CIRCUIT:

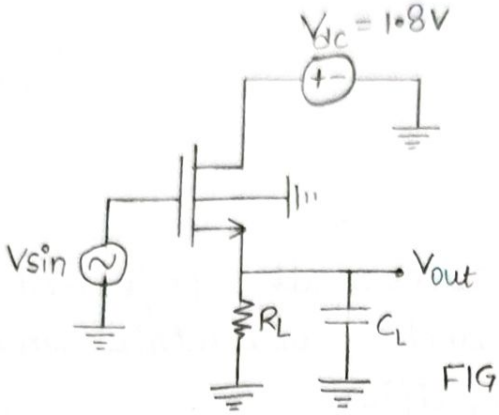


FIG: SOURCE FOLLOWER AMPLIFIER

SIMULATIONS:

- PARAMETRIC ANALYSIS:

Sweep	0	0.3	0.6	0.9	1.2	1.5	1.8
Region	0	3	3	2	2	2	2
R_{out}	64.35 G	7.78 M	206.49 k	78.37 k	45.03 k	29.99 k	21.26 k
I_D	30.25 p	266.3 n	12.05 µ	32.93 µ	36.0 µ	89.09 µ	104.75 µ
g_m	951.71 p	7.422 µ	236.2 µ	529.15 µ	770.82 µ	963.8 µ	1.113 m
V_{th}	0.473	0.4733	0.479	0.534	0.569	0.599	0.627
V_{ds}	1.8	1.797	1.679	1.470	1.239	0.999	0.752
V_{gs}	-320.58 n	0.297	0.479	0.570	0.639	0.699	0.752

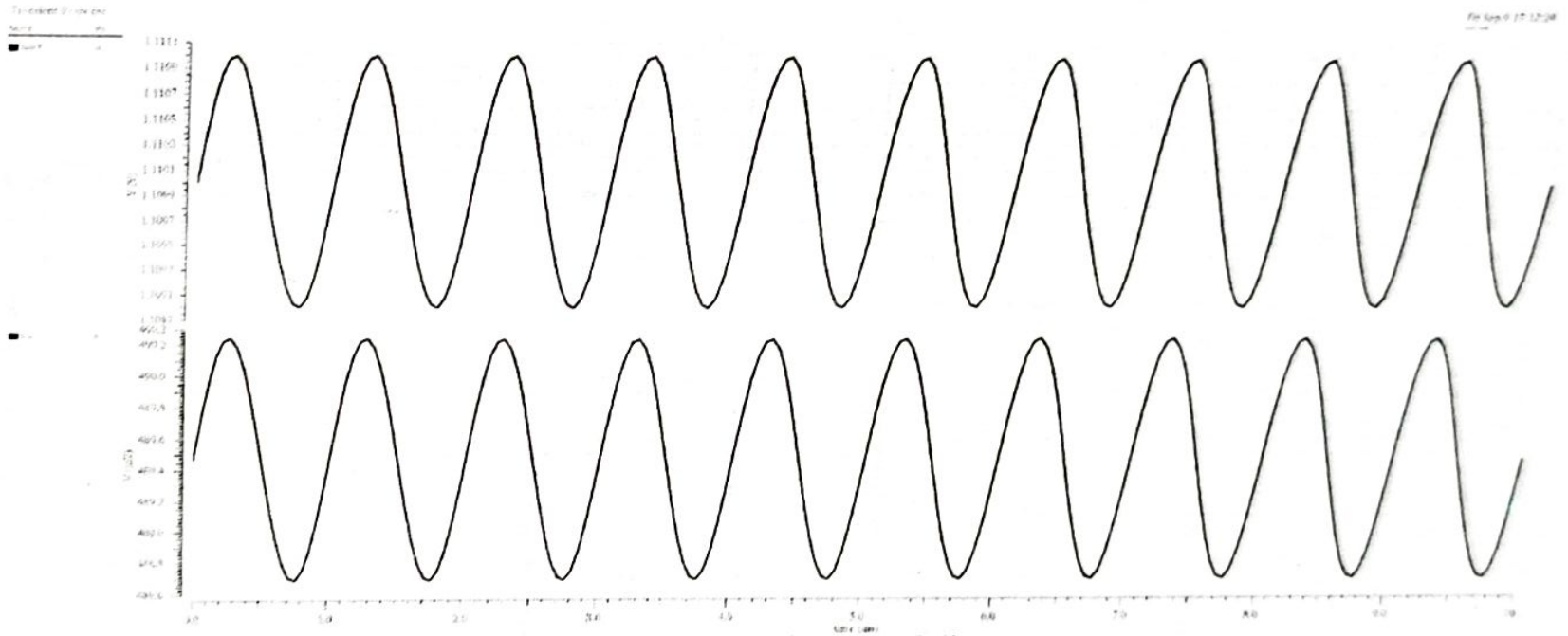
- DC ANALYSIS: Transistors operating in Region 2

- TRANSIENT ANALYSIS: $V_{in\,pp}$ = 2 mV $V_{out\,pp}$ = 1.55 mV

A_V = 0.775

- AC ANALYSIS: Gain vs freq. and phase vs freq. graphs are plotted.

