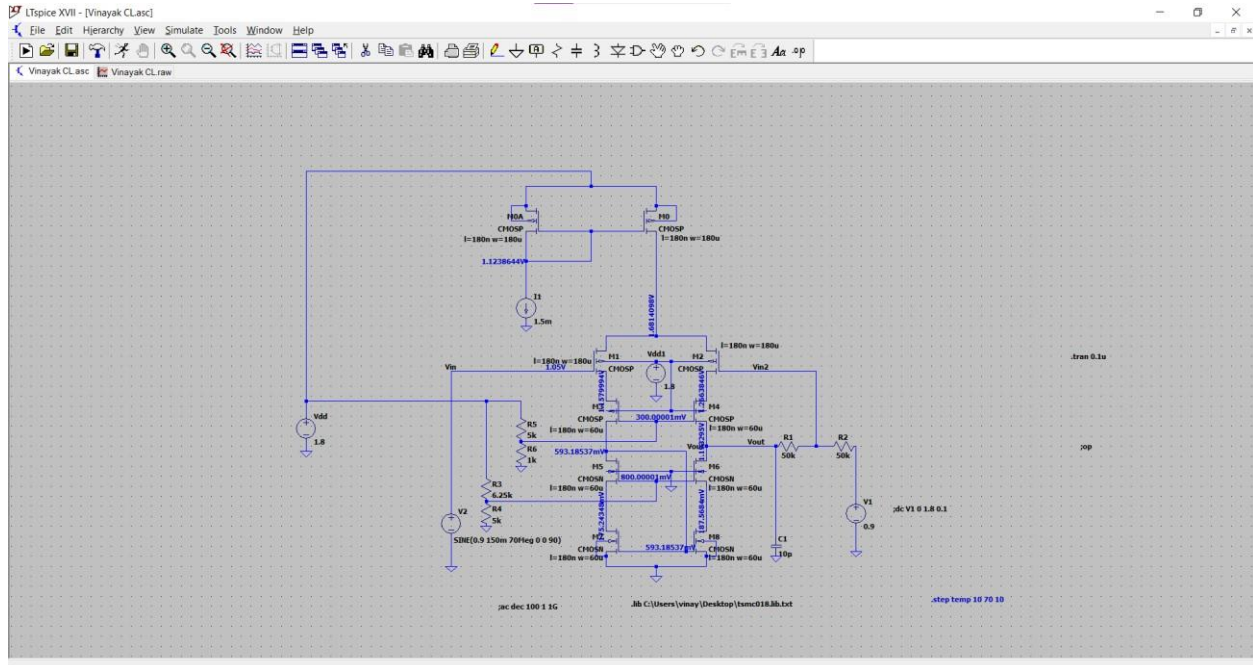
$$N_o = 18 \text{ mV}$$

$$\therefore \text{S.S.E} = 19.93 \text{ mV} - 18 \text{ mV}$$

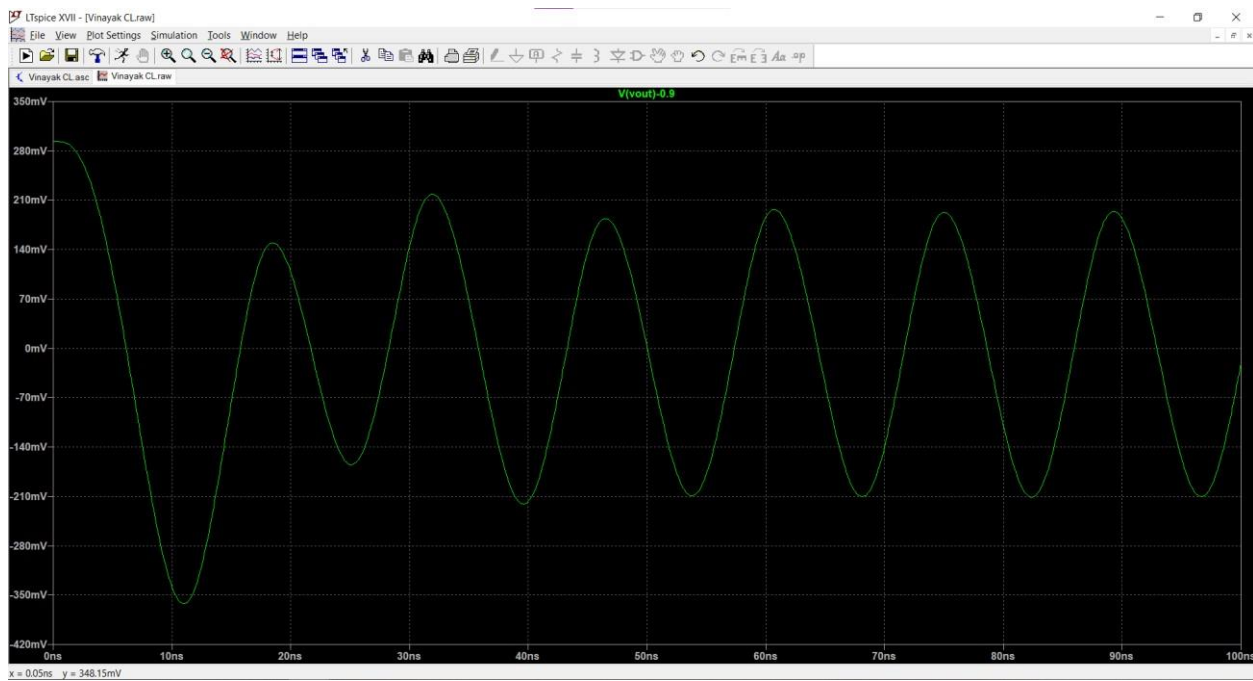
$$\boxed{\text{S.S.E} = 1.93 \text{ mV}}$$



