Project report

EE5780 VLSI CAD

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Software package introduction

Where to find the code?

Path: All the code is put into the source folder: …release\source

How to run the circuit solver?

1. Double click (open) the <main.m> file, click 'run' demand of matlab(F5 key);
2. Select the ckt file in the folder : …release\ckt_files
3. After some indication, the results will be printed out in the command window, or plotted in new popped windows.
4. Enjoy ☺

What the purpose of each function file?

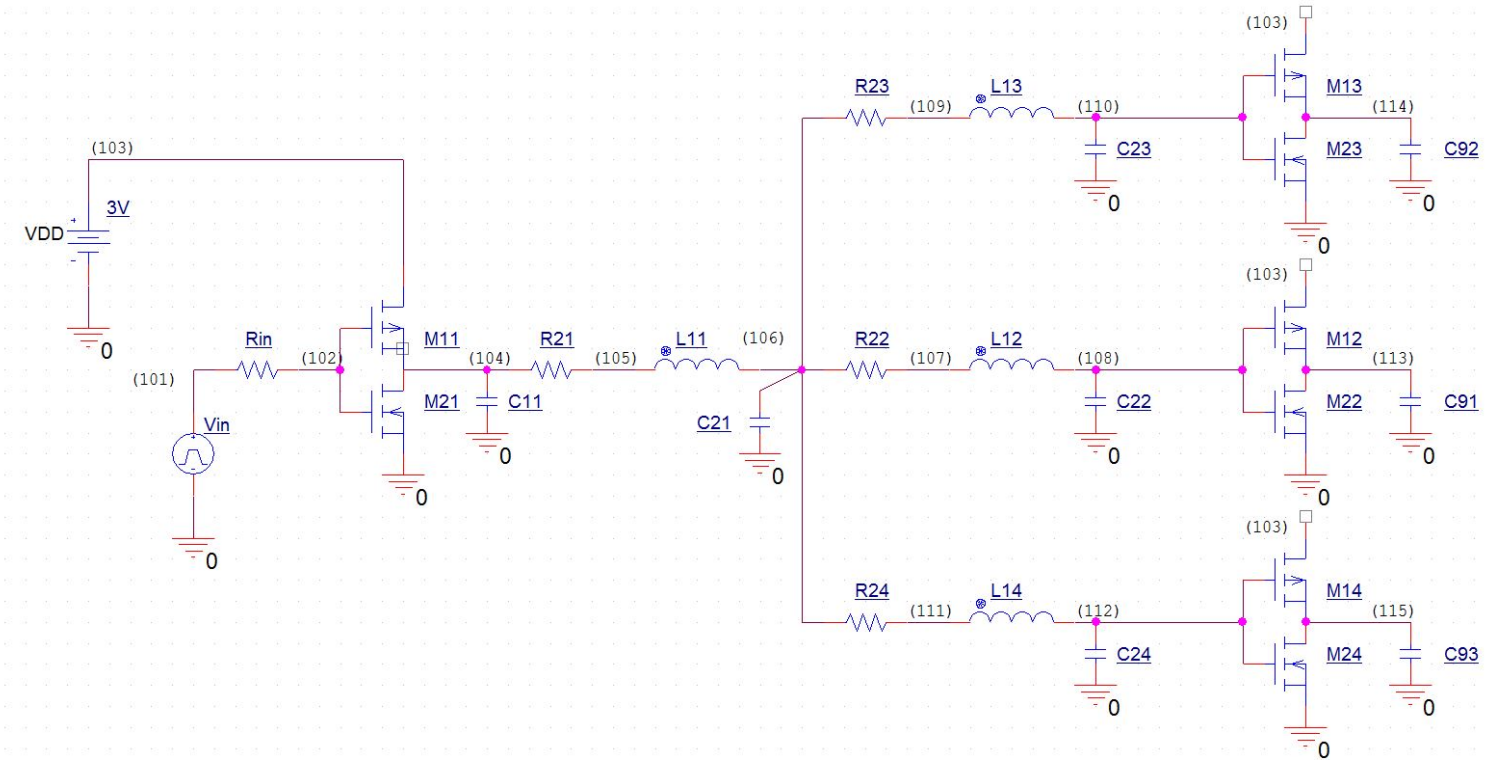
The function sheet is listed as table below, among them, <main.m>, <DCanlysis.m>, <TRanlysis.m> and <ACanlysis.m> are most important.

	Responsibility	Manipulation
main.m	• Entry of the software; • Main control flow of the software	• AWE or not switching • NR tolerant value setting • Gmin step setting
DCanlysis.m	• Linear DC analysis solver. • Nonlinear DC analysis solver(gmin+NR method). • Called by TRanlysis.m to perform transient analysis.	
TRanlysis.m	• Transient analysis solver using Trapezoidal modals • Time domain iteration • Call DCanlysis.m to calculate at each time point	
ACanlysis.m	• AC analysis solver using both LU method and AWE • Output the stream for plotting Bode diagram • LU method or AWE can be swithing by setting the global variant 'AWE' to true or false	
ScanCKT.m	• Parse the .ckt file into cells in matlab	
Outstream.m	• Print the result or plotting the curve	
Loc.m	• Some local function in programming	
FindDC.m	• Some local function in programming	
Mat_size.m	• Some local function in programming	

