Gm Calculations:

EE-610A Project

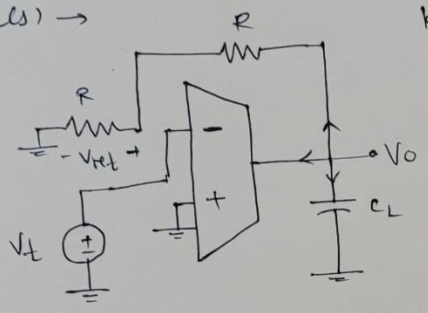
Roll No = 22104137 = 4N+1

$V_{DD} = 1.8V$ $C_L = 10pF$ Loop gain = 40dB

-3dB BW $V_o/V_i = 50MHz$ CMRR (@DC) = 80dB.

1)

$L(s) \rightarrow$



KCL At node $V_o \rightarrow$

$$\frac{V_{ref}}{R} + V_{ref}.(2.5C_L) + g_m.V_{test} = 0$$

$$V_{ref}\left(\frac{1}{R} + 25C_L\right) = -g_m V_{test}$$

$$\frac{-V_{ref}}{V_{test}} = \frac{g_m}{\left(\frac{1}{R} + 25C_L\right)}$$

$$L(s) = \frac{g_m}{1/R + 25C_L}$$

$$\therefore L(s) = \frac{g_m}{1/50k + 2.5.10p}$$

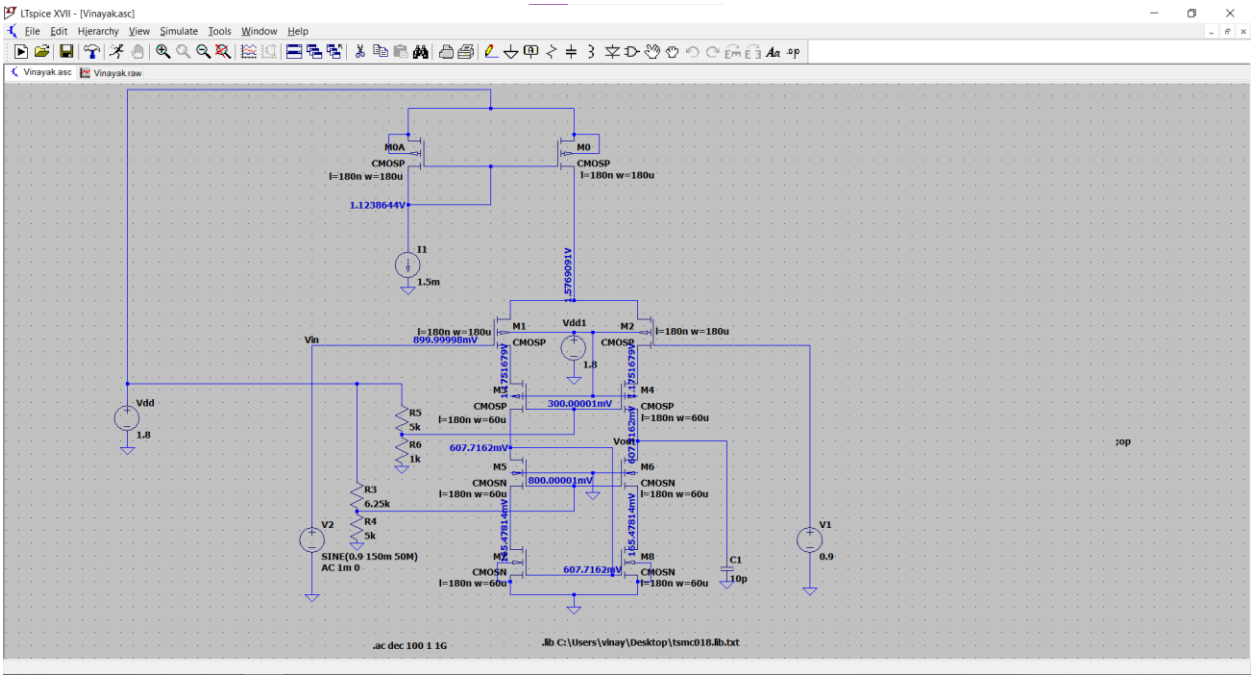
At $\omega = 50MHz \times 2\pi$, $|L(j\omega)| = 1$

$$1 = \frac{g_m}{\frac{1}{50k} + 2\times 50\times10^6 \times 10\times10^{-12}\times 2\pi}$$

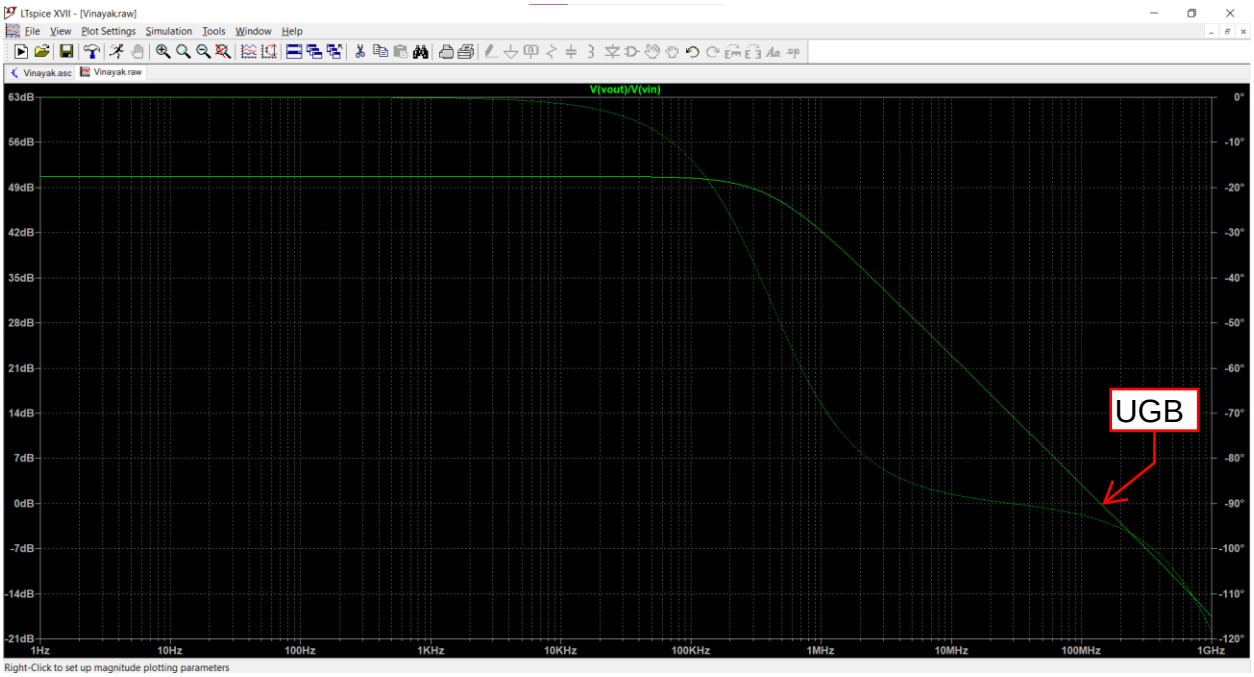
$$g_m \approx 2\times 2\pi\times 50\times10^6 \times 10\times10^{-12}$$

