

HW4

ARDA ÜNAL

1)

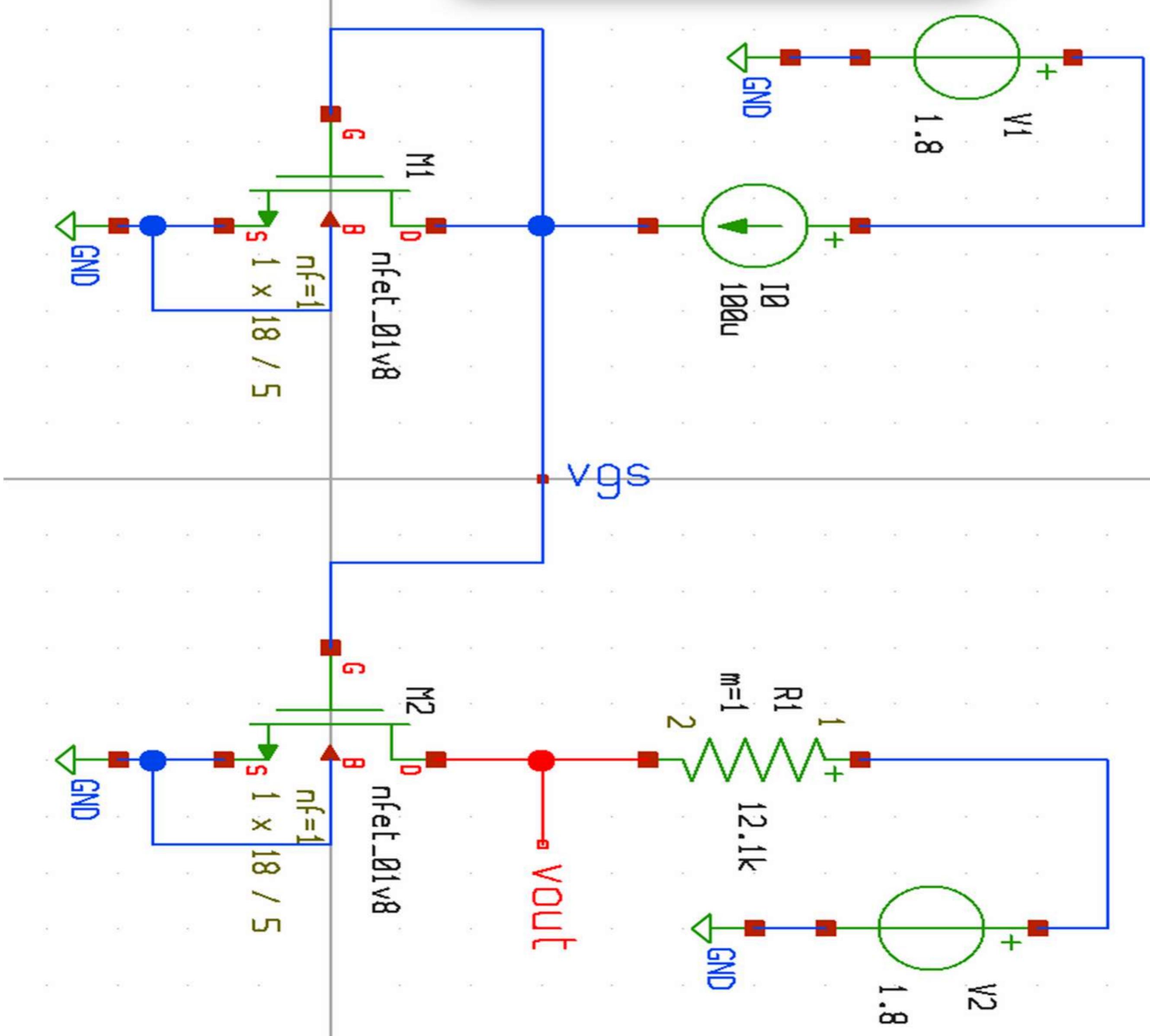
For $V_{out} = 0.6V$
 Error is
 0.9137%

```
hw41_simple.spice" -a || sh
Note: No compatibility mode selected!
Circuit: ** sch_path: /home/arda/Desktop/Advanced_Electronic_Circuits/hw4/hw41/
hw41_simple.sch
Doing analysis at TEMP = 27.000000 and THDM = 27.000000

Initial Transient Solution
```

Node	Voltage
net1	1.8
vgs	1.0174
net2	1.8
vout	0.601055
v2fb_branch	-9.30883e-05
v1fb_branch	-0.0001

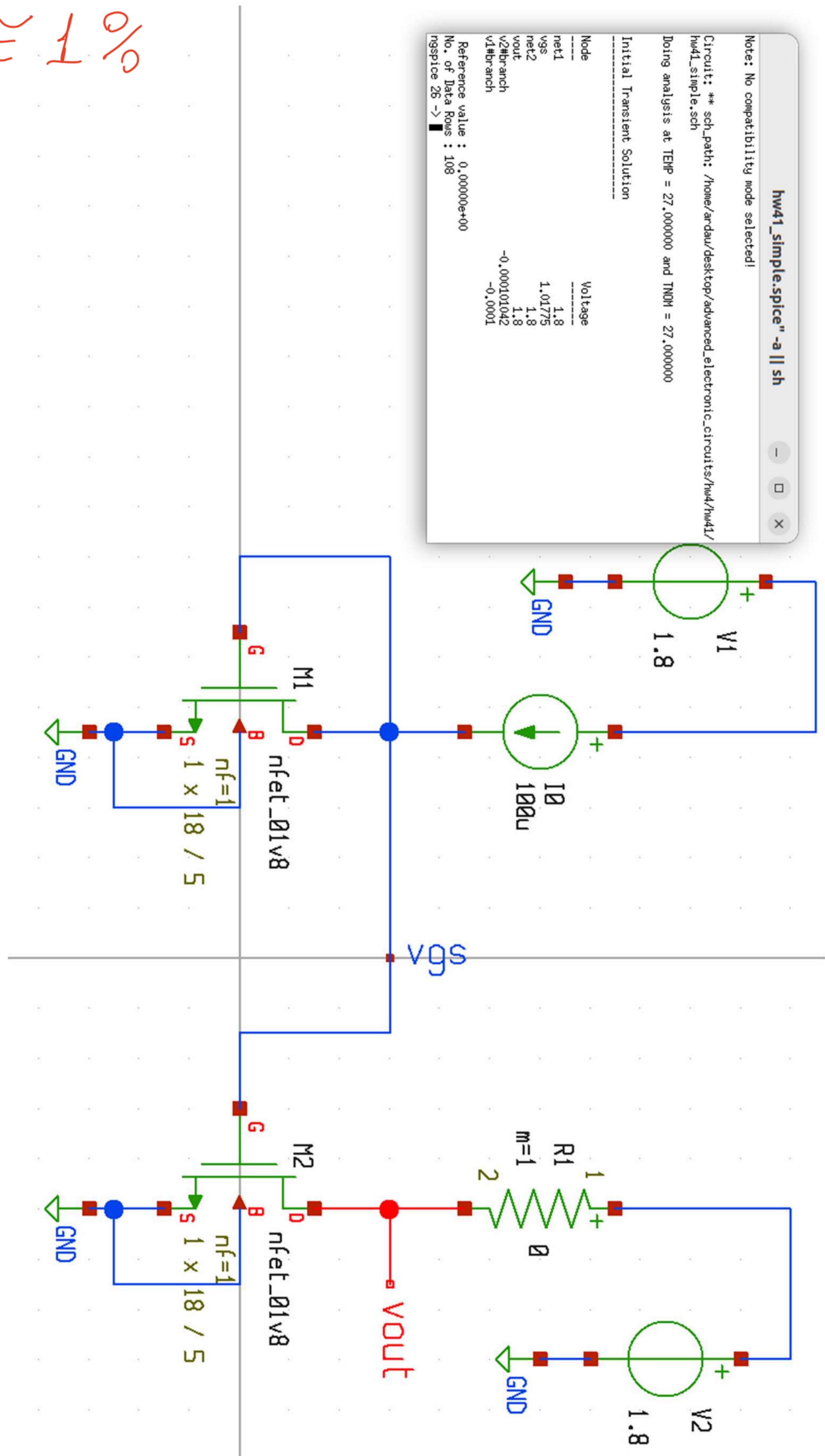
Reference value : 0.000000e+00
 No. of Data Rows : 108
 nspice 26 -> 1



Note: - V_2 #branch is the output current!