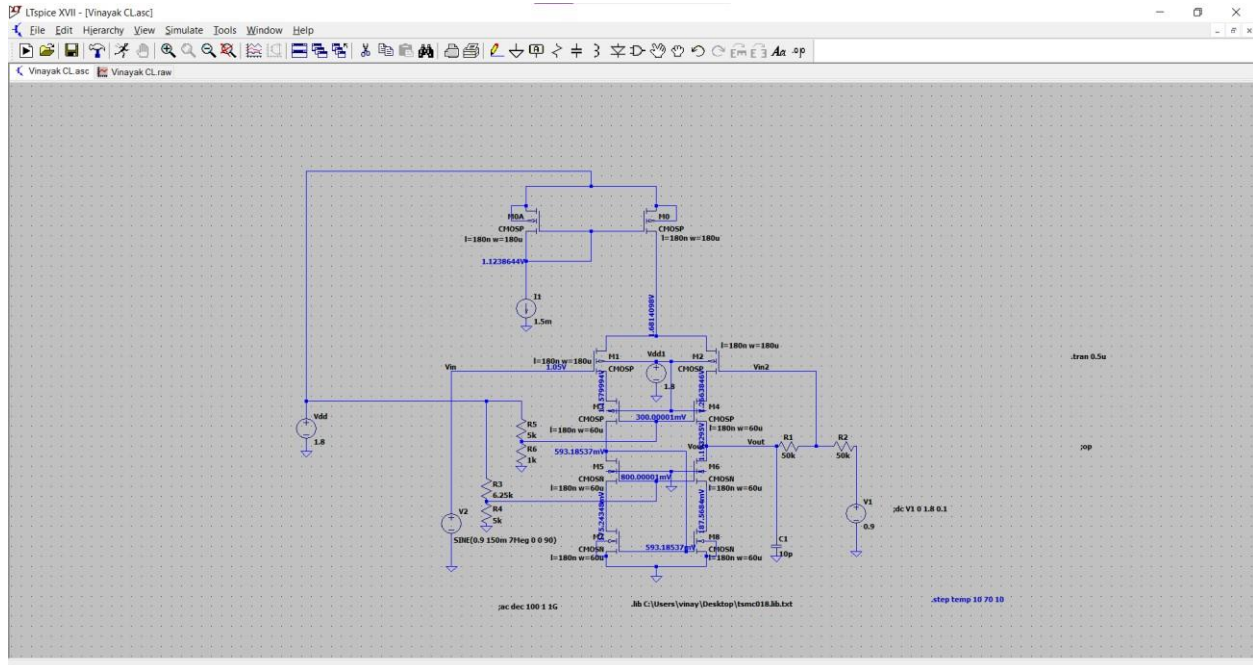
13. Schematic for Transient for Sinusoidal input of $(150\text{mV})\cos(W_{3\text{dB}} \cdot t)$, $W_{3\text{dB}} = 2\pi \cdot 70\text{MHz} = 439.82 \text{ Mrad/sec}$:



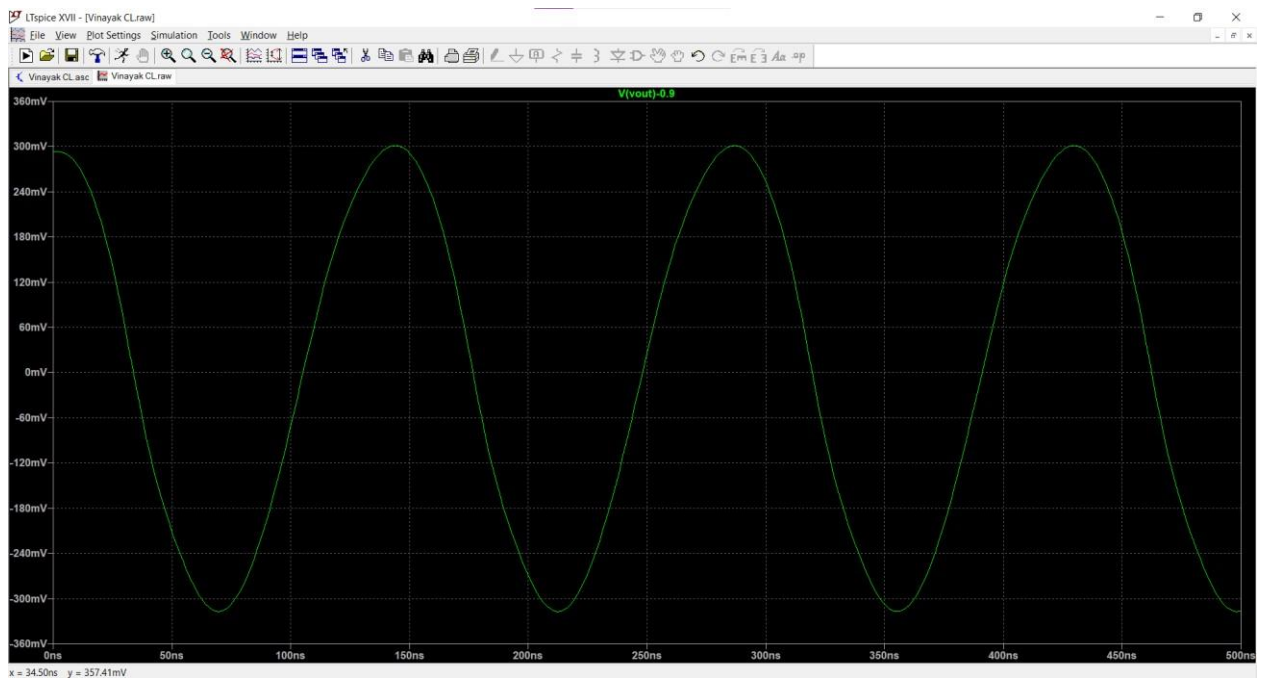
14. Transient response for Sinusoidal input of $(150\text{mV})\cos(W_{3\text{dB}}*t)$, $W_{3\text{dB}}=2\pi*70\text{MHz}=439.82$ Mrad/sec:



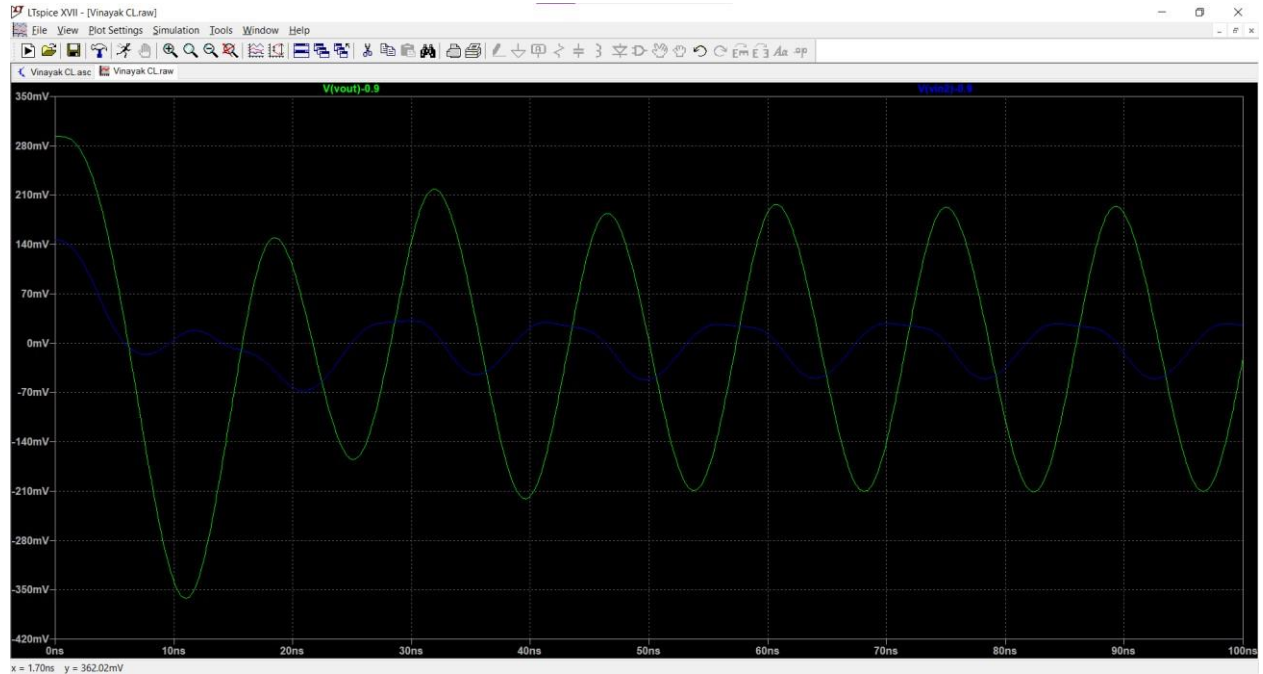
15. Schematic for Transient for Sinusoidal input of $(150\text{mV})\cos(W_{3\text{dB}}/10*t)$, $W_{3\text{dB}}=2\pi*7\text{MHz}=43.982$ Mrad/sec:



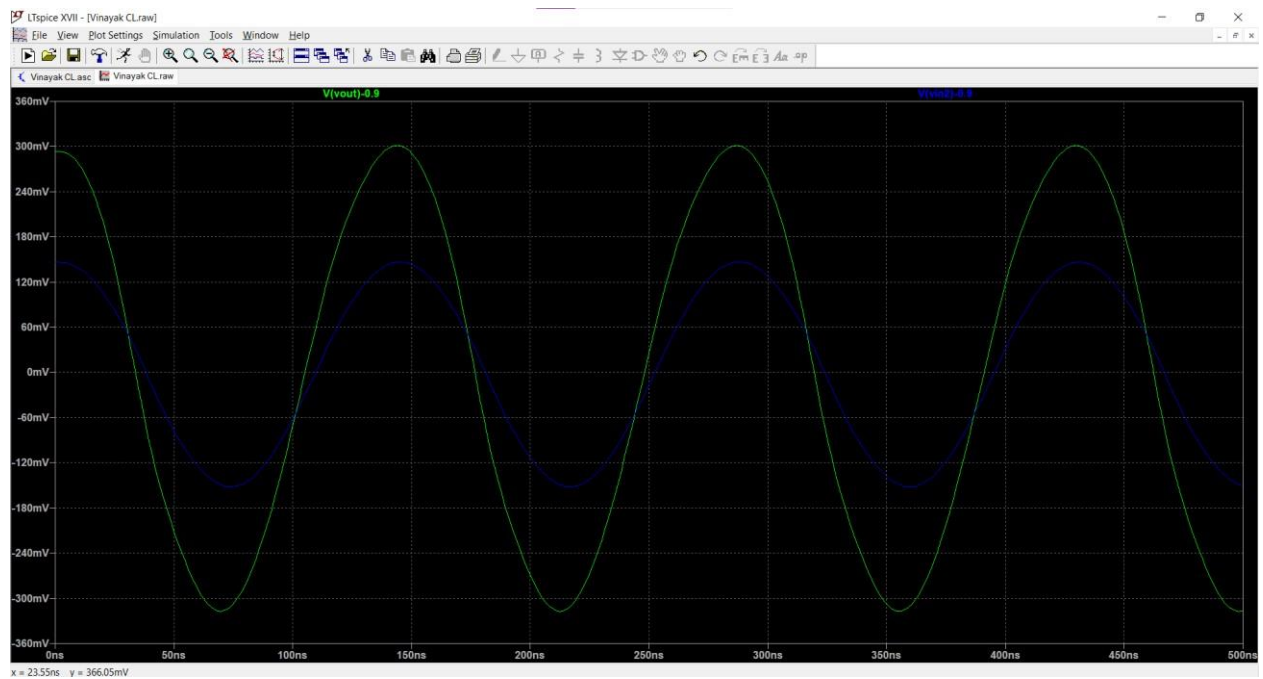
16. Transient response for Sinusoidal input of $(150\text{mV})\cos(W_{3\text{dB}}/10 \cdot t)$, $W_{3\text{dB}} = 2\pi \cdot 7\text{MHz} = 43.982 \text{ Mrad/sec}$:



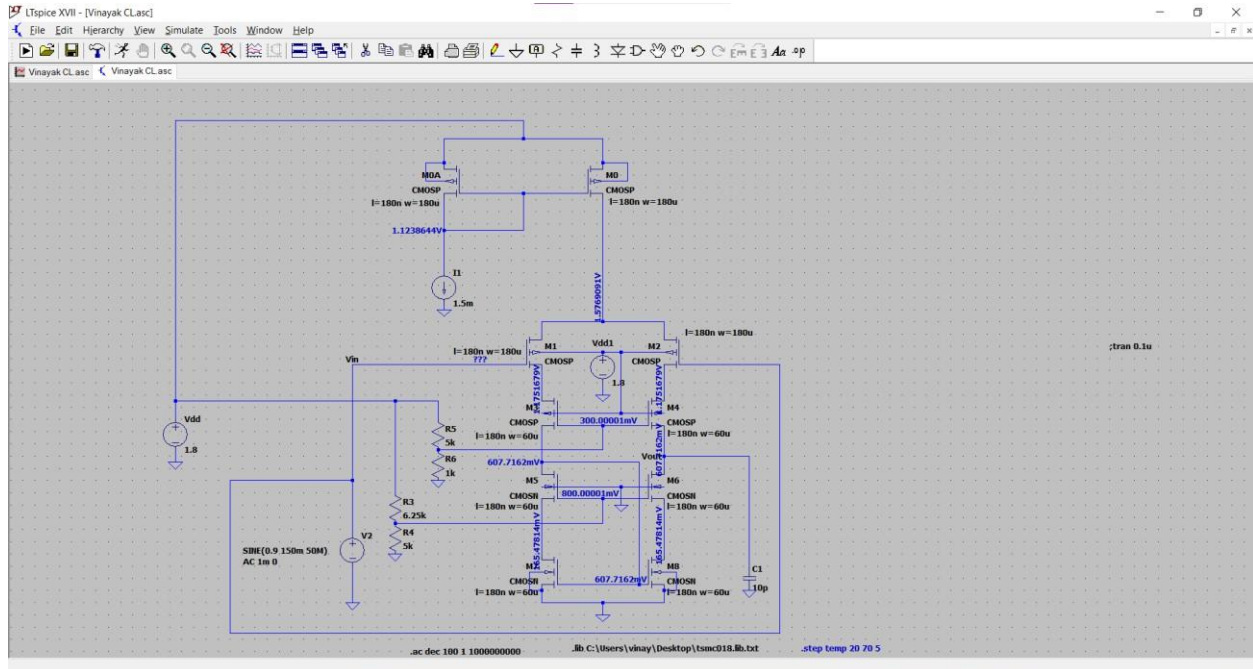
17. Difference between input voltages for Sinusoidal input of $(150\text{mV})\cos(W_{3\text{dB}} \cdot t)$:



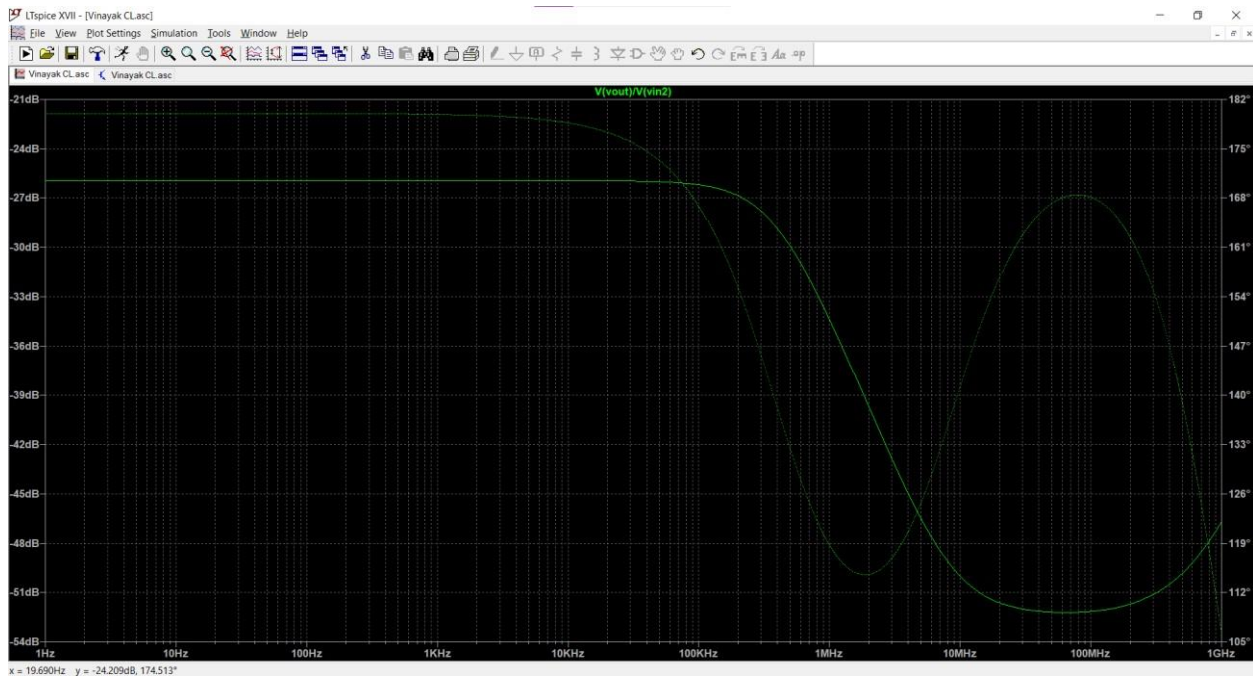
18. Difference between input voltages for Sinusoidal input of $(150\text{mV})\cos(W_{3\text{dB}}/10 \cdot t)$:



19. Schematic for differential gain:

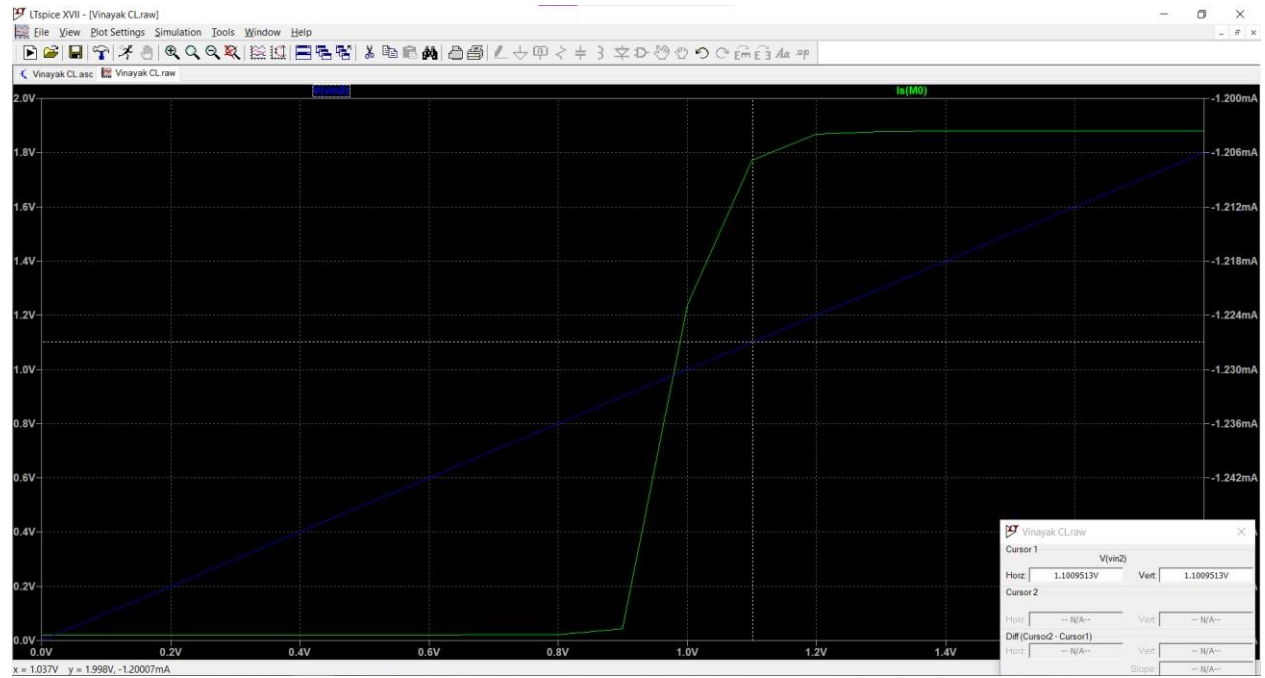


22. Bode Plot for common mode gain:



23. ICMR:-

V1 Sweep from 0 to 1.8Volt & Current I_o is observed. At edge of saturation, V_{BIAS} value is noted as: 1.1V



Parameters of MOSFET:

Semiconductor Device Operating Points:

--- BSIM3 MOSFETS ---

Name: Vinayak Kumbhar
Roll No: 22104137

Name:	m3	m4	m0a	m0	m2
Model:	cmosp	cmosp	cmosp	cmosp	cmosp
Id:	6.27e-04	6.32e-04	1.50e-03	1.26e-03	6.32e-04
Vgs:	-3.07e-01	-5.98e-01	0.00e+00	-4.53e-01	-2.87e-01
Vds:	5.67e-01	2.88e-01	6.76e-01	2.23e-01	3.90e-01
Vbs:	1.19e+00	9.02e-01	6.76e-01	2.23e-01	6.14e-01
Vth:	-6.82e-01	-6.80e-01	-5.09e-01	-5.10e-01	-5.76e-01
Vdsat:	-1.76e-01	-1.85e-01	-1.46e-01	-1.45e-01	-1.09e-01
Gm:	5.58e-03	5.13e-03	1.59e-02	1.29e-02	9.18e-03
Gds:	1.63e-04	4.43e-04	2.92e-04	1.16e-03	2.37e-04
Gmb:	1.44e-03	1.33e-03	4.77e-03	3.91e-03	2.57e-03
Cbd:	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Cbs:	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Cgsov:	3.81e-14	3.81e-14	1.14e-13	1.14e-13	1.14e-13
Cgdov:	3.81e-14	3.81e-14	1.14e-13	1.14e-13	1.14e-13
Cgbov:	1.21e-19	1.21e-19	1.21e-19	1.21e-19	1.21e-19
dQgdVgb:	1.28e-13	1.29e-13	3.86e-13	3.87e-13	3.79e-13
dQgdVdb:	-3.80e-14	-3.82e-14	-1.14e-13	-1.15e-13	-1.14e-13
dQgdVsb:	-8.98e-14	-8.99e-14	-2.67e-13	-2.67e-13	-2.60e-13
dQddVgb:	-5.84e-14	-5.87e-14	-1.75e-13	-1.76e-13	-1.72e-13
dQddVdb:	3.80e-14	3.83e-14	1.14e-13	1.15e-13	1.14e-13
dQddVsb:	2.55e-14	2.56e-14	7.93e-14	7.95e-14	7.40e-14
dQbdVgb:	-1.14e-14	-1.12e-14	-3.65e-14	-3.53e-14	-3.55e-14
dQbdVdb:	-2.71e-17	-2.82e-16	-2.13e-17	-1.29e-15	-9.93e-17
dQbdVsb:	6.49e-16	5.89e-16	-5.86e-15	-6.10e-15	-2.56e-15

Name:	m1	m6	m5	m7	m8
Model:	cmosp	cmosn	cmosn	cmosn	cmosn
Id:	6.27e-04	6.32e-04	6.27e-04	6.27e-04	6.32e-04
Vgs:	-2.75e-01	6.28e-01	6.34e-01	6.07e-01	6.07e-01
Vds:	4.02e-01	7.26e-01	4.42e-01	1.66e-01	1.72e-01
Vbs:	6.25e-01	-1.72e-01	-1.66e-01	0.00e+00	0.00e+00
Vth:	-5.76e-01	5.43e-01	5.43e-01	5.01e-01	5.01e-01
Vdsat:	-1.08e-01	8.51e-02	8.78e-02	9.25e-02	9.26e-02
Gm:	9.14e-03	9.75e-03	9.59e-03	8.93e-03	9.03e-03
Gds:	2.27e-04	2.62e-04	3.14e-04	8.61e-04	8.16e-04
Gmb:	2.56e-03	2.29e-03	2.27e-03	2.23e-03	2.26e-03
Cbd:	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Cbs:	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Cgsov:	1.14e-13	4.94e-14	4.94e-14	4.94e-14	4.94e-14
Cgdov:	1.14e-13	4.94e-14	4.94e-14	4.94e-14	4.94e-14
Cgbov:	1.21e-19	1.46e-19	1.46e-19	1.46e-19	1.46e-19
dQgdVgb:	3.79e-13	1.58e-13	1.59e-13	1.61e-13	1.61e-13
dQgdVdb:	-1.14e-13	-4.91e-14	-4.91e-14	-4.96e-14	-4.95e-14
dQgdVsb:	-2.60e-13	-1.03e-13	-1.04e-13	-1.05e-13	-1.05e-13
dQddVgb:	-1.72e-13	-7.20e-14	-7.23e-14	-7.33e-14	-7.33e-14
dQddVdb:	1.14e-13	4.92e-14	4.93e-14	4.98e-14	4.97e-14
dQddVsb:	7.39e-14	2.85e-14	2.89e-14	3.01e-14	3.01e-14
dQbdVgb:	-3.55e-14	-1.44e-14	-1.43e-14	-1.40e-14	-1.41e-14
dQbdVdb:	-8.93e-17	1.06e-17	-9.14e-18	-5.97e-16	-5.32e-16
dQbdVsb:	-2.55e-15	-3.08e-15	-3.18e-15	-4.50e-15	-4.49e-15