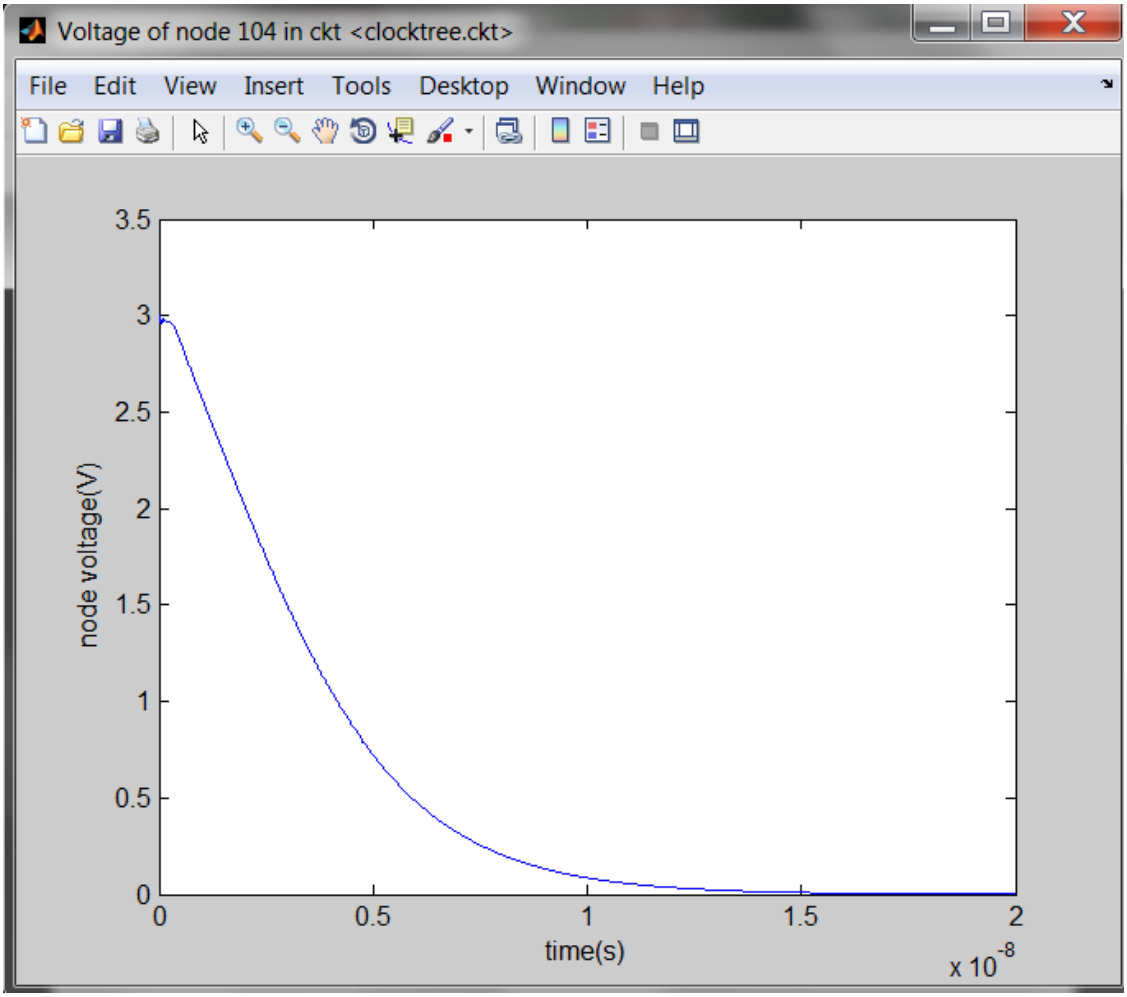
Results

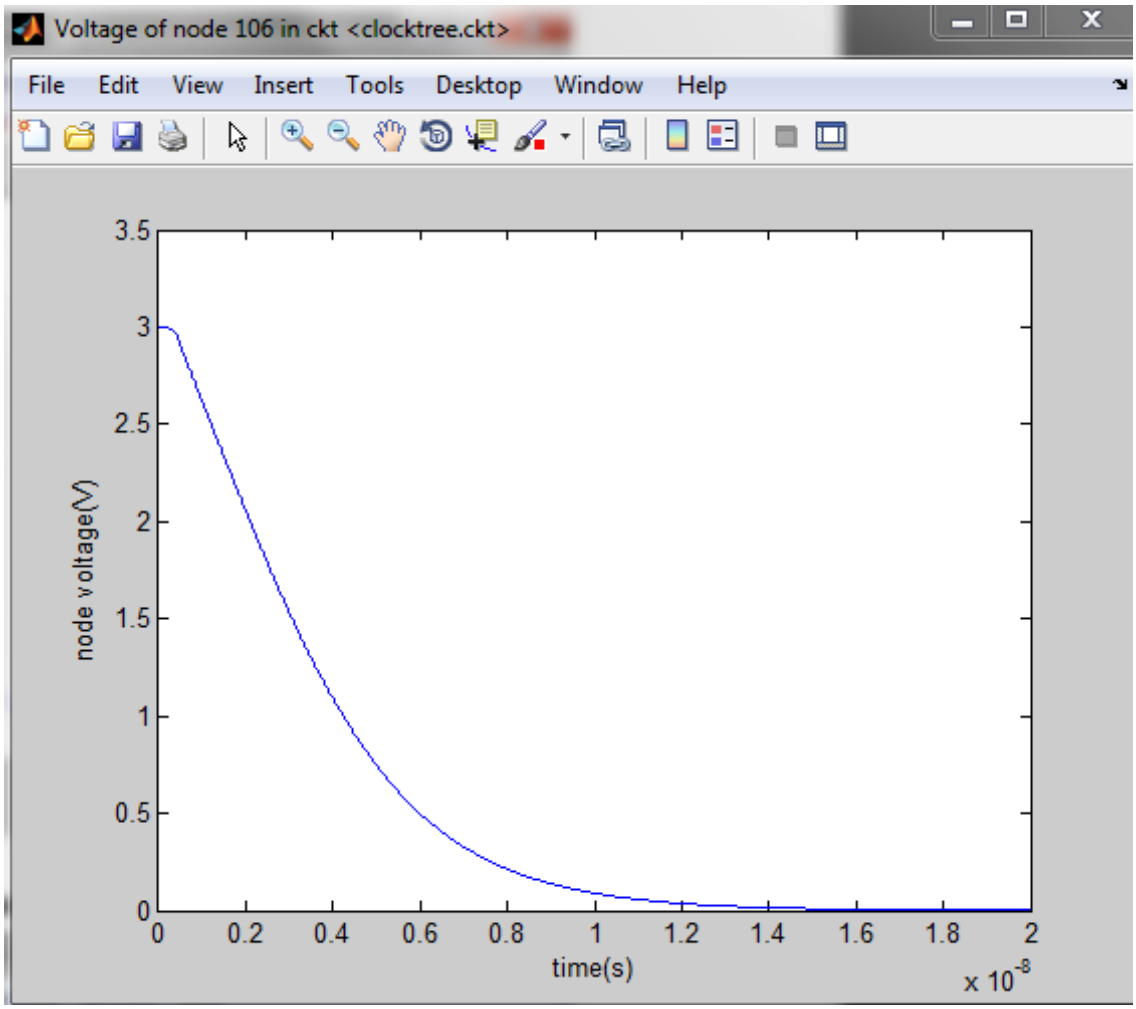
DC and transient analysis

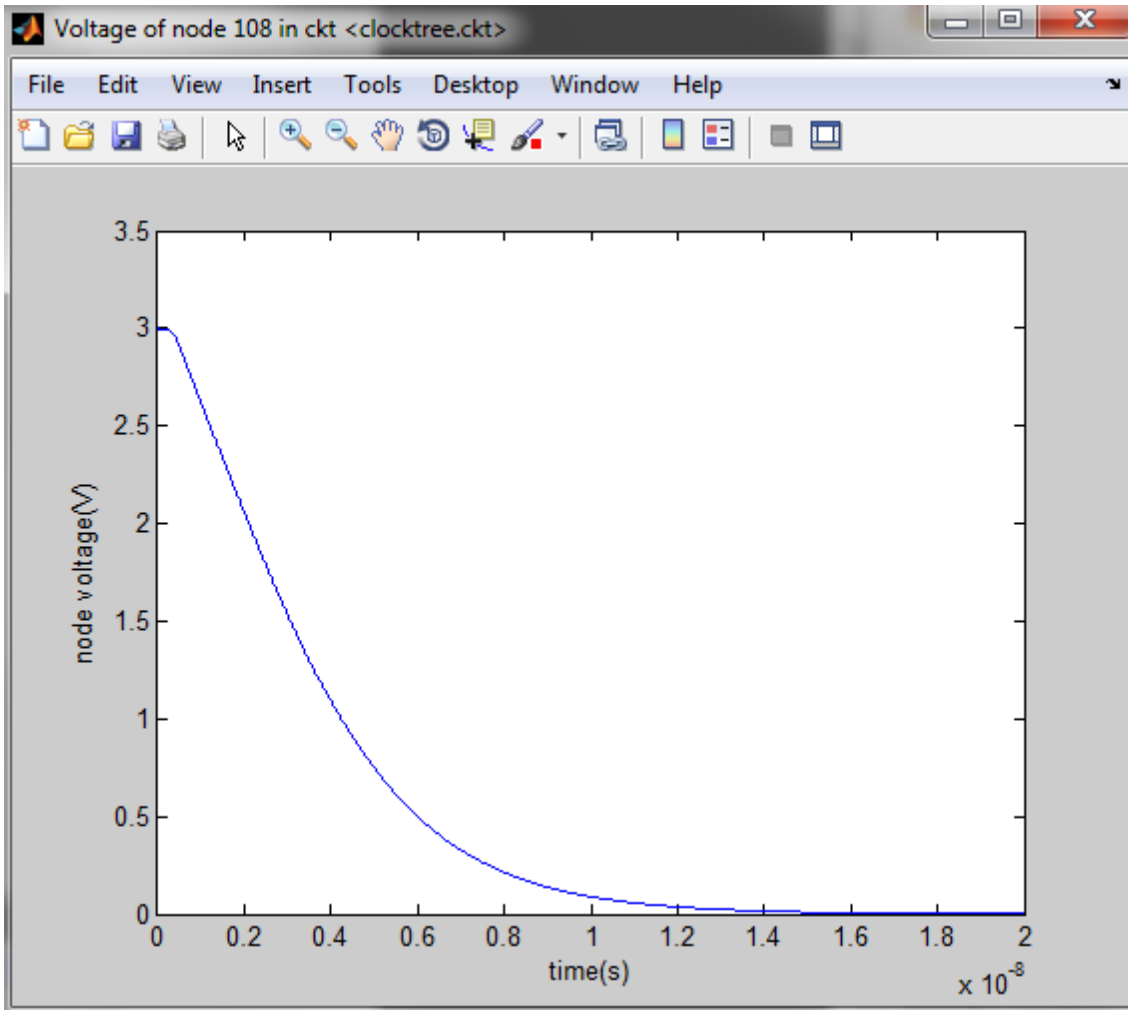
Clocktree.ckt

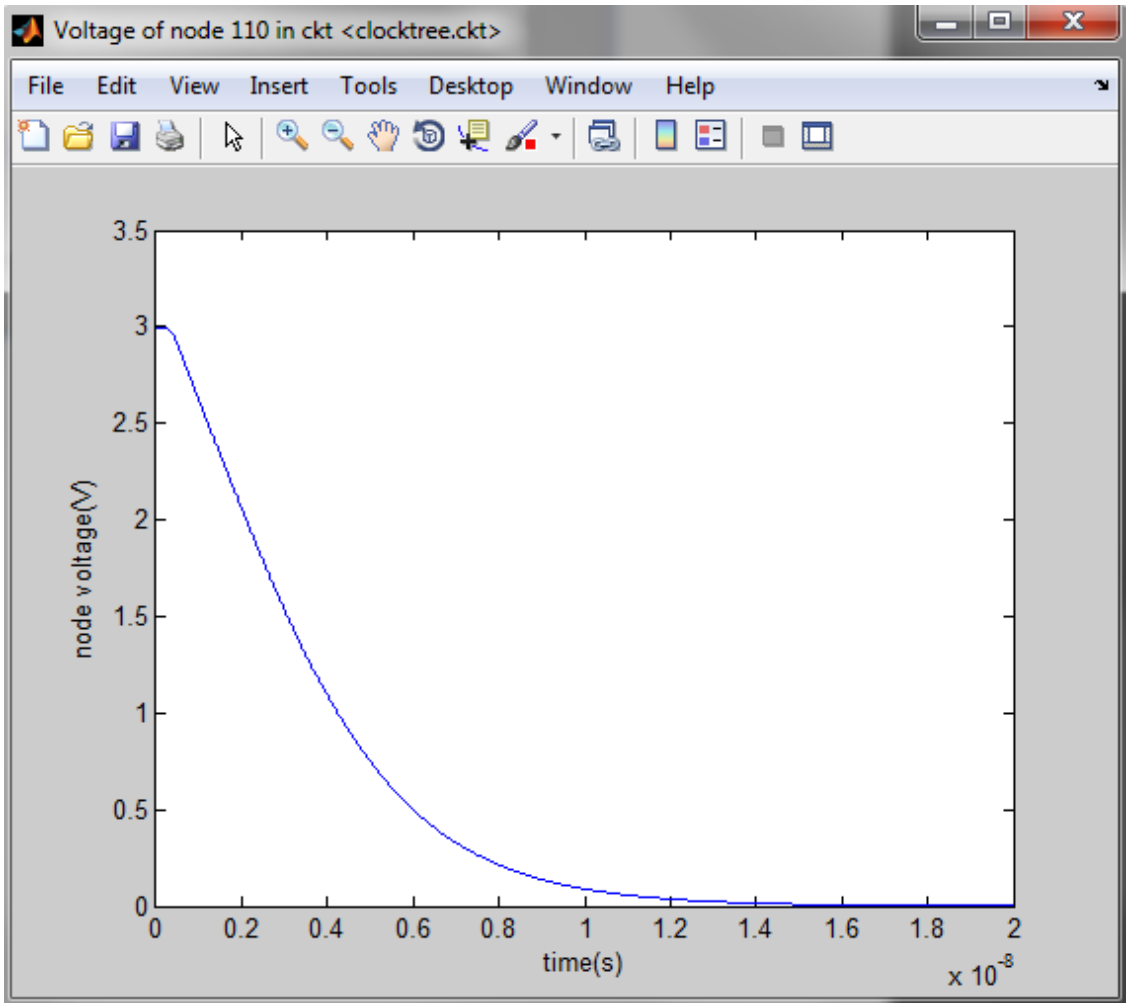


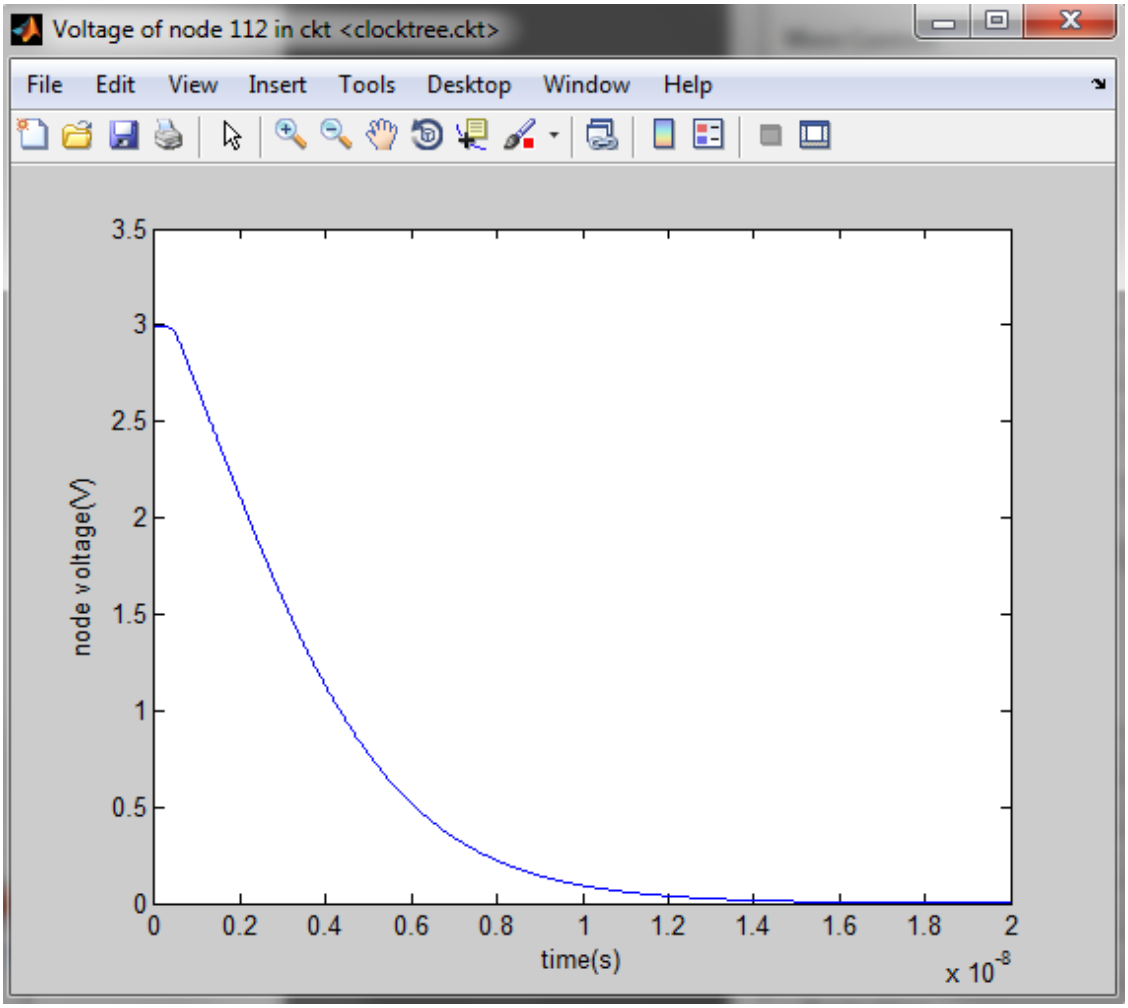
Result

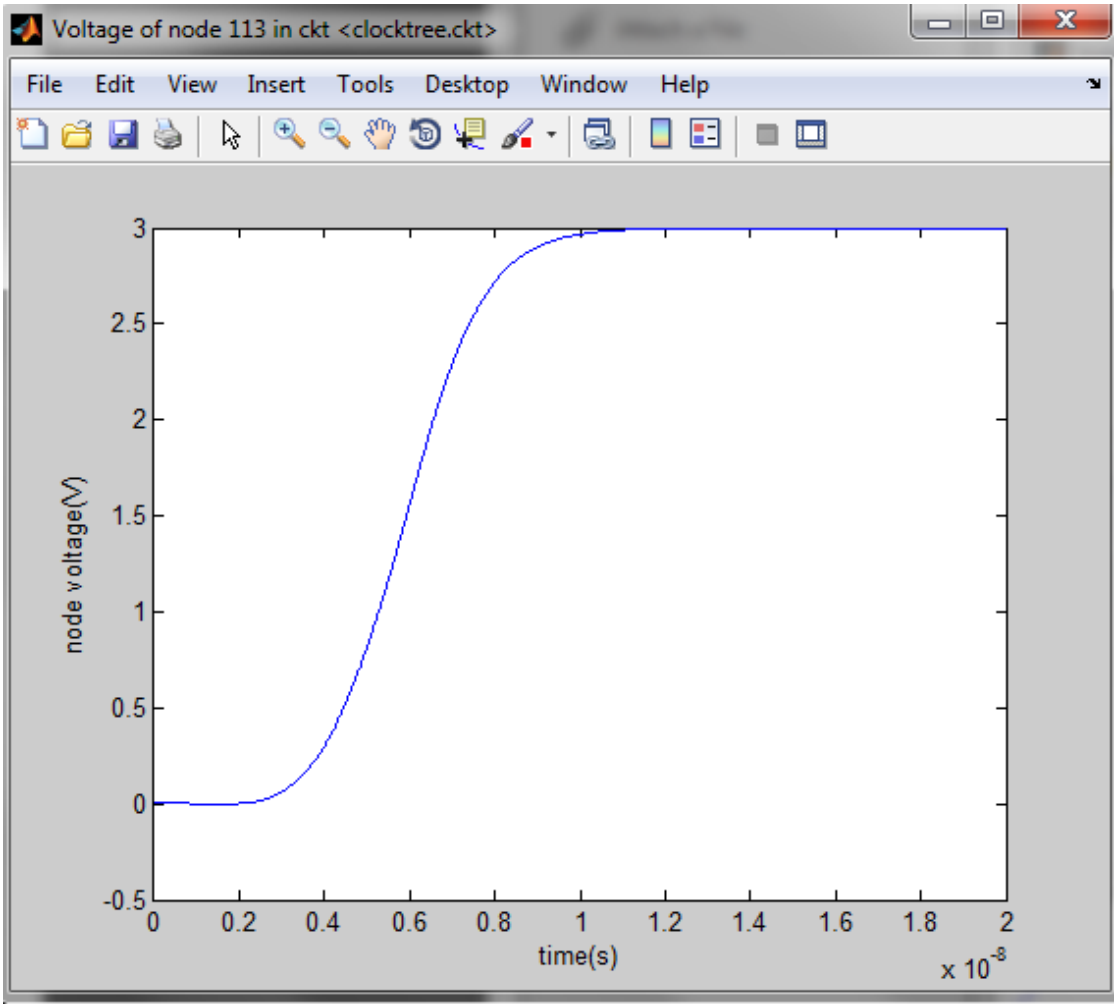

Voltage of node 104 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0
0.5
1
1.5
2
2.5
3
3.5

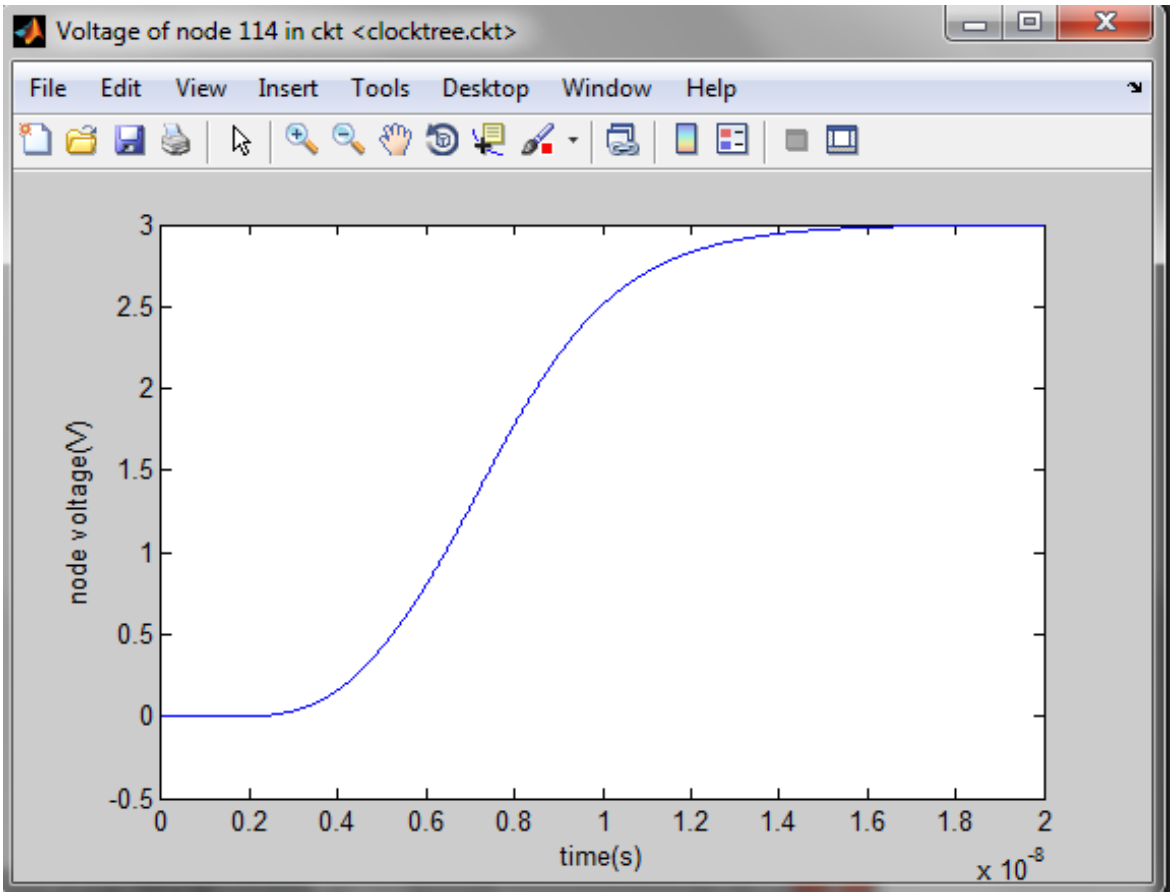

Voltage of node 106 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0.5
1.5
2.5
3
3.5

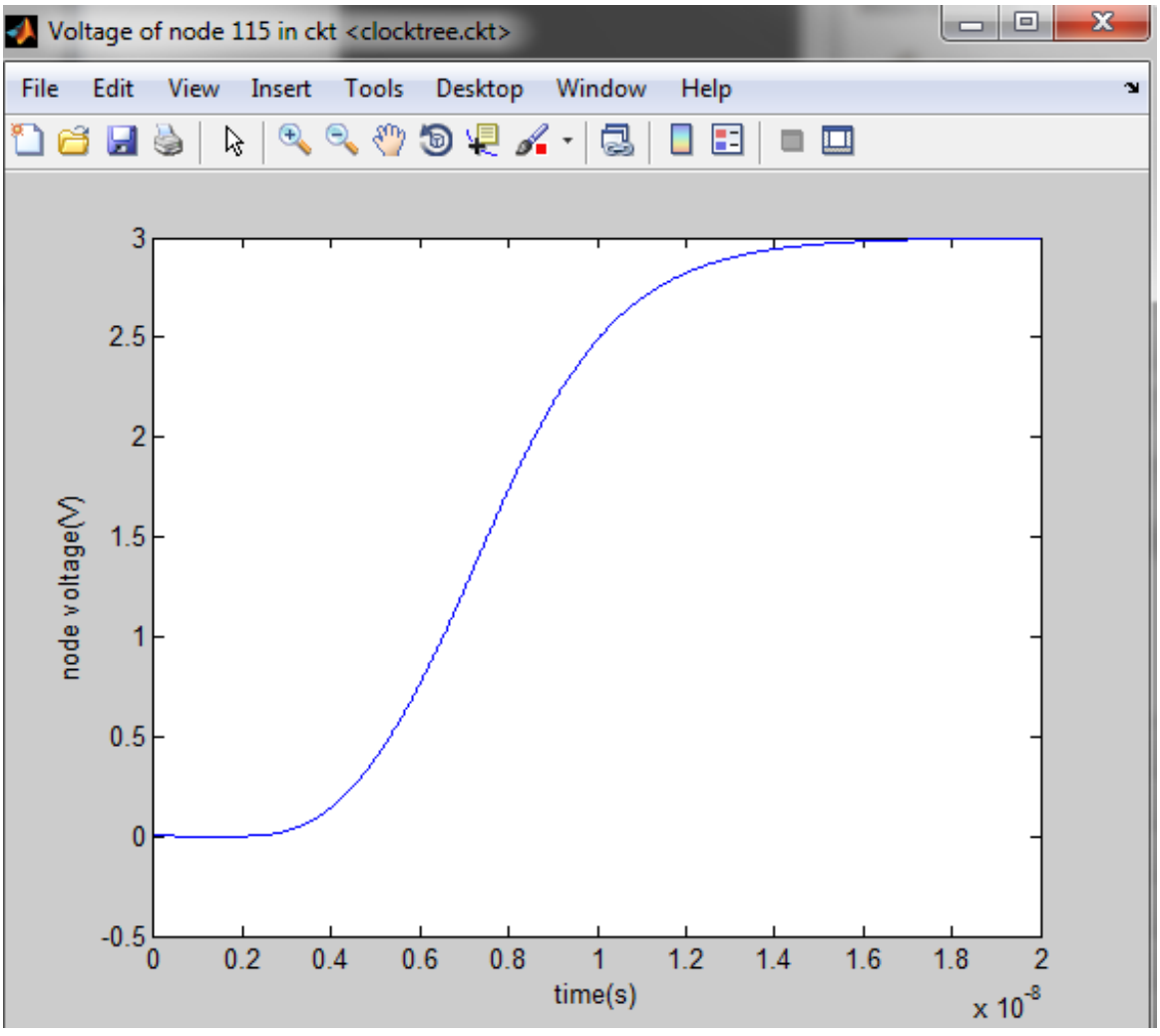

Voltage of node 108 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0 0.5 1 1.5 2 2.5 3 3.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2


Voltage of node 110 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0 0.5 1 1.5 2 2.5 3 3.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

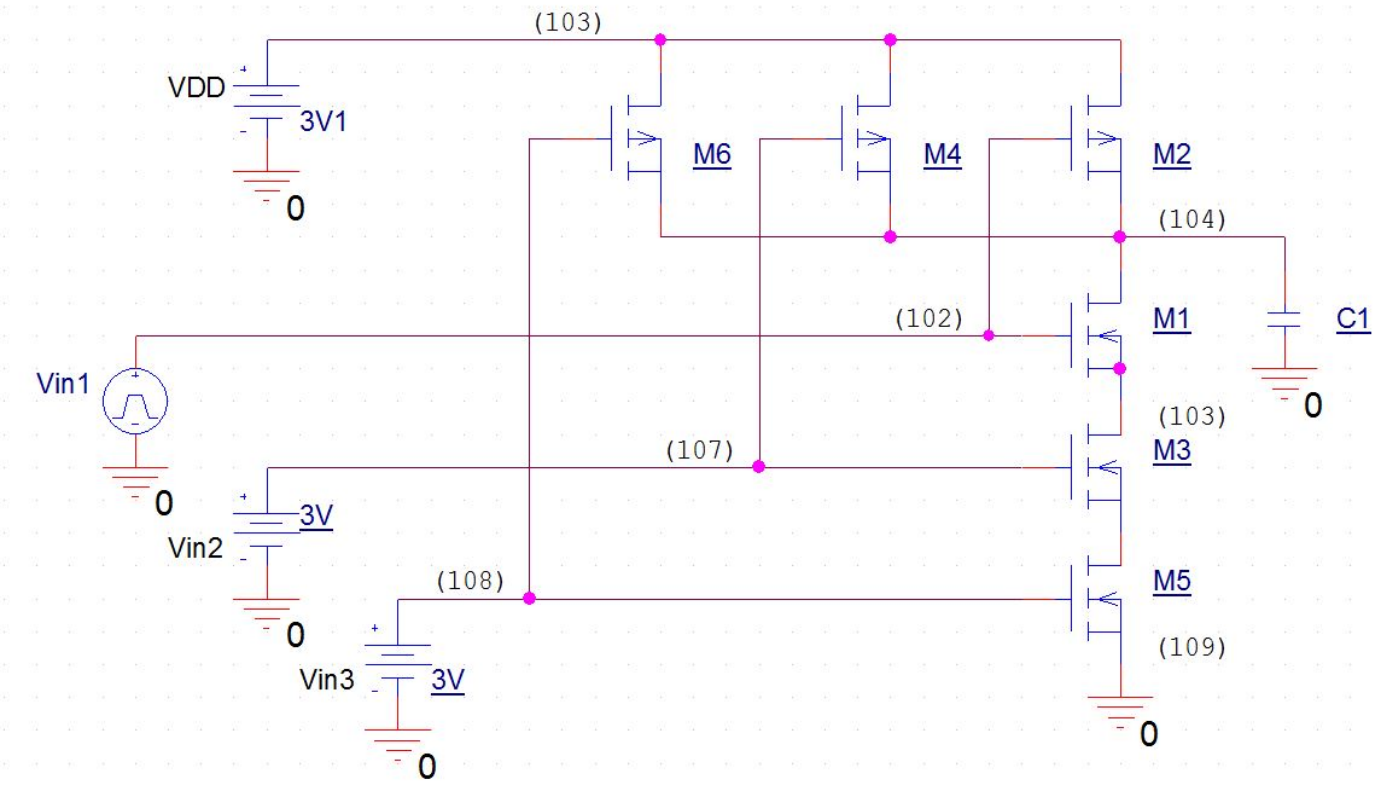

Voltage of node 112 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0 0.5 1 1.5 2 2.5 3 3.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2


Voltage of node 113 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
-0.5 0 0.5 1 1.5 2 2.5 3
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2


Voltage of node 114 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
3
2.5
2
1.5
1
0.5
0
-0.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2


Voltage of node 115 in ckt <clocktree.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
3
2.5
2
1.5
1
0.5
0
-0.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

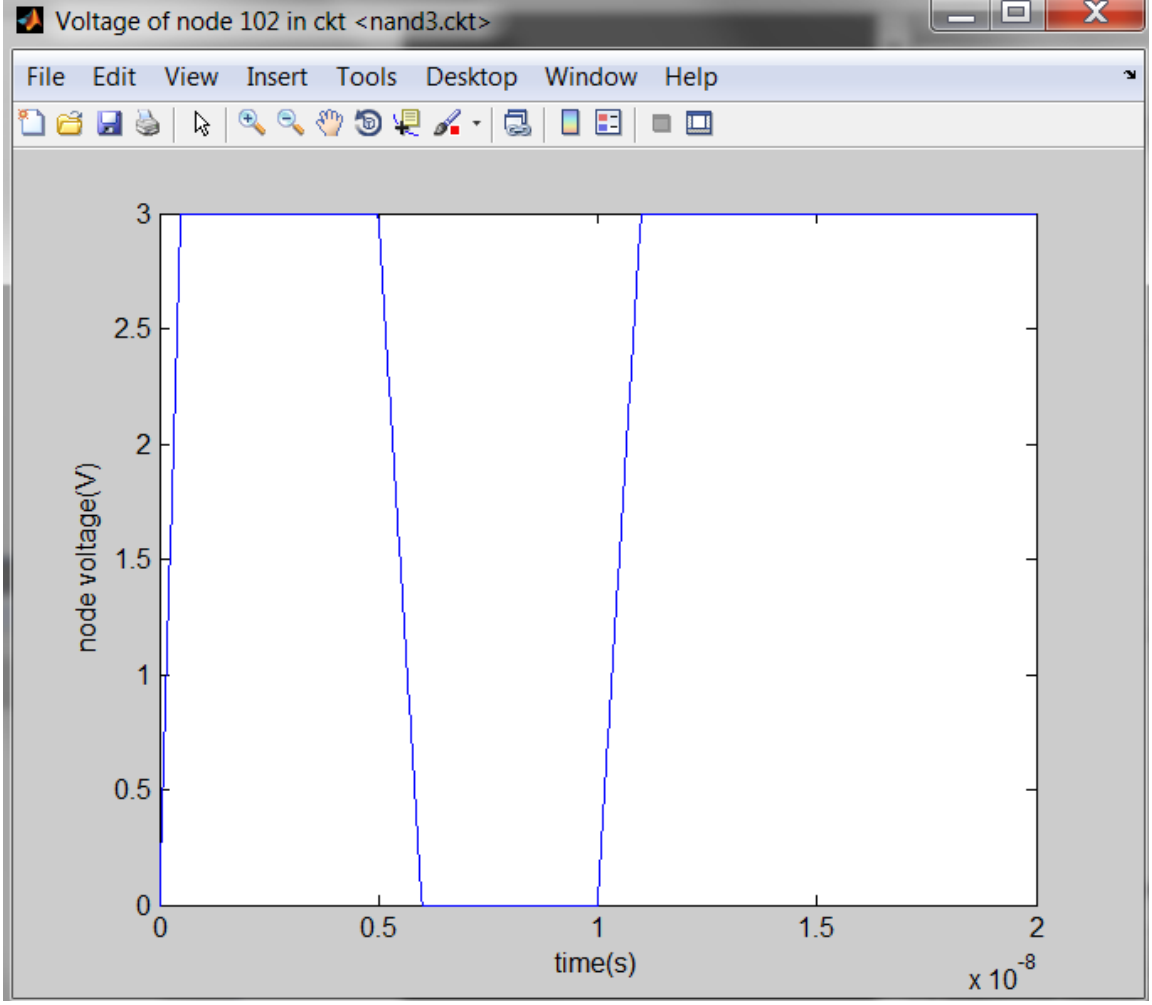
nand3.ckt

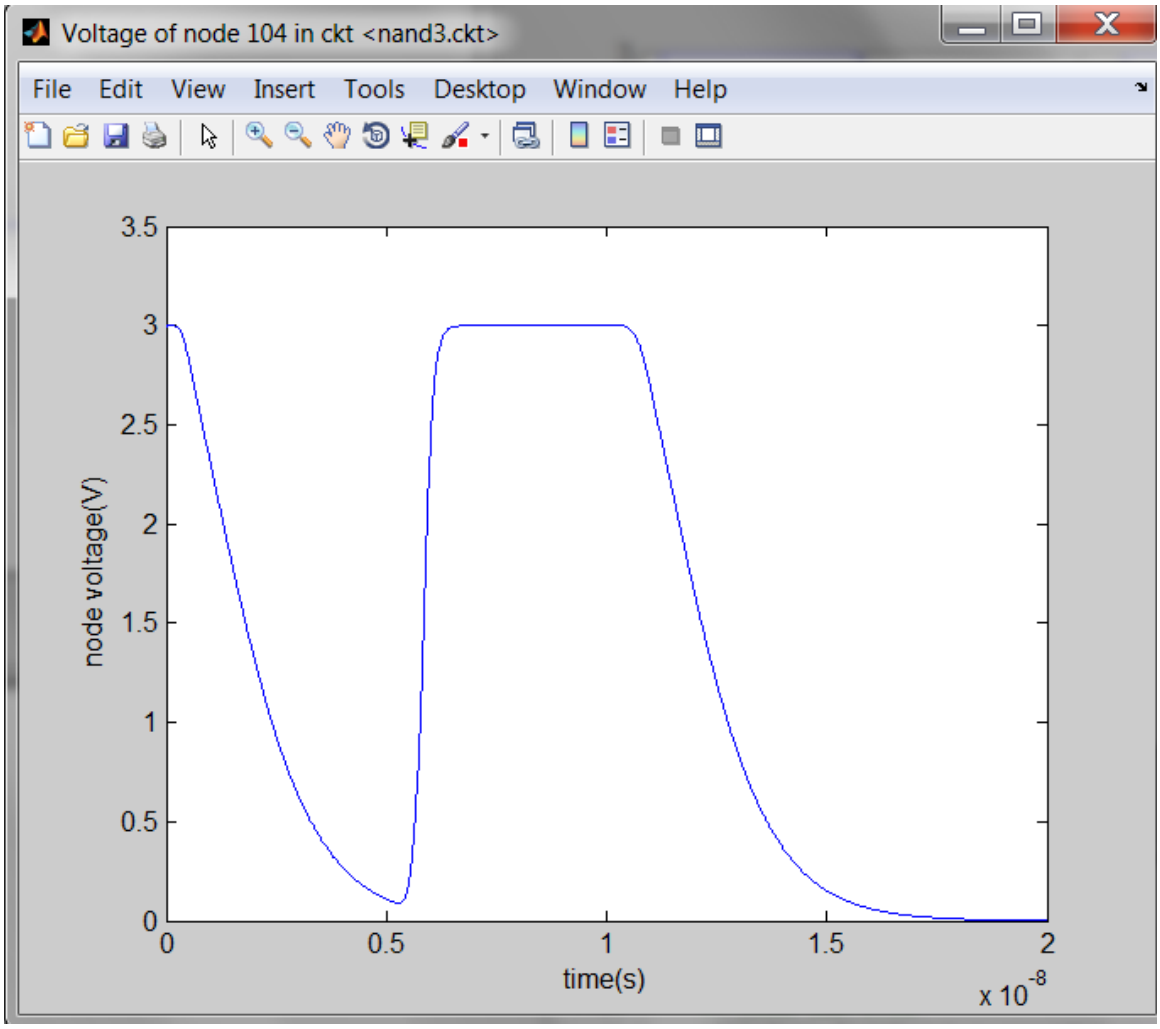