Gain = -2.17099 dB ⇒ Gain = 0.778



Transient response of source follower

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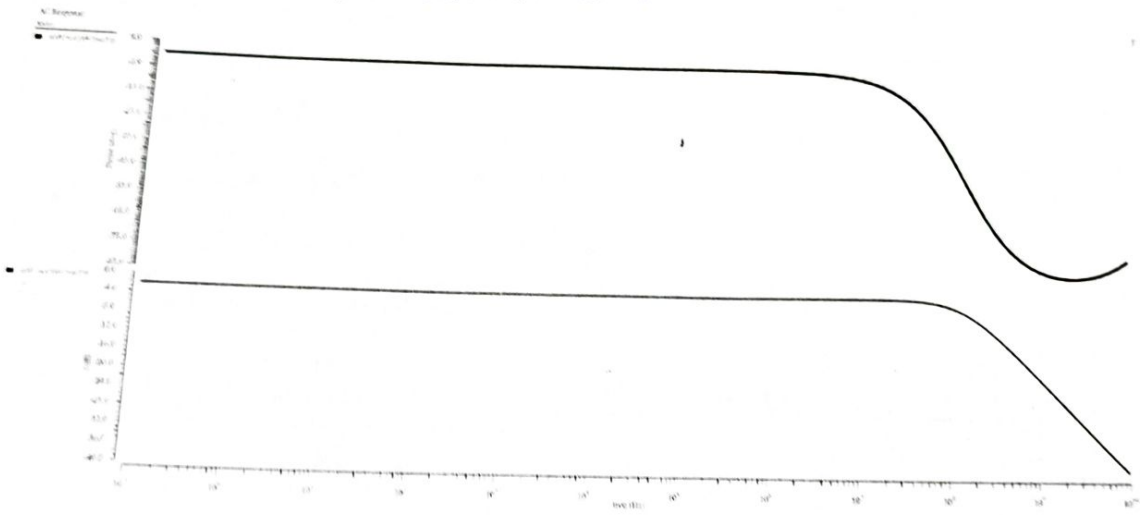
Experiment No. 7

Aim: Simulation and analysis of source follower circuit.



gain Vs freq and phase Vs freq of source follower

$$50\mu = \frac{300\mu}{2} \times \frac{8100}{3} (V_{gs} - V_{th})^2$$

$$\Rightarrow V_{gs} - V_{th} = 0.11$$

$$\because V_{gs} = V_{in} - V_{out}$$

$$\therefore \underline{V_{in} = 1.11V}$$

$$\Rightarrow \frac{W}{L} = \frac{(1m)^2 (0.9m)^2}{2 \times 300\mu \times 50\mu}$$

for $\Rightarrow L = 0.18\,\mu m$

$W = 4.86\,\mu m$

Result: We have successfully performed DC, AC, transient and parametric analysis of source follower amplifier.

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Experiment No. 7

Aim: Simulation and analysis of source follower circuit.

Tools Required: Work Cadence (virtuoso)

Calculations:

Design Specifications — $V_{DD} = 1.8V$, $|A_V| = 0.9$, $V_{out} = 0.5V$
$k_n' = 300\,\mu A/V^2$, $I_D = 50\,\mu A$, $BW = 1\,MHz$, $L = 180nm$, $V_{th} = 0.5V$
R_L, g_m, $\frac{W}{L}$, $V_{in} = ?$

- $\because |A_V| = \frac{R_L}{R_L + 1/g_m}$ & $V_{out} = I_D R_L$
  $\Rightarrow \underline{R_L} = \frac{0.5}{50\mu} = \underline{10k\Omega}$
- $\Rightarrow 0.9(10k + 1/g_m) = 10k \Rightarrow \underline{g_m} = \underline{0.9mV}$
- $I_D = \frac{k_n'}{2}\left(\frac{W}{L}\right)(V_{gs} - V_{th})^2$ & $g_m = \sqrt{2k_n'\left(\frac{W}{L}\right) I_D}$

  $50\mu = \frac{300\mu}{2} \times \frac{8100}{3}(V_{gs} - V_{th})^2$

  $\Rightarrow V_{gs} - V_{th} = 0.11$

  $\because V_{gs} = V_{in} - V_{out}$

  $\therefore \underline{V_{in} = 1.11V}$

  $\Rightarrow \frac{W}{L} = \frac{(0.9m)^2}{2 \times 300\mu \times 50\mu}$

  for $\Rightarrow L = 0.18\,\mu m$

  $\underline{W = 4.86\,\mu m}$

Result: We have successfully performed DC, AC, transient and parametric analysis of source follower amplifier.