For $V = 1.8V$

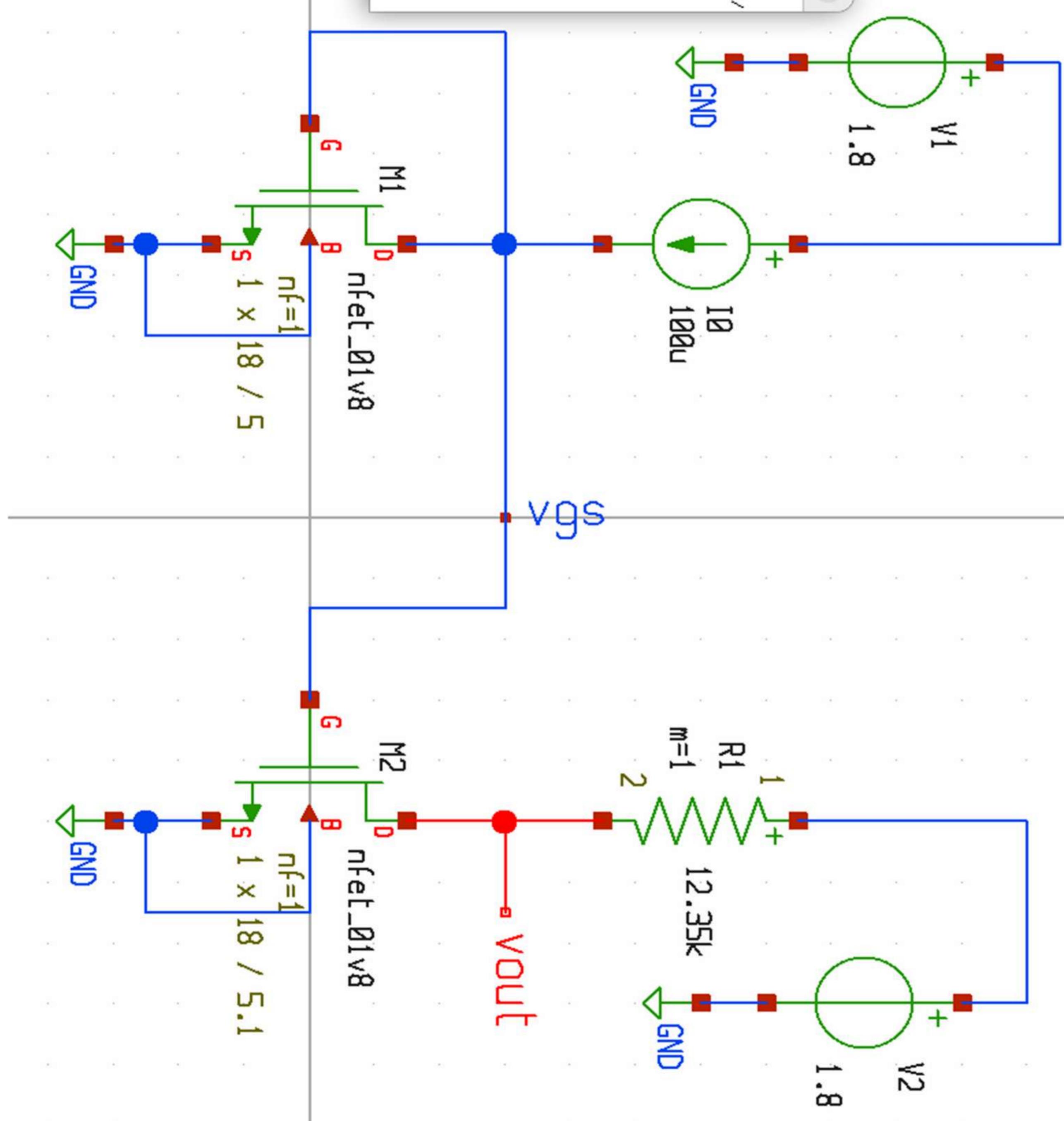
Error $\approx 1\%$



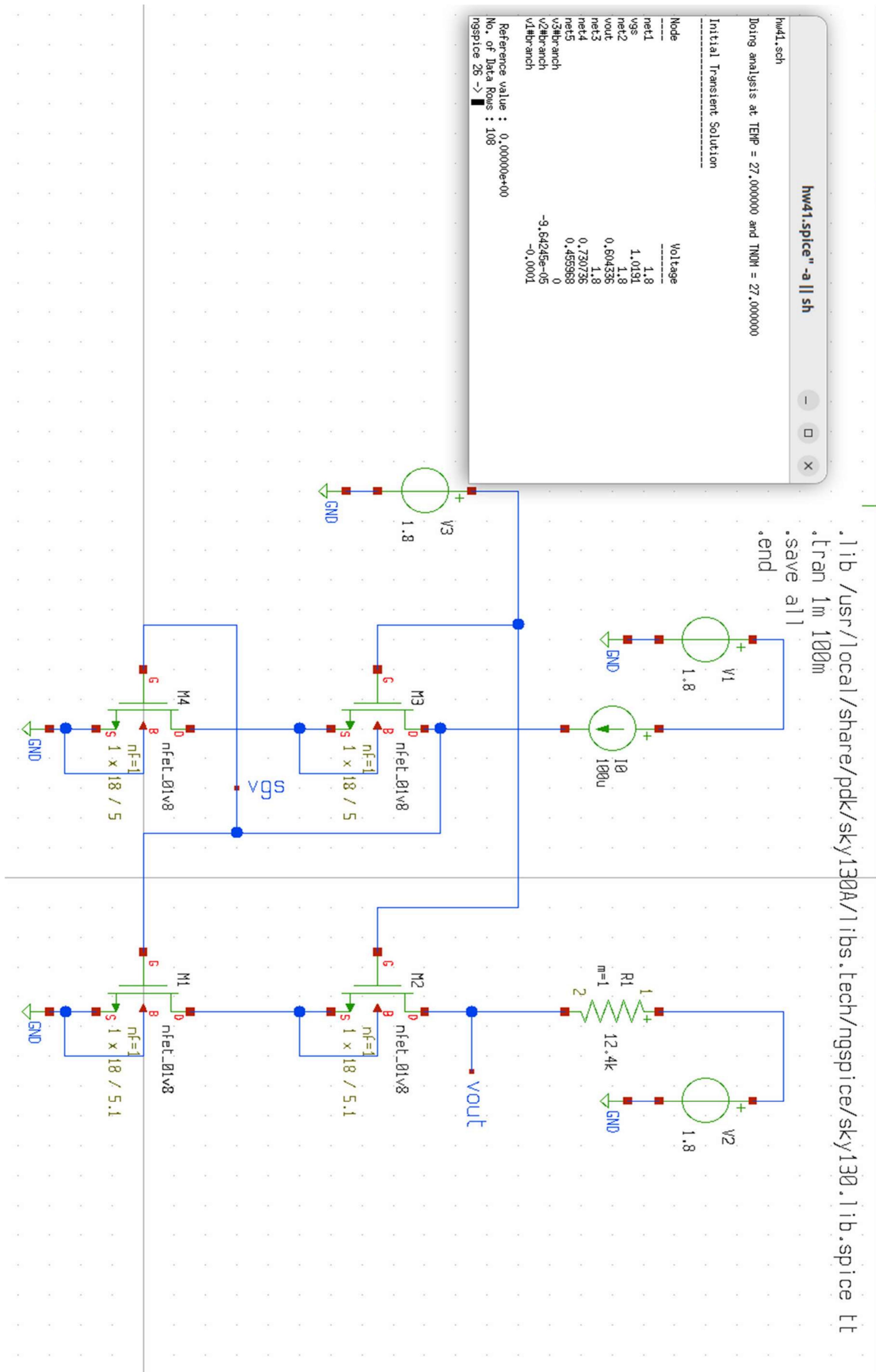
2)

For $V_{out} = 0.6V$
 $Error \approx 2.8\%$
 $L = L + 0.1$

```
hw41_simple.spice" -a || sh
Note: No compatibility mode selected!
Circuit: ** sch_Path: /home/ardau/desktop/advanced_electronic_circuits/hw4/hw41/
hw41_simple.sch
Doing analysis at TEMP = 27.000000 and TNOM = 27.000000
```