$$\boxed{g_m = 6.28\ mS}$$

1. Open loop schematic diagram:



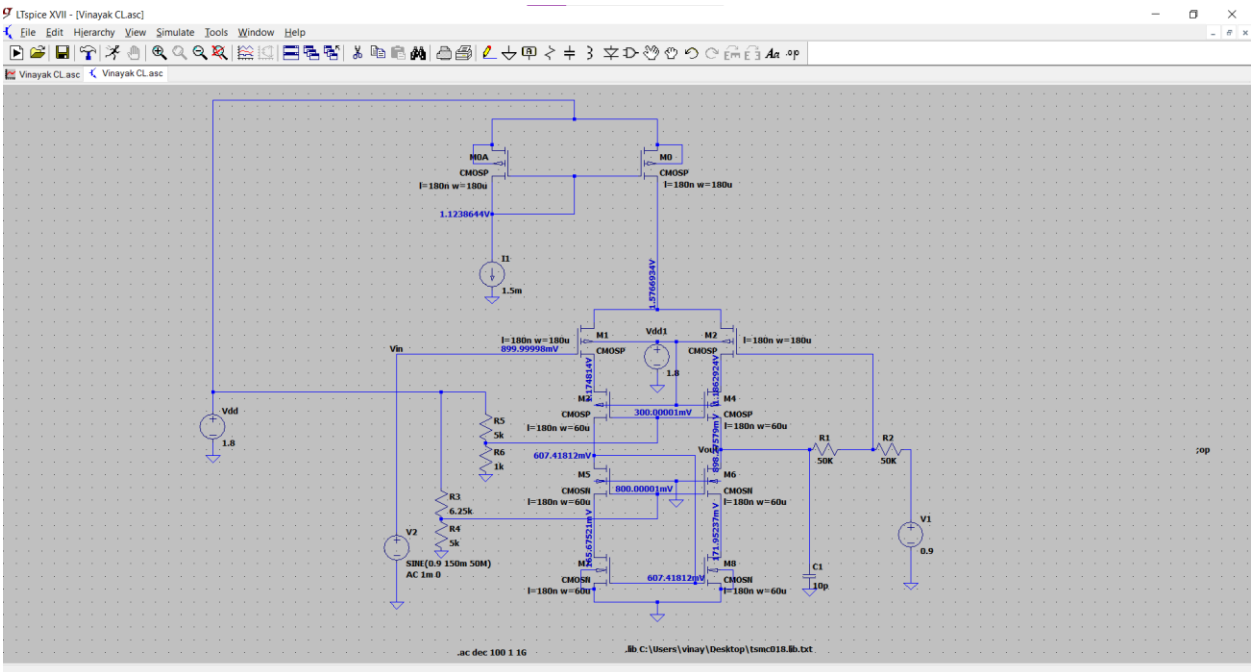
2. Open Loop Bode plot:



Name: Vinayak Kumbhar
Roll No: 22104137

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

4. Closed Loop schematic diagram:



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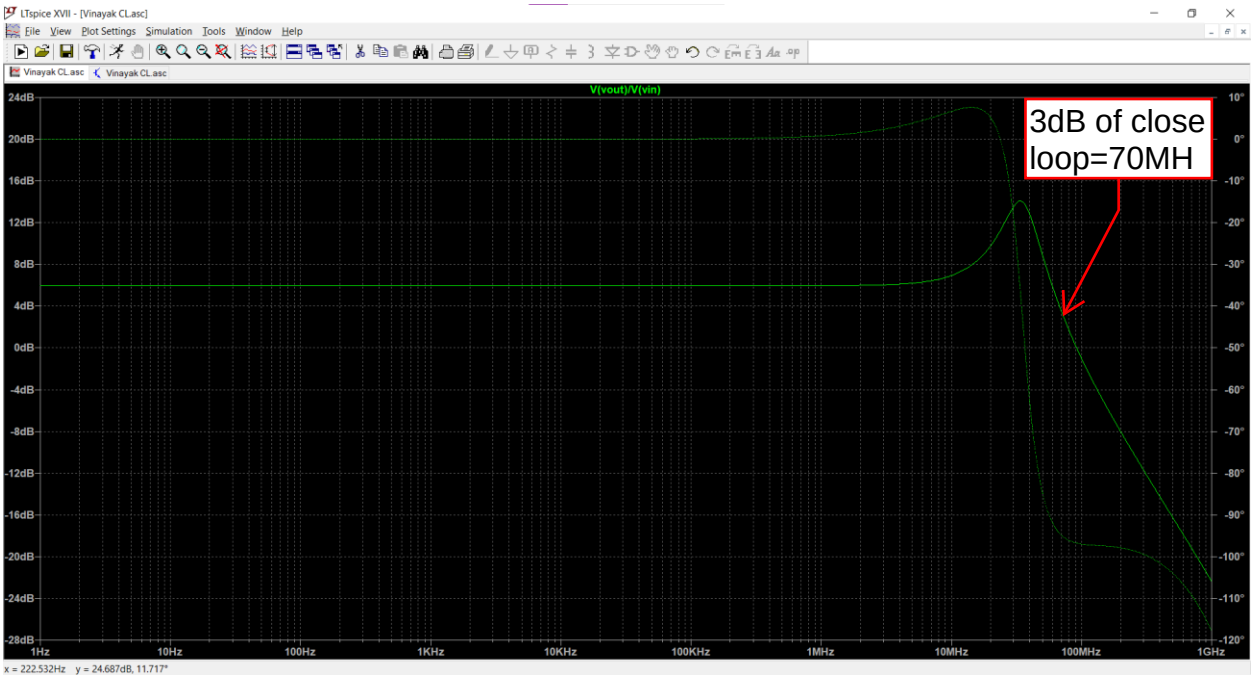
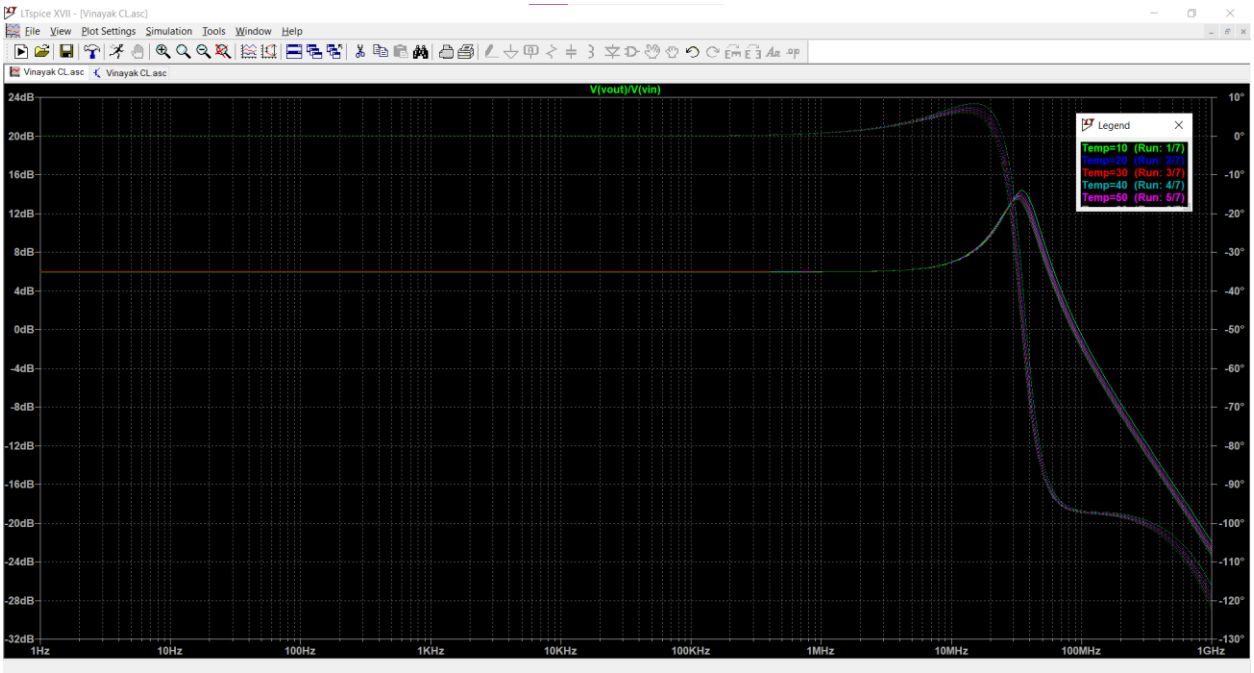
5. Closed Loop Bode Plot:



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



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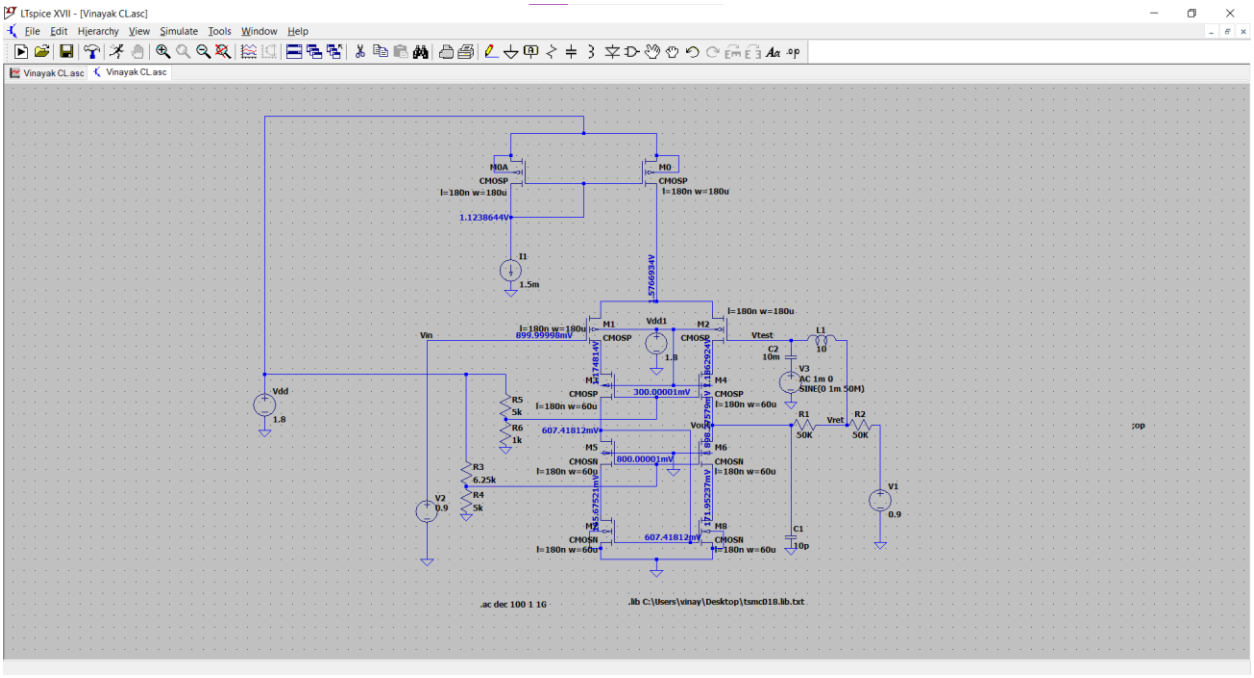
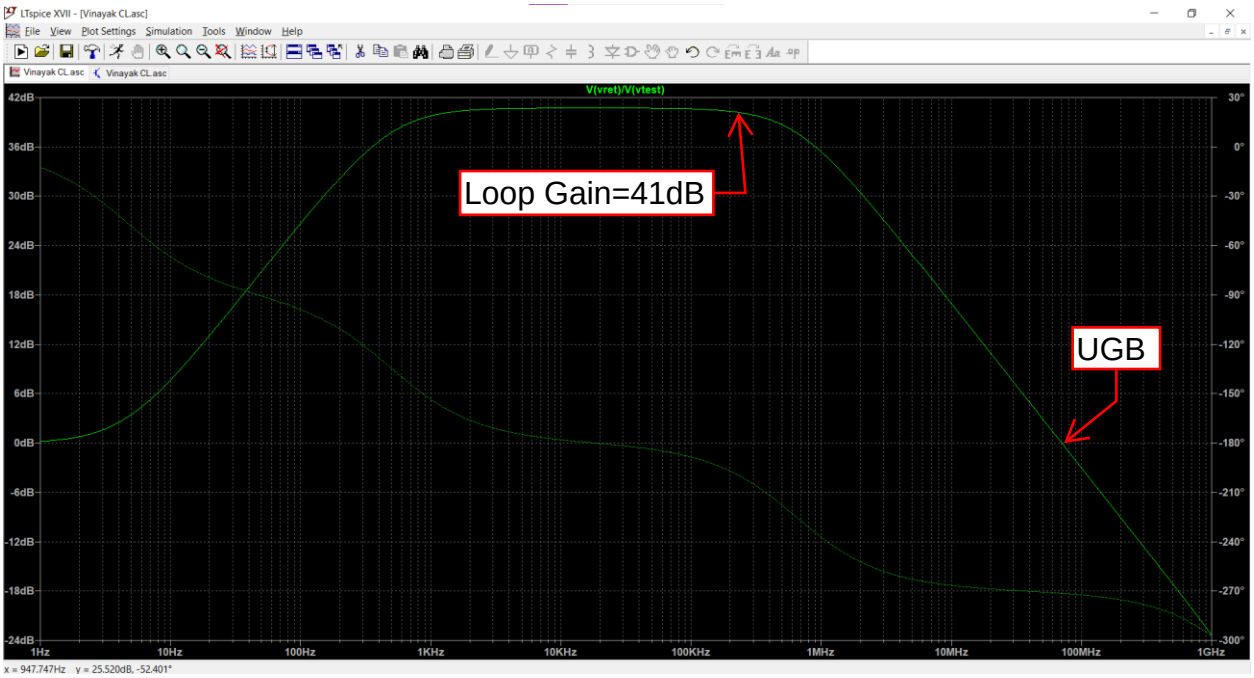
7. Loop Gain schematic diagram:



8. Loop Gain Bode Plot:



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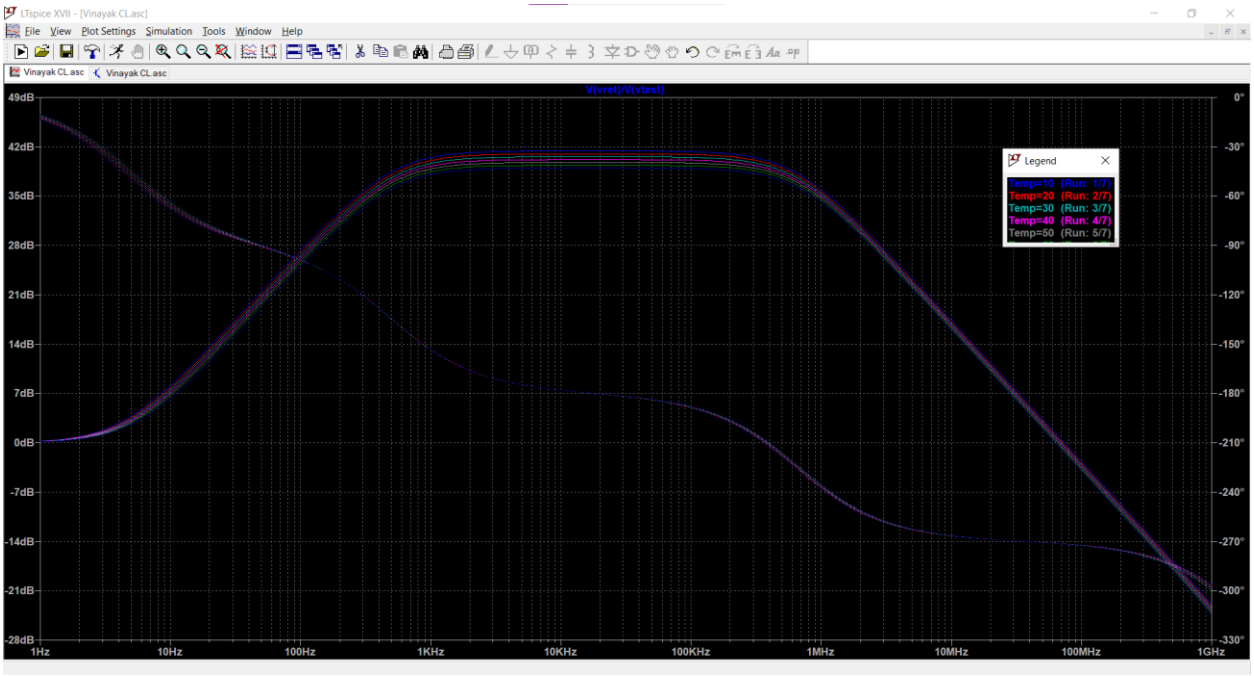
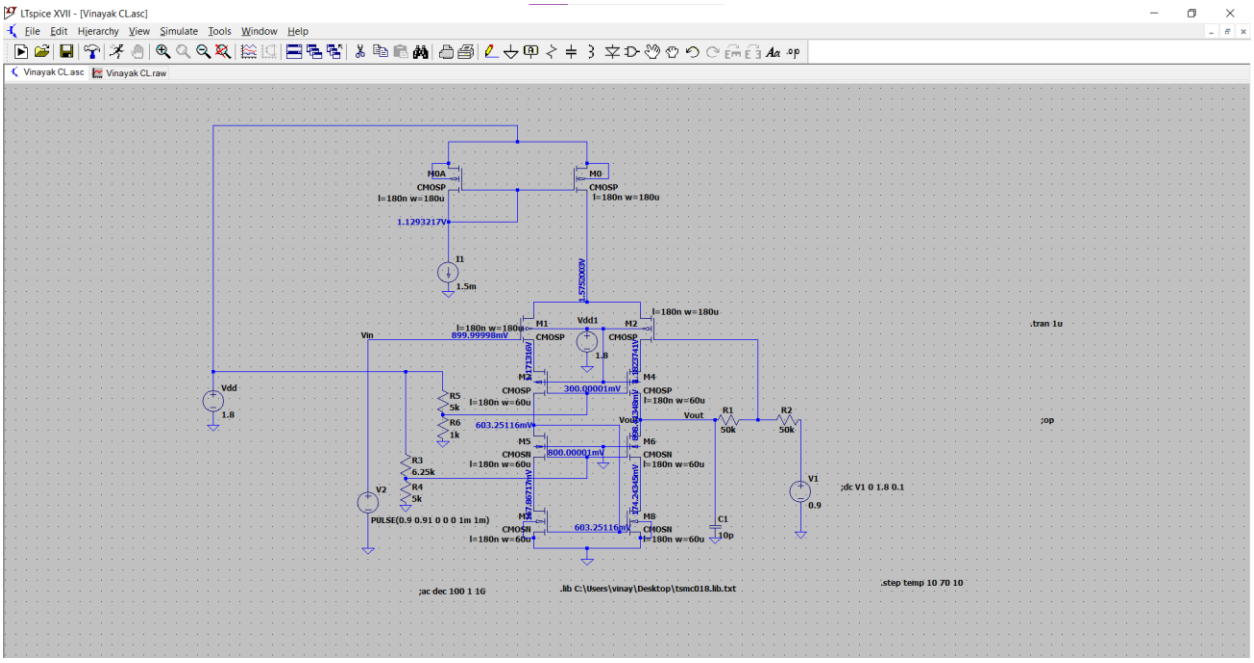
Roll No: 22104137

9. Loop Gain Bode Plot Variation for temperature sweep of 0°C to 70°C:



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



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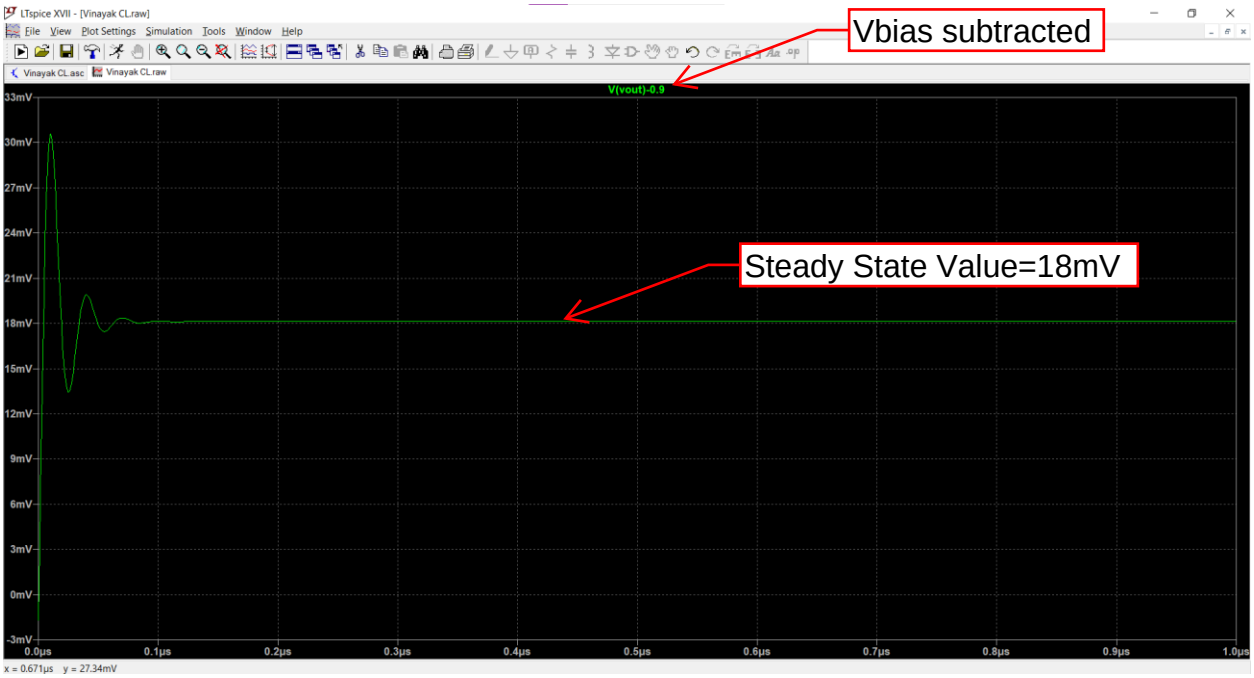
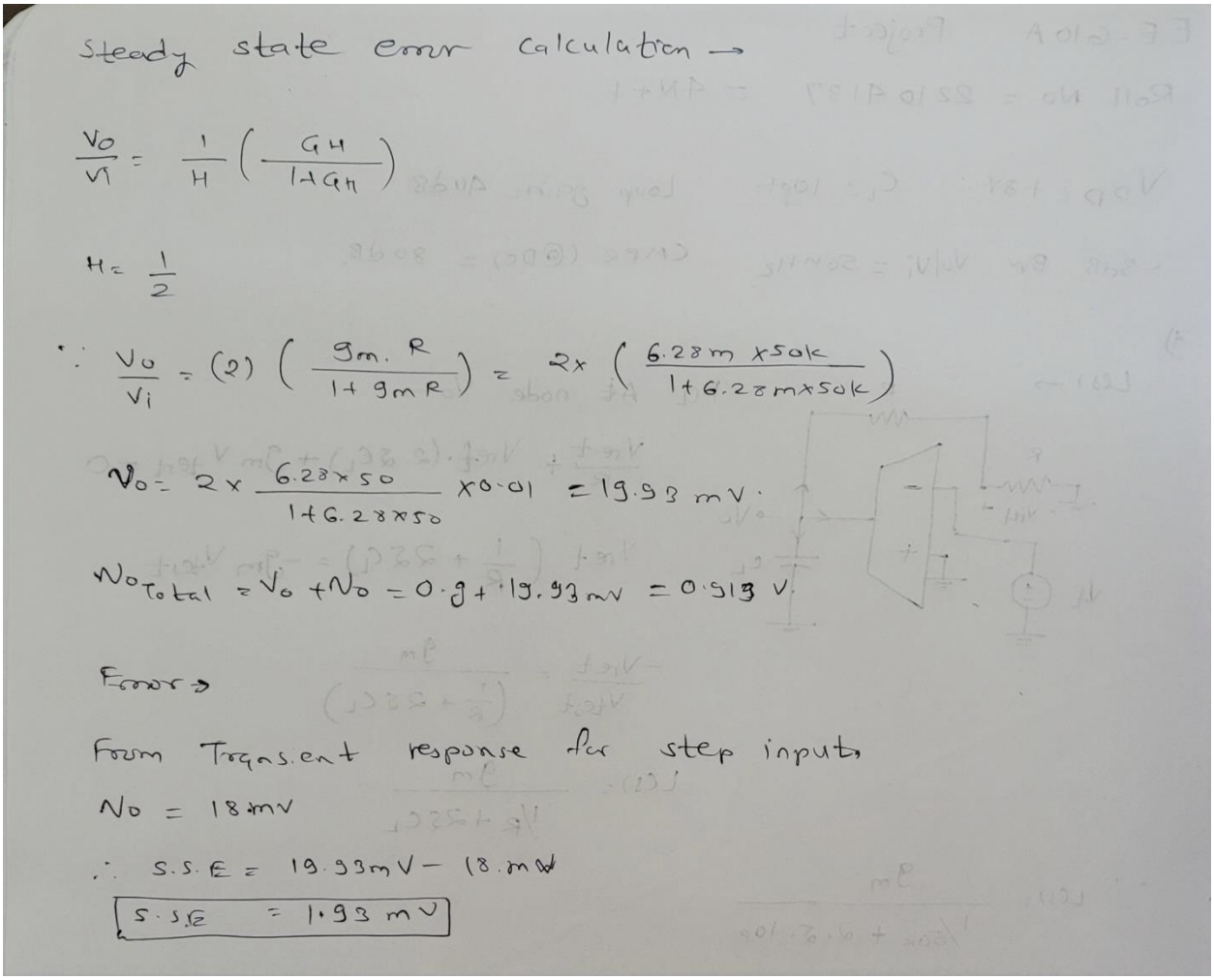
11. Transient response for step input of 0.01V:



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

Name: Vinayak Kumbhar
Roll No: 22104137

Steady State Error Calculation:



Name: Vinayak Kumbhar
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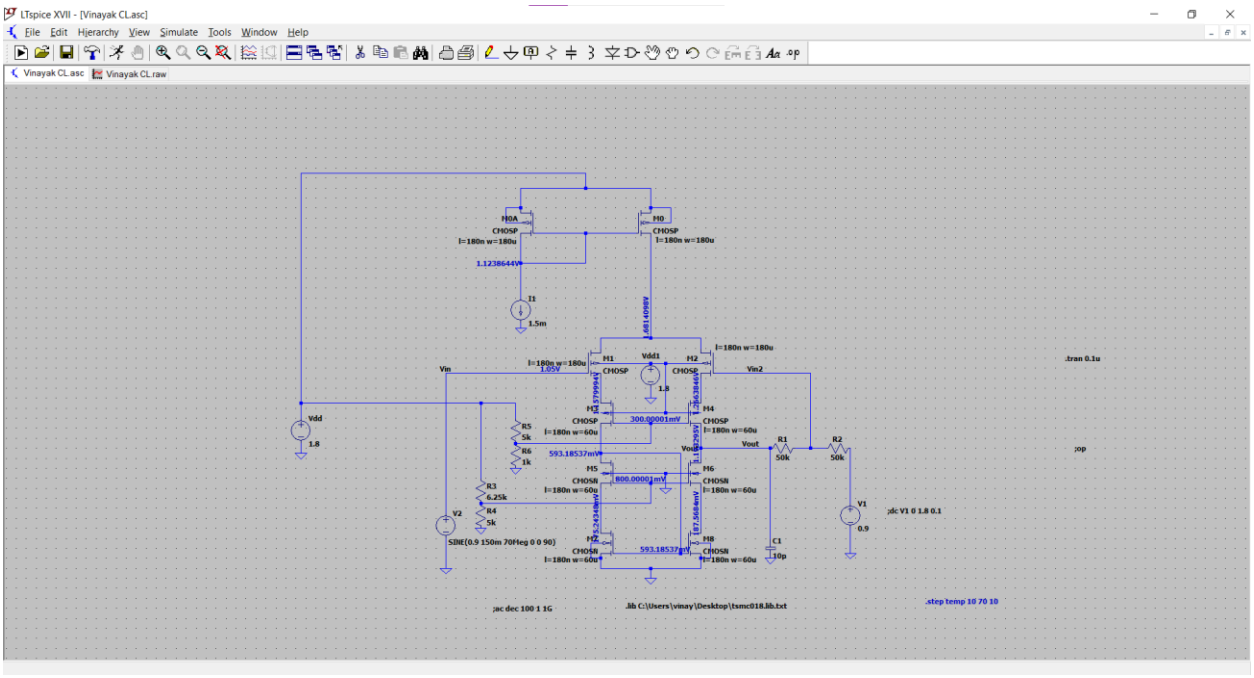
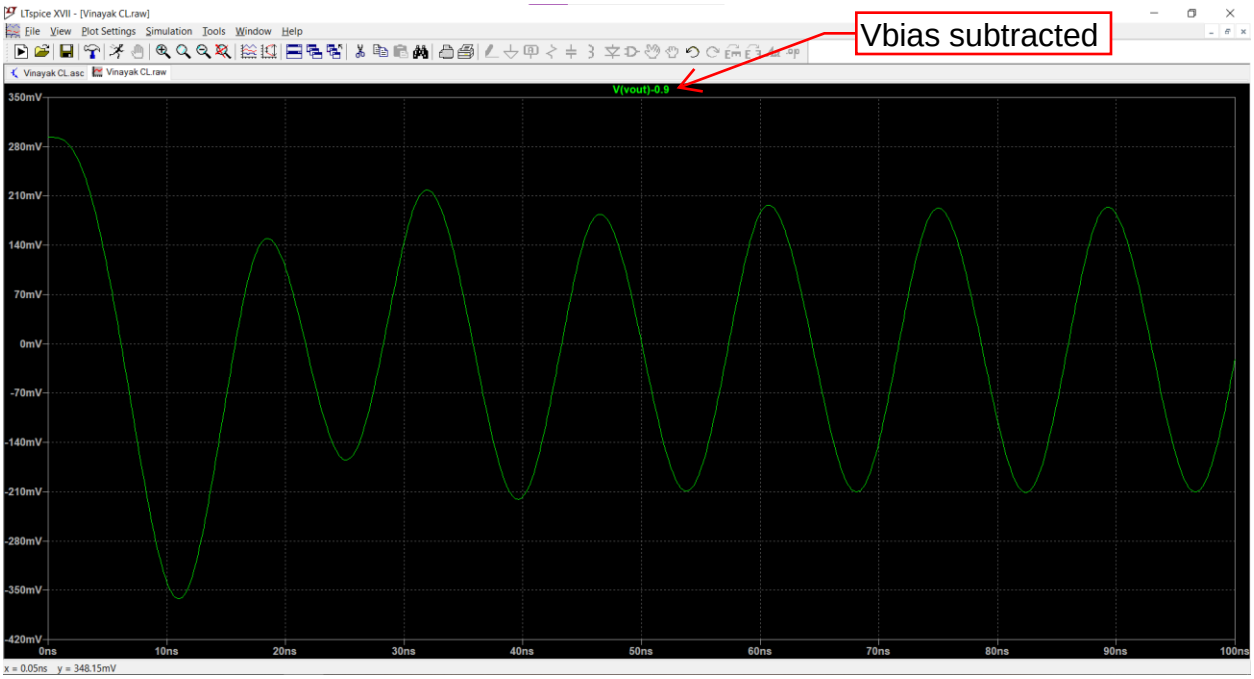
13. Schematic for Transient for Sinusoidal input of (150mv)COS(W_{3dB}*t), $W_{3dB}=2\pi*70MHz=439.82$ Mrad/sec:

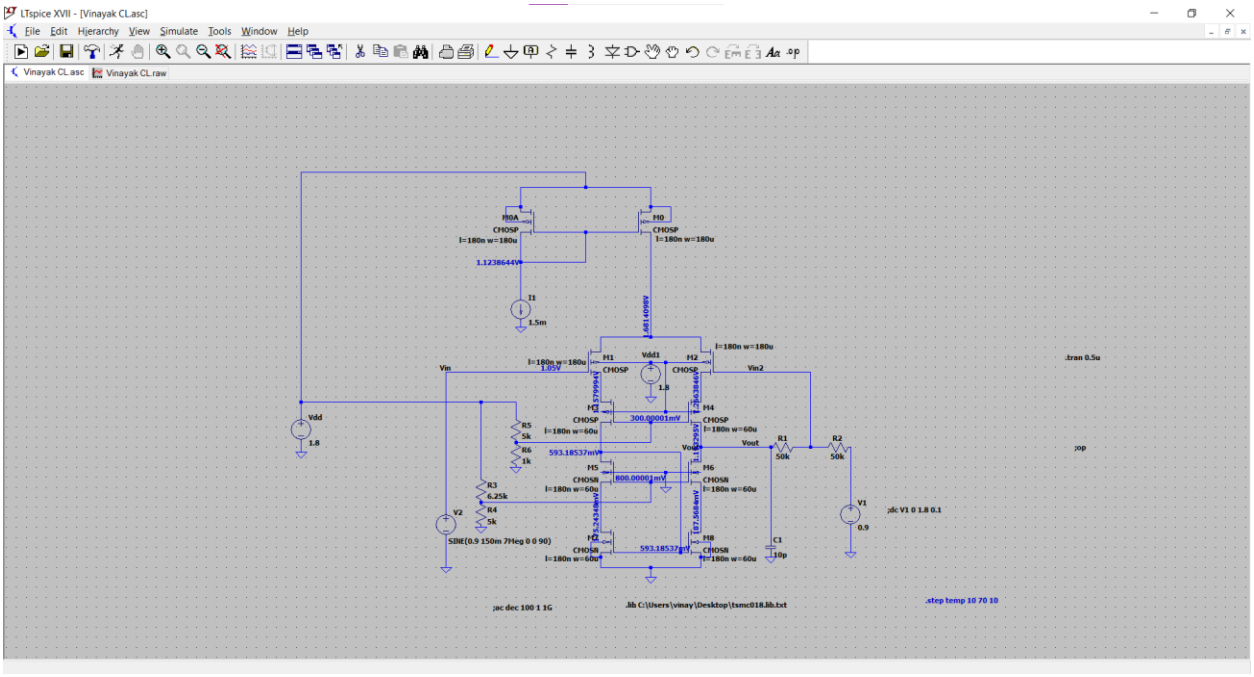


14. Transient response for Sinusoidal input of (150mv)COS(W_{3dB}*t), $W_{3dB}=2\pi*70MHz=439.82$ Mrad/sec:

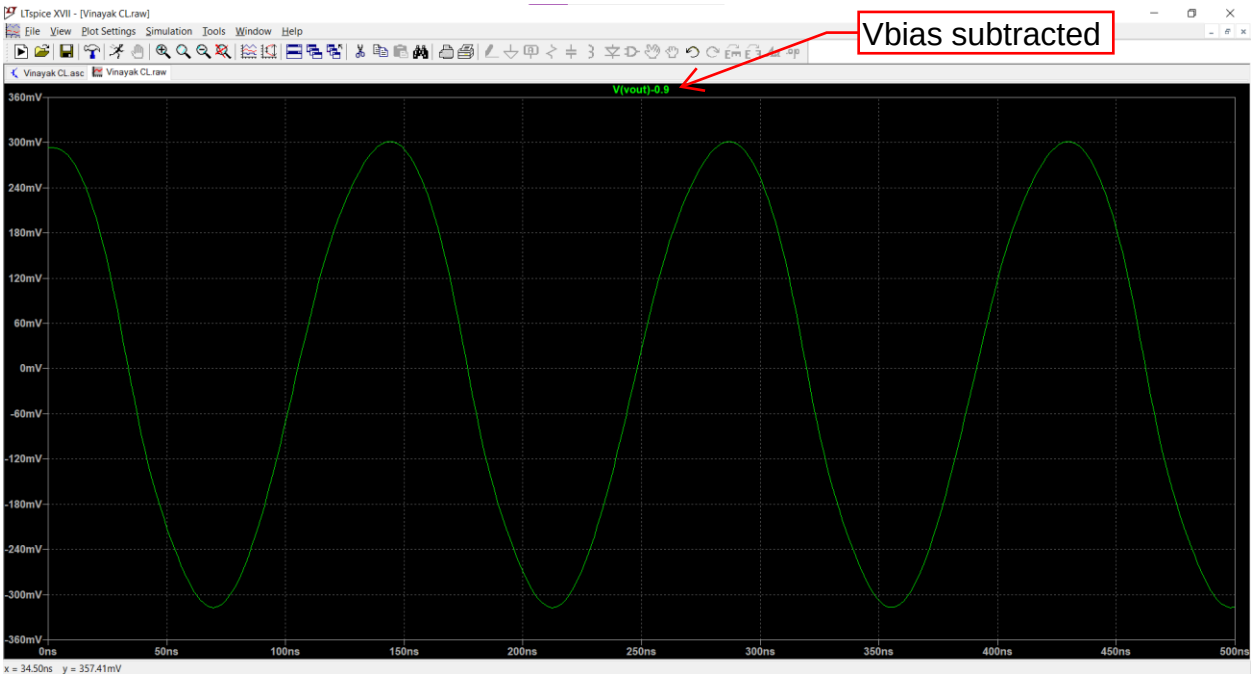


Name: Vinayak Kumbhar
Roll No: 22104137

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

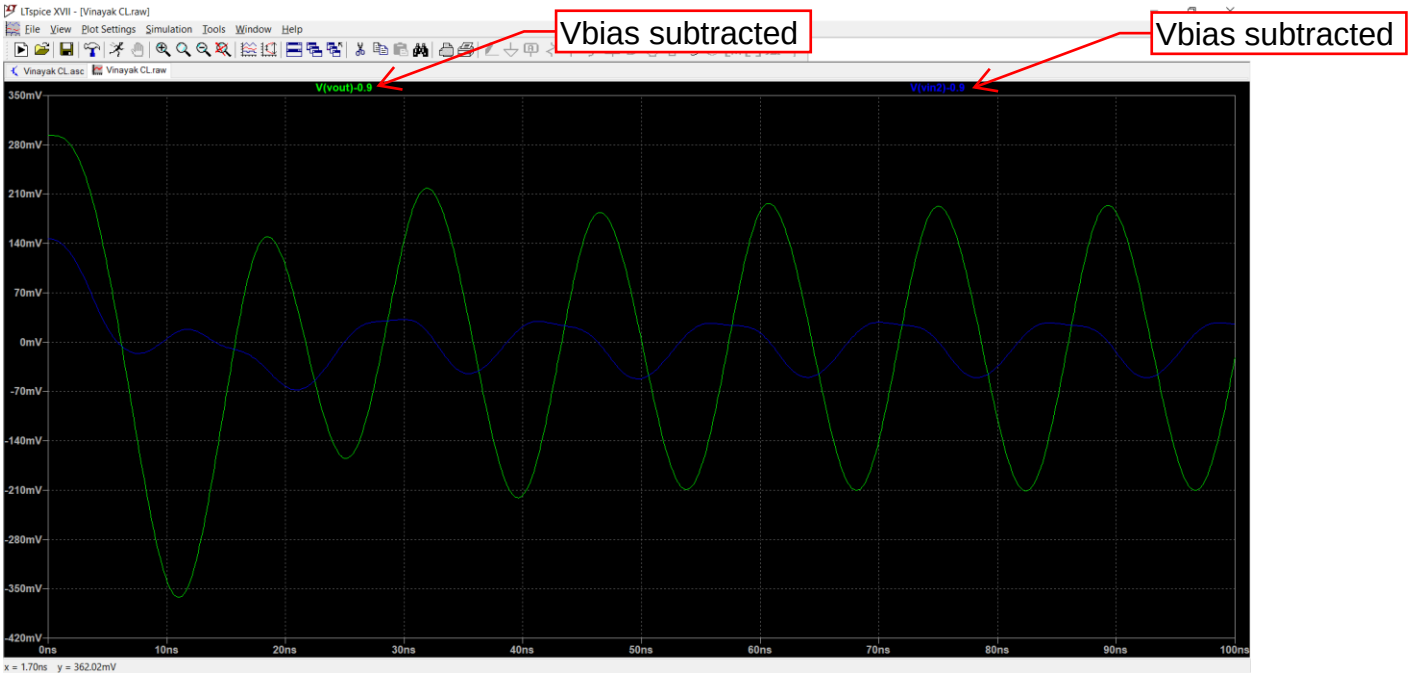


16. Transient response for Sinusoidal input of (150mv)COS(W_{3dB}/10*t), $W_{3dB}=2\pi*7MHz=43.982$ Mrad/sec:

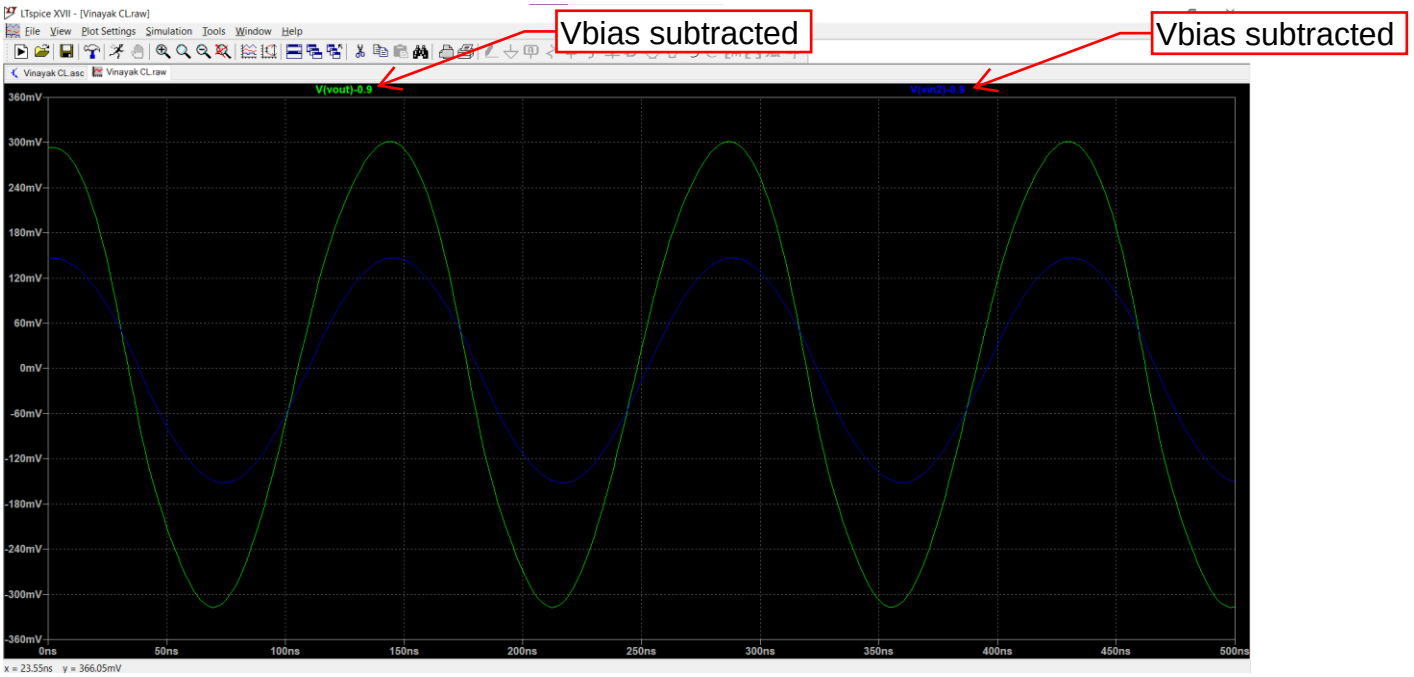


Name: Vinayak Kumbhar