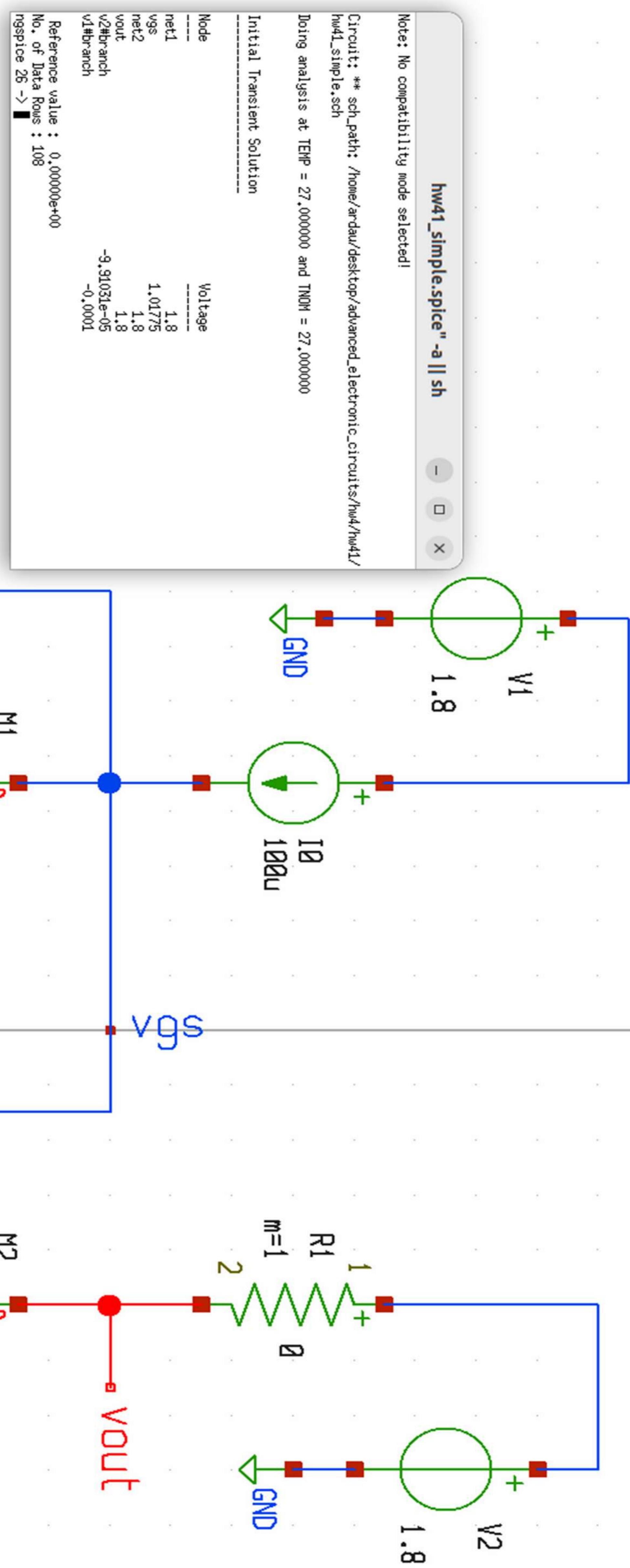


After improved current mirror, $L = L + 0.1$
 Error $\approx 3.575\%$ for $V_{out} = 0.6V$



$$L = L + 0.1, \quad V_{out} = 1.8V$$

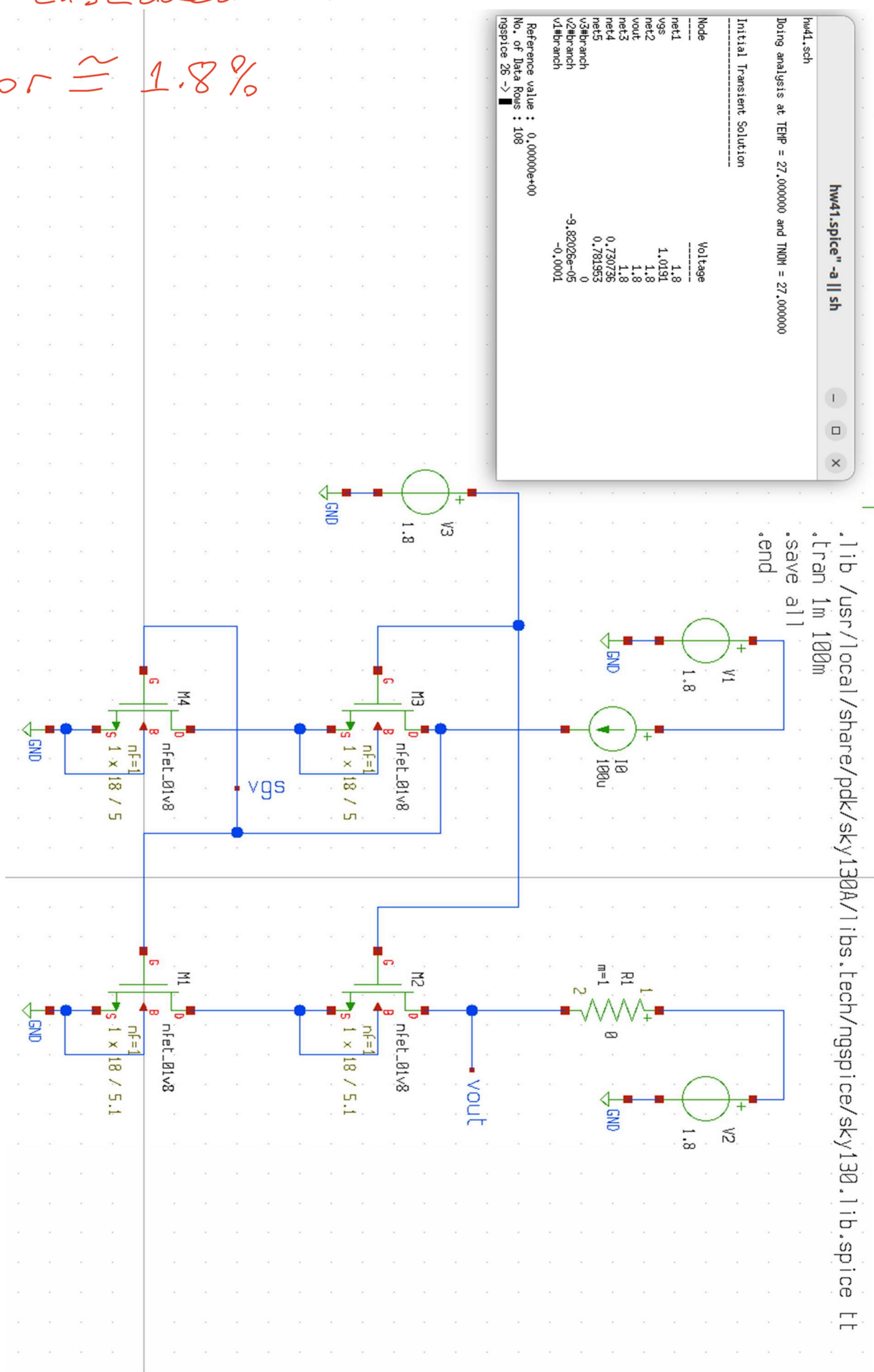
Error $\approx 0.9\%$



$$L = L + 0.1, V_{out} = 1.8V$$

For cascaded current mirror

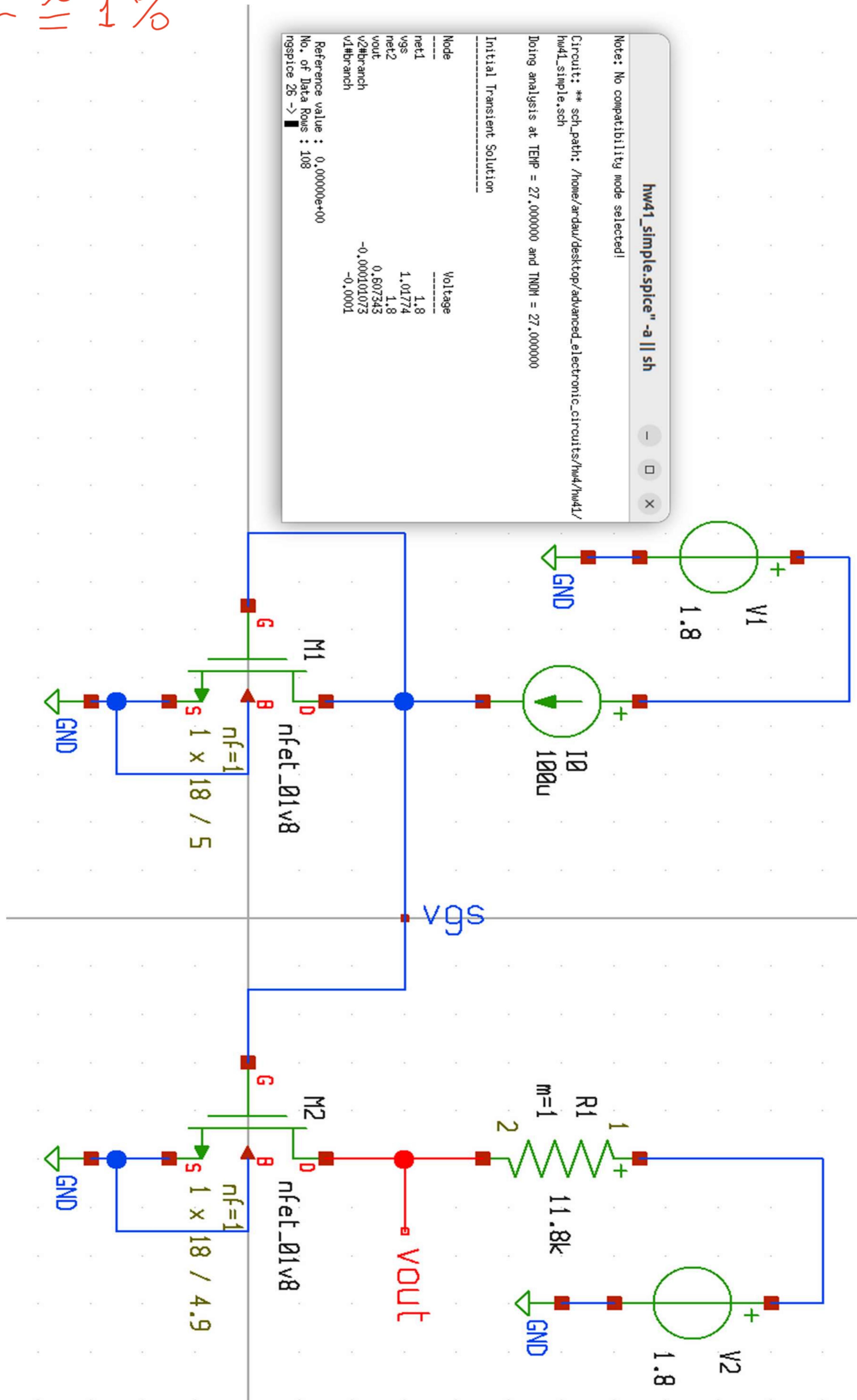
Error $\approx 1.8\%$



$$L = L - 0.1$$

$$V_{out} = 0.6$$

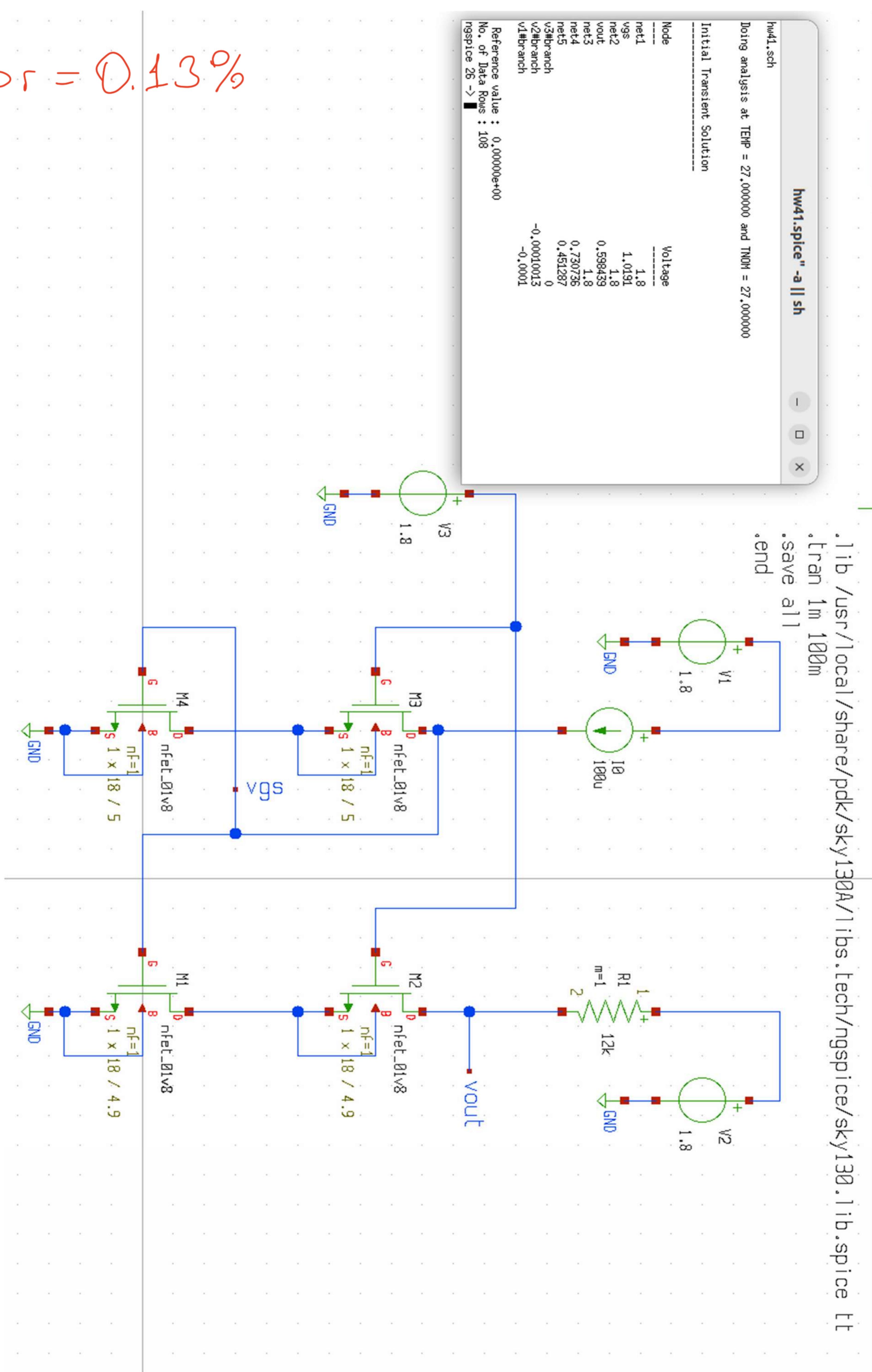
Error $\approx 1\%$



$$L = L - 0.1, V_{out} = 0.6V$$

For cascaded current mirror

$$\text{Error} = 0.13\%$$



$$L = L - Q \cdot 1$$

$$V_{out} = 1.8V$$

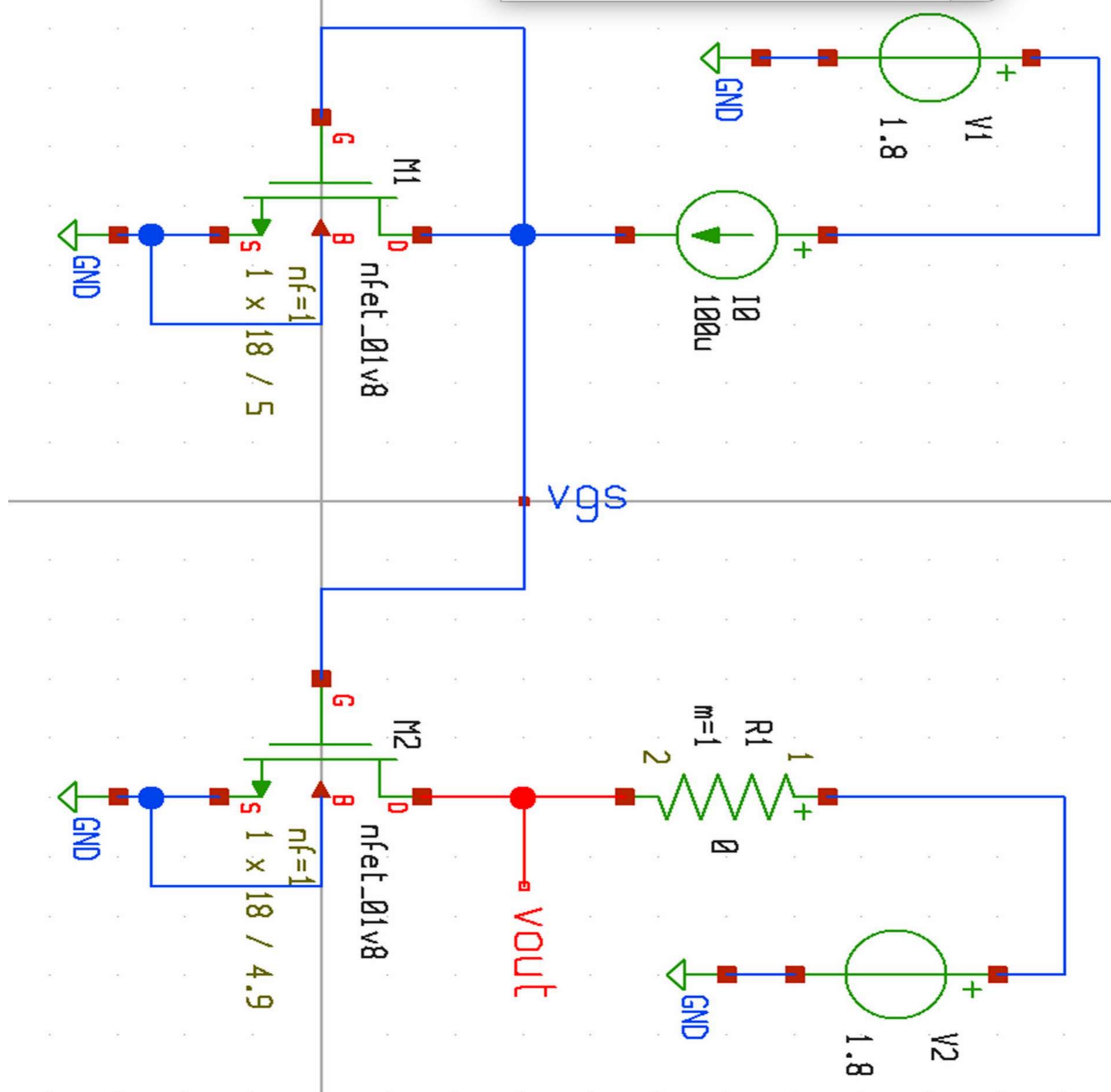
$$\text{Error} \approx 3\%$$

```
hw41_simple.spice" -a || sh
Note: No compatibility mode selected!
Circuit: **sch_path: /home/ardau/Desktop/advanced_electronic_circuits/hw4/hw41/
hw41_simple.sch
Doing analysis at TEMP = 27.000000 and TNOM = 27.000000

Initial Transient Solution
-----
```

Node	Voltage
net1	1.8
vgs	1.01775
net2	1.8
vout	1.8
v2#branch	-0.000103058
v1#branch	-0.0001

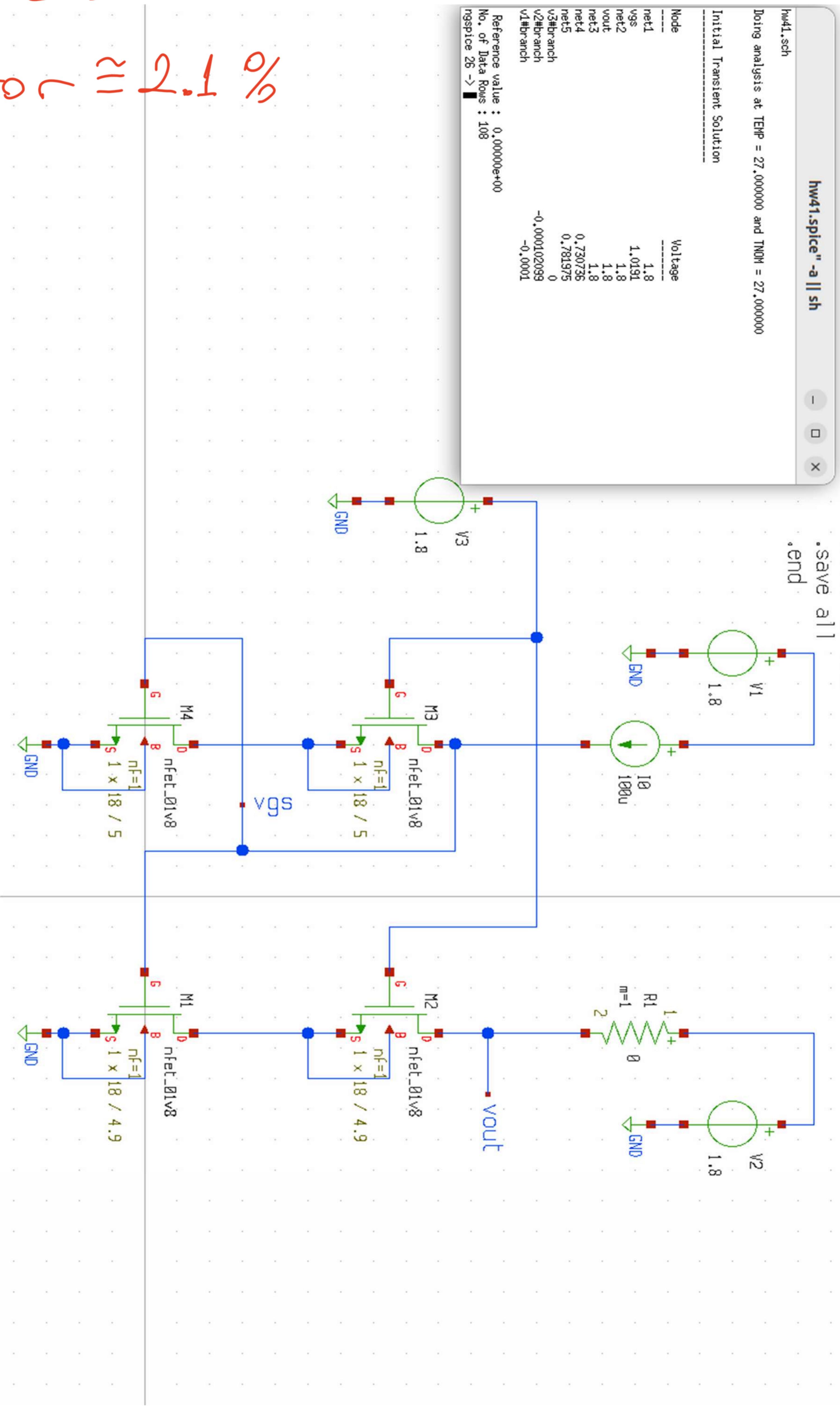
Reference value : 0.00000e+00
No. of Data Rows : 108
ngspice 26 -> ■



$$L = L - 0.1 \quad V_{out} = 1.8V$$

For cascoded current mirror

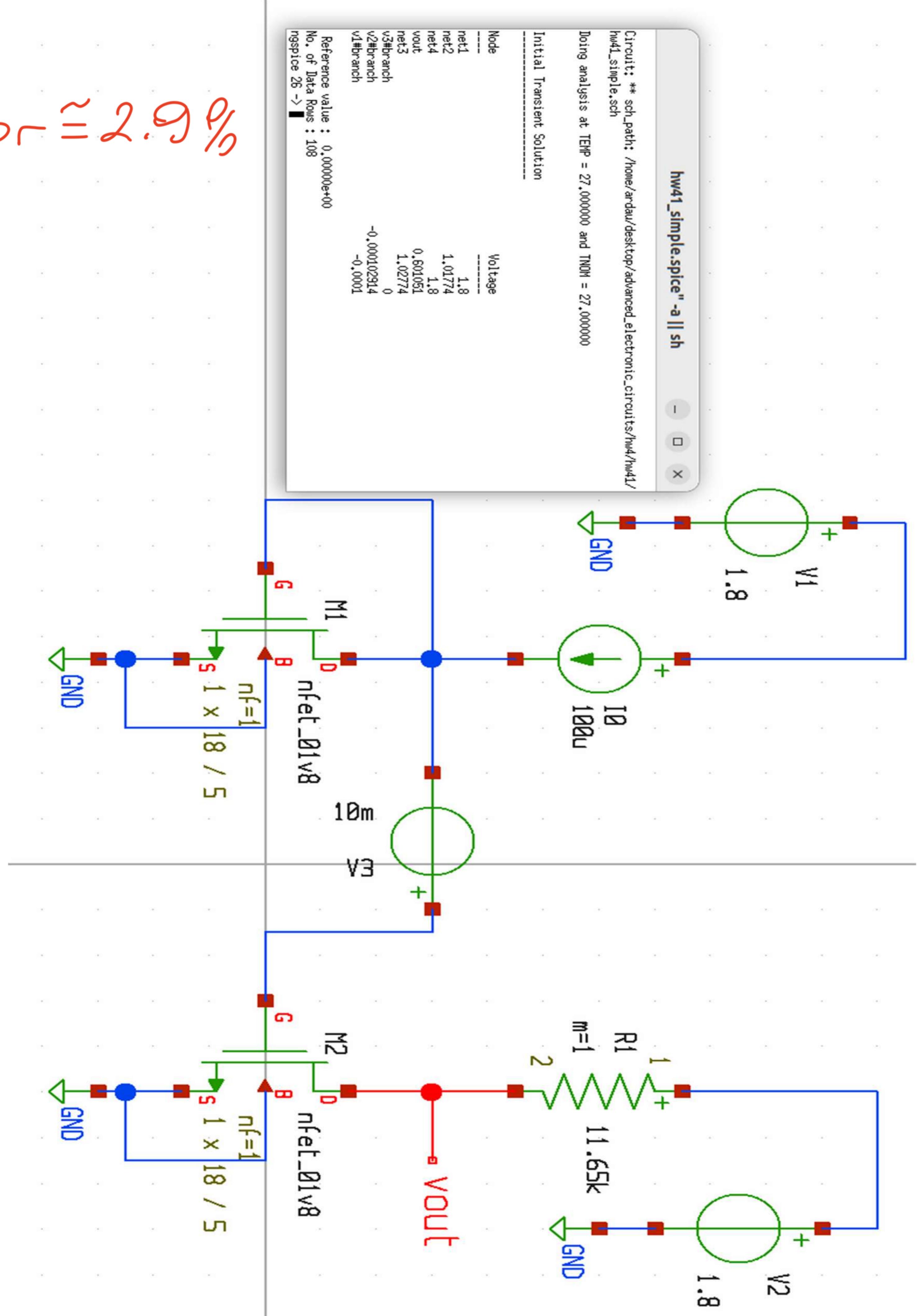
$$\text{Error} \approx 2.1\%$$



$$V_{t,\text{error}} = 10 \text{ mV}, \quad V_{\text{out}} = 1.8 \text{ V}$$

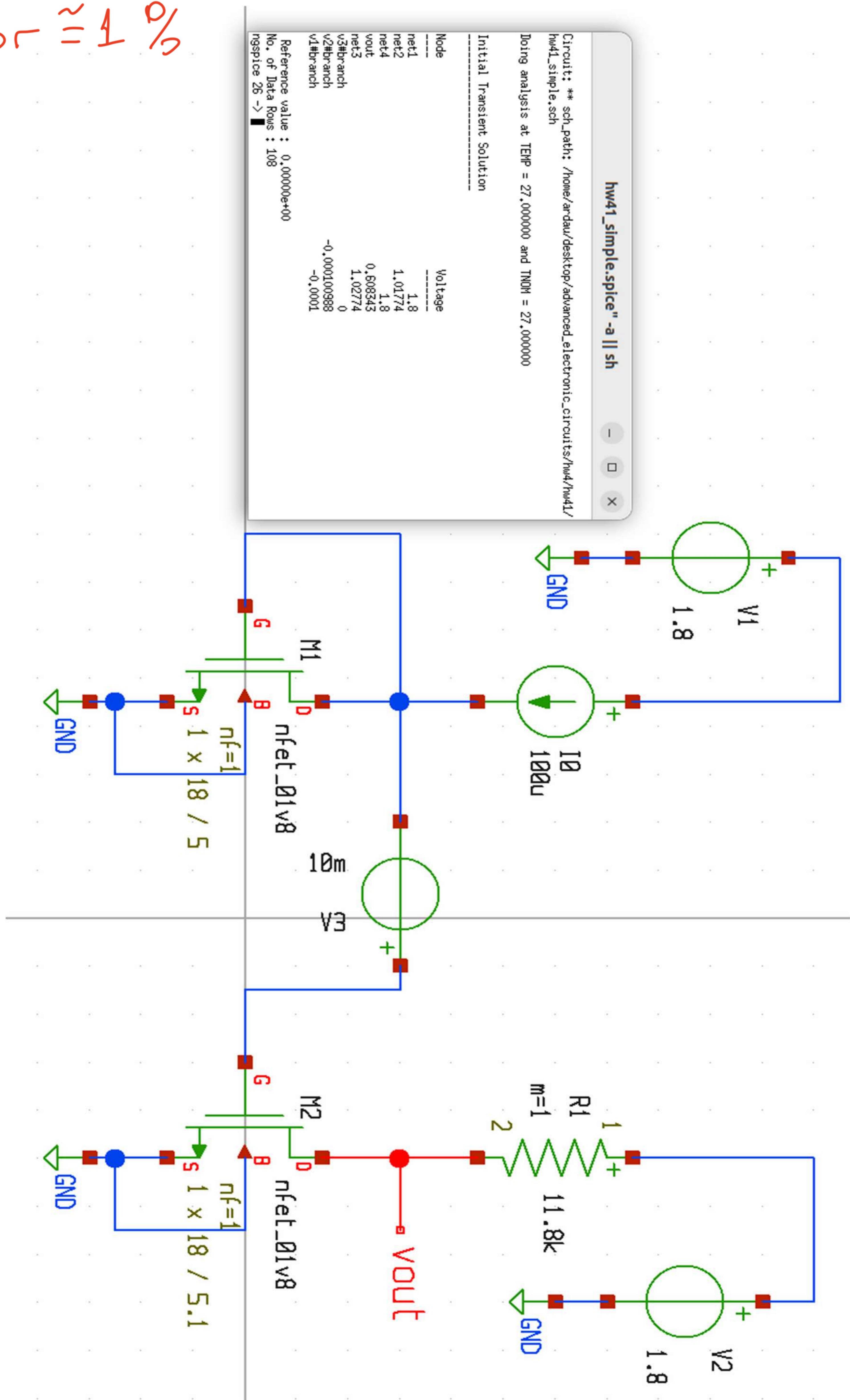
3)

$$\text{Error} \approx 2.9\%$$



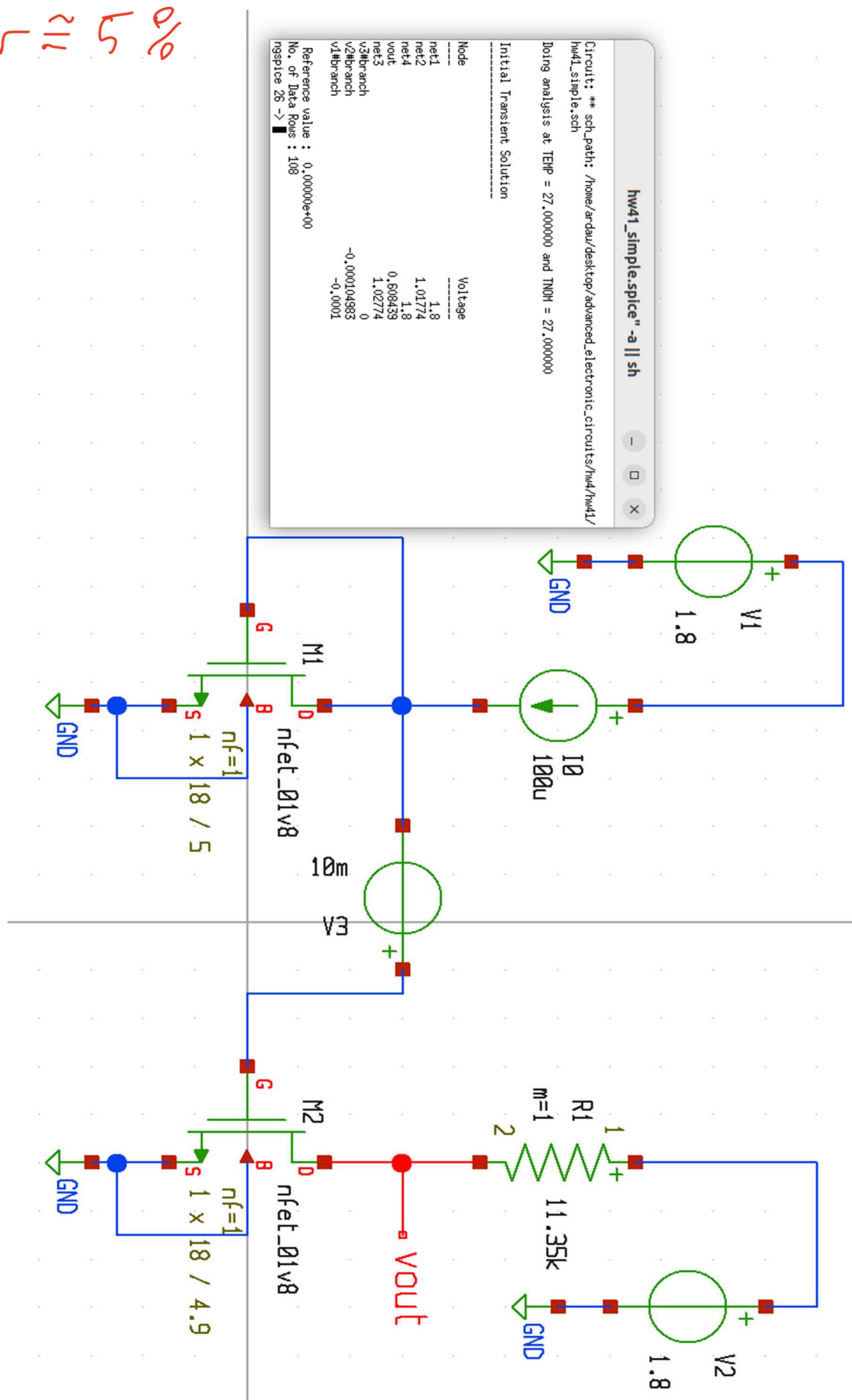
$$V_{out} = 0.6, \quad L = L + 0.1, \quad V_{t,error} = 10mV$$

Error $\approx 1\%$



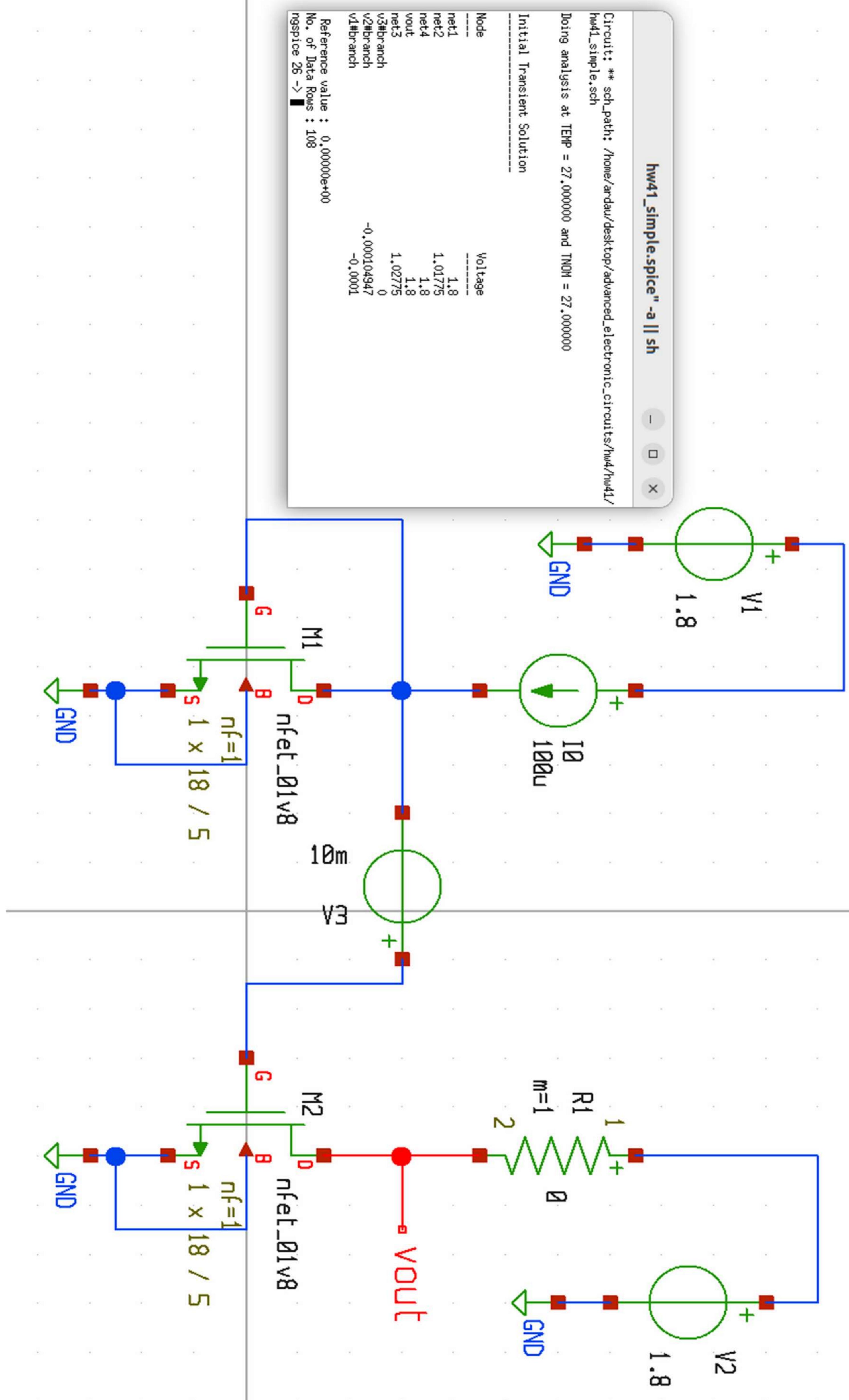
$$V_{out} = 0.6, \quad L = L - 0.1, \quad V_{t,error} = 10mV$$

Error $\approx 5\%$



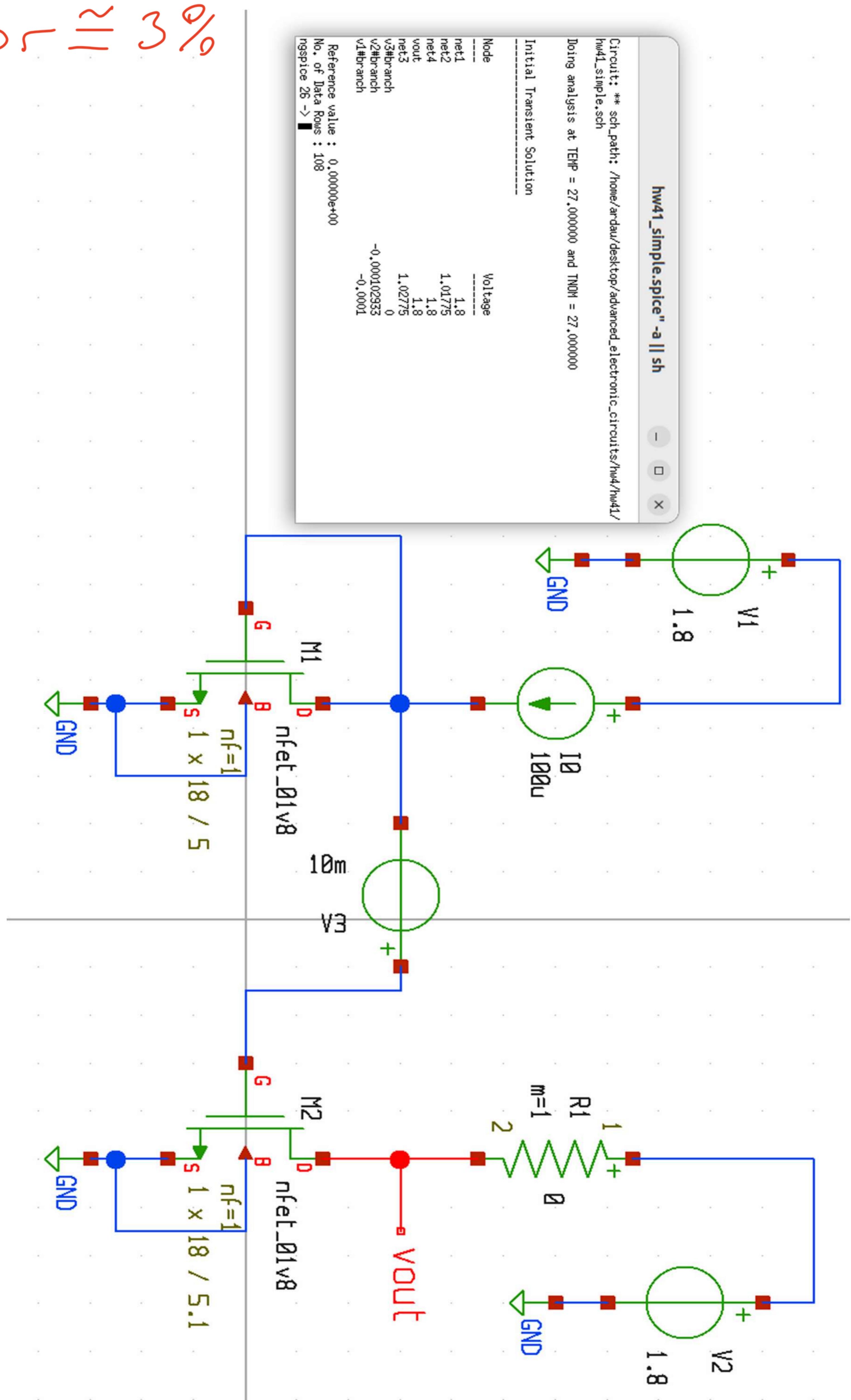
$$V_{out} = 1.8V, \quad L = L, \quad V_{t,error} = 10mV$$

$$\text{Error} \approx 4.95\%$$



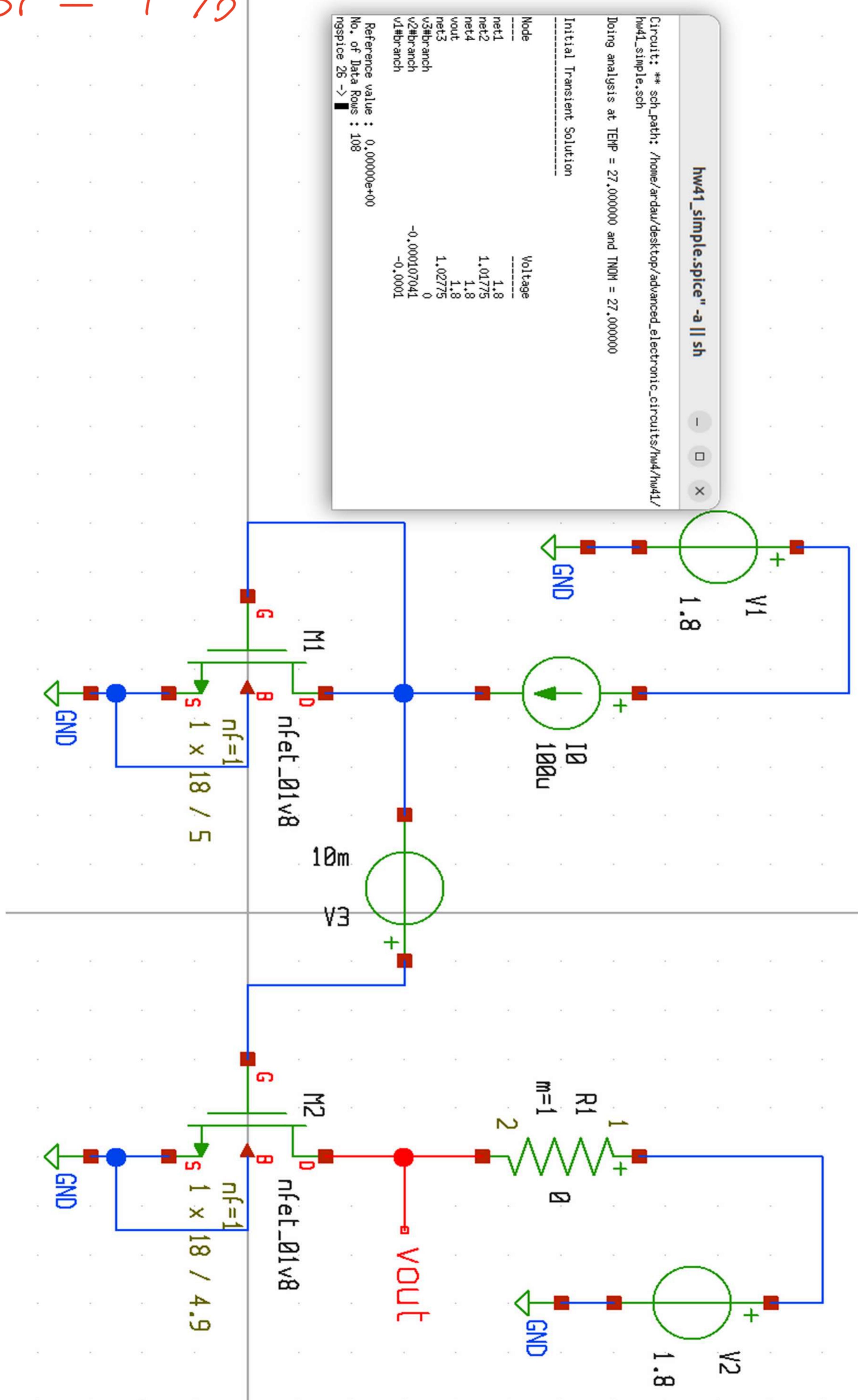
$$V_{out} = 1.8 \text{ V}, \quad L = L + Q.1, \quad V_{t,error} = 10 \text{ mV}$$

Error $\approx 3\%$



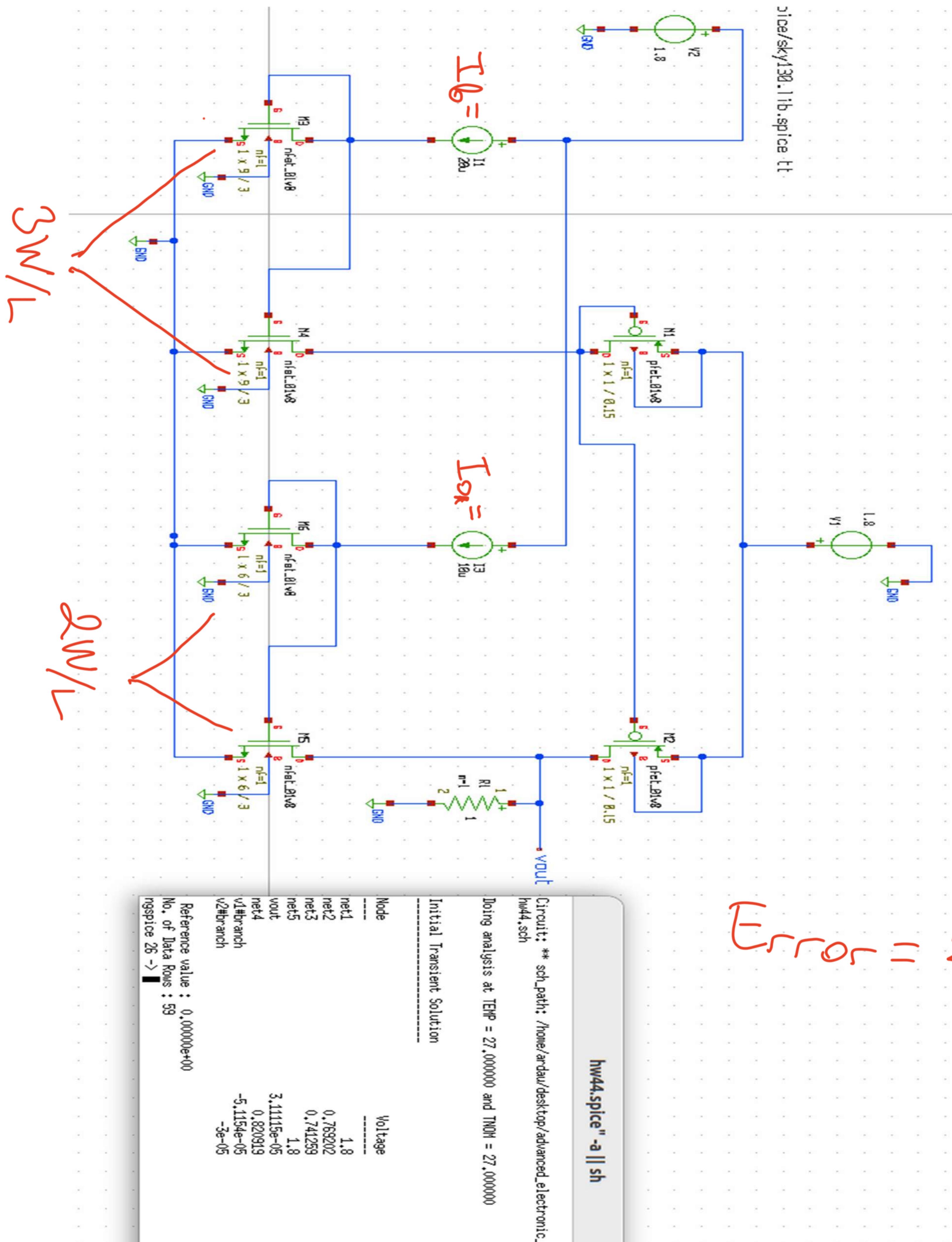
$$V_{out} = 1.8V, \quad L = L - Q.1, \quad V_{t,error} = 10mV$$

Error = 7%



4)

I found this circuit from a paper

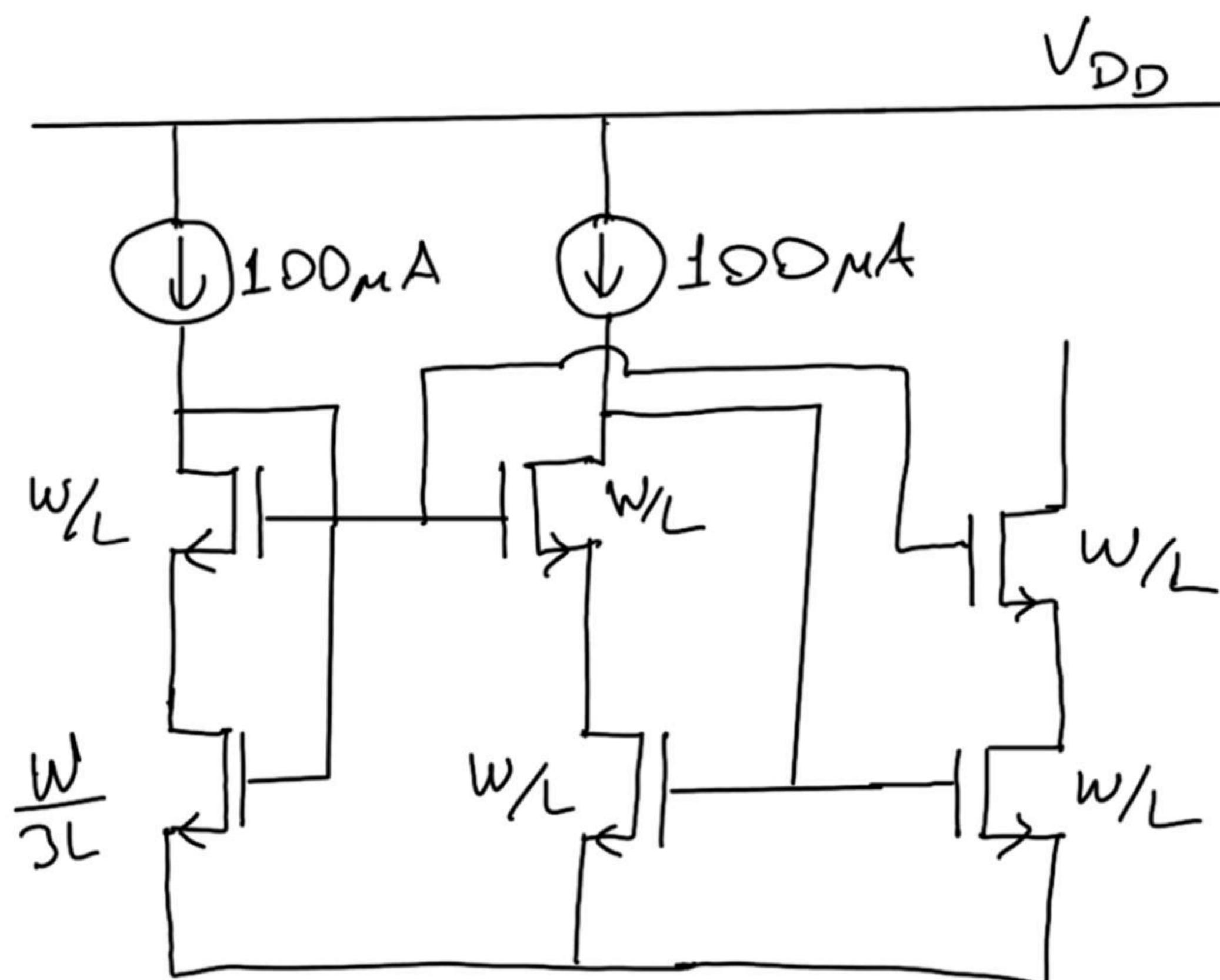


Error = 22.25 %

5)

HW4

5) Modified Sooch Current Mirror



$$V_{IN(max)} = 0.5 + 2 \times 0.3 = 1.1V$$

$$I_D = \frac{\mu_n C_o x}{2} \frac{W}{L} (0.15)^2 (1 + 2 \times 0.15)$$

$$\Rightarrow \frac{W}{L} = 68 \text{ assuming } \lambda = 1.5$$

$$\text{let } L = 0.3, \text{ then } W = 20.4$$



From Huawei Notepad