Roll No: 22104137

17. Difference between input voltages for Sinusoidal input of (150mv)COS(W_{3dB}*t):



18. Difference between input voltages for Sinusoidal input of (150mv)COS(W_{3dB}/10*t):



Name: Vinayak Kumbhar
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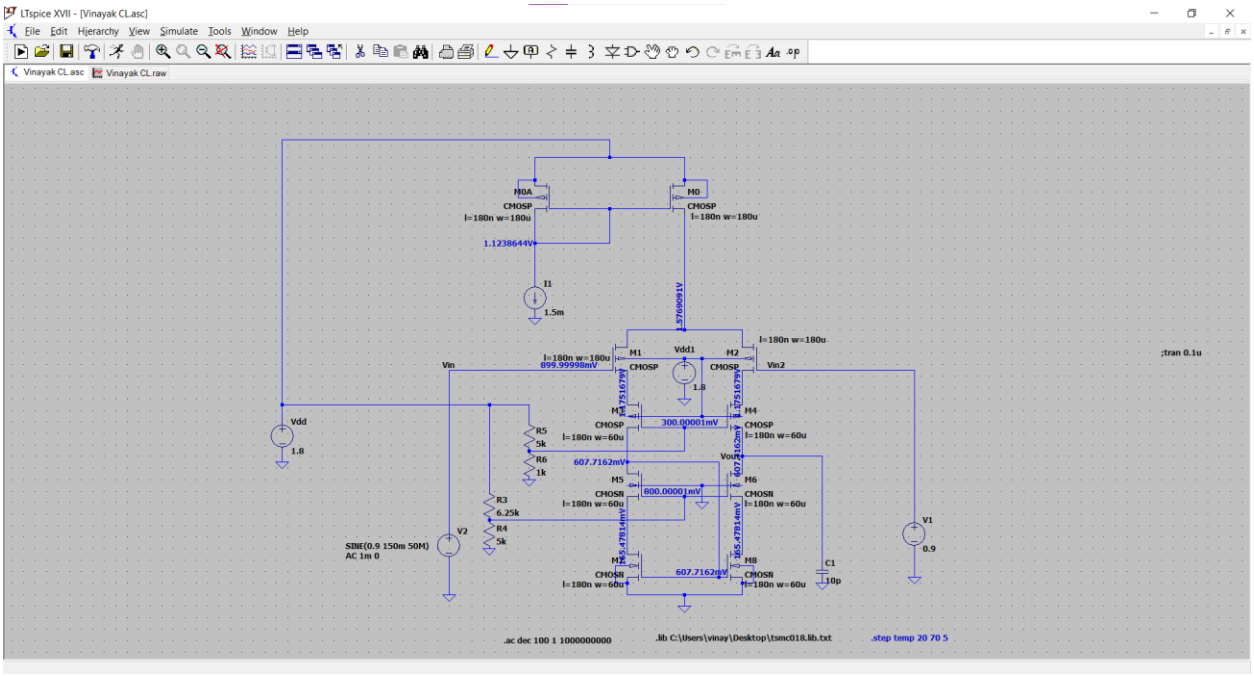
19. Schematic for differential gain:



20. Bode Plot for differential gain:

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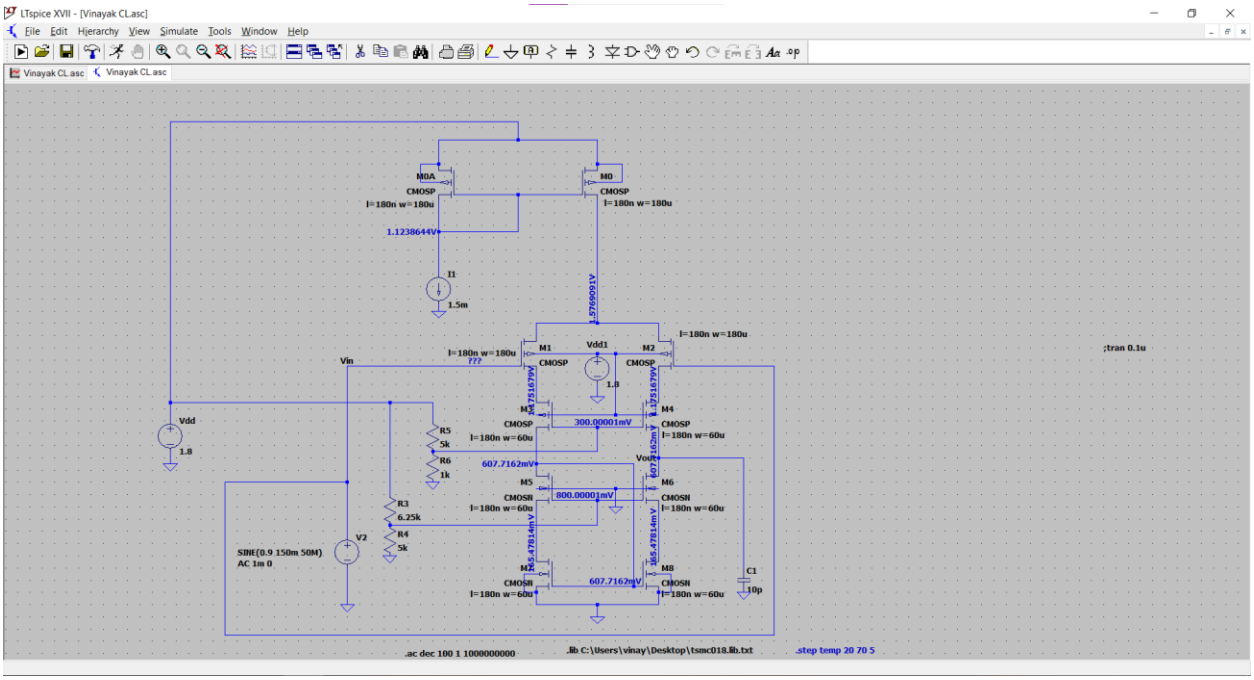
21. Schematic for common mode gain:



22. Bode Plot for common mode gain:

CMRR(@DC)= 20log(Ad)-20log(Acm)=52-(-26)=78dB

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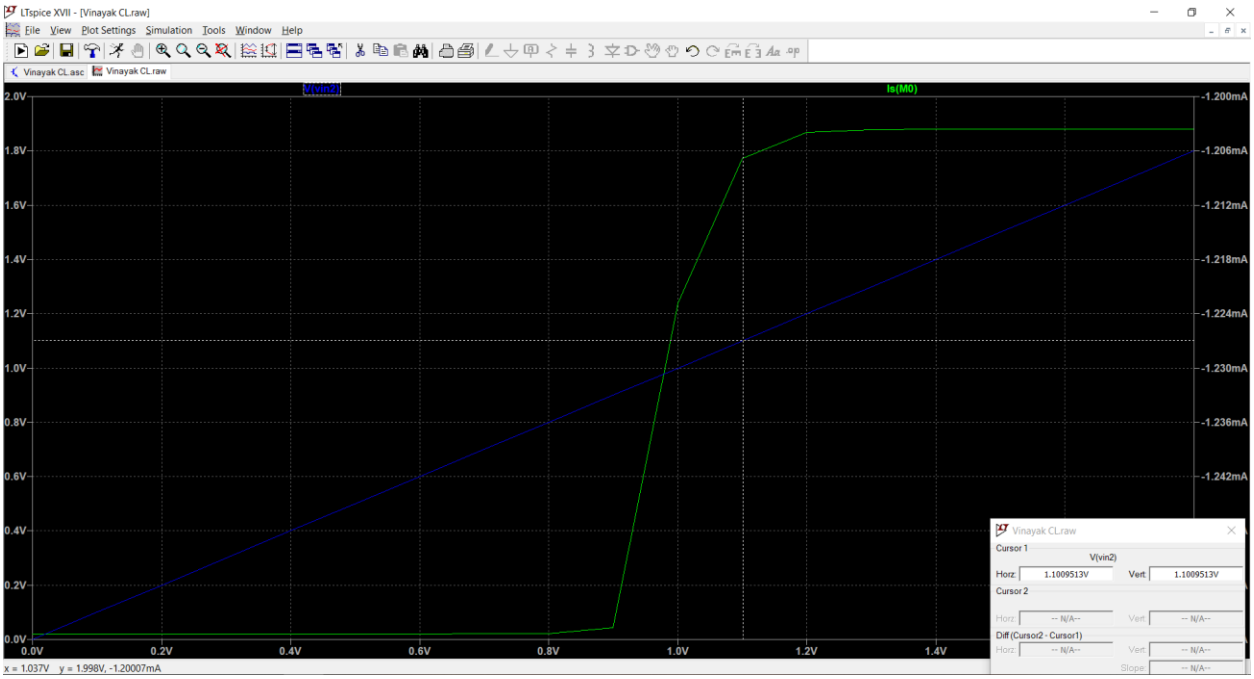
23. ICMR-:

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



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Parameters of MOSFET:

Semiconductor Device Operating Points:

--- BSIM3 MOSFETS ---

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

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Roll No: 22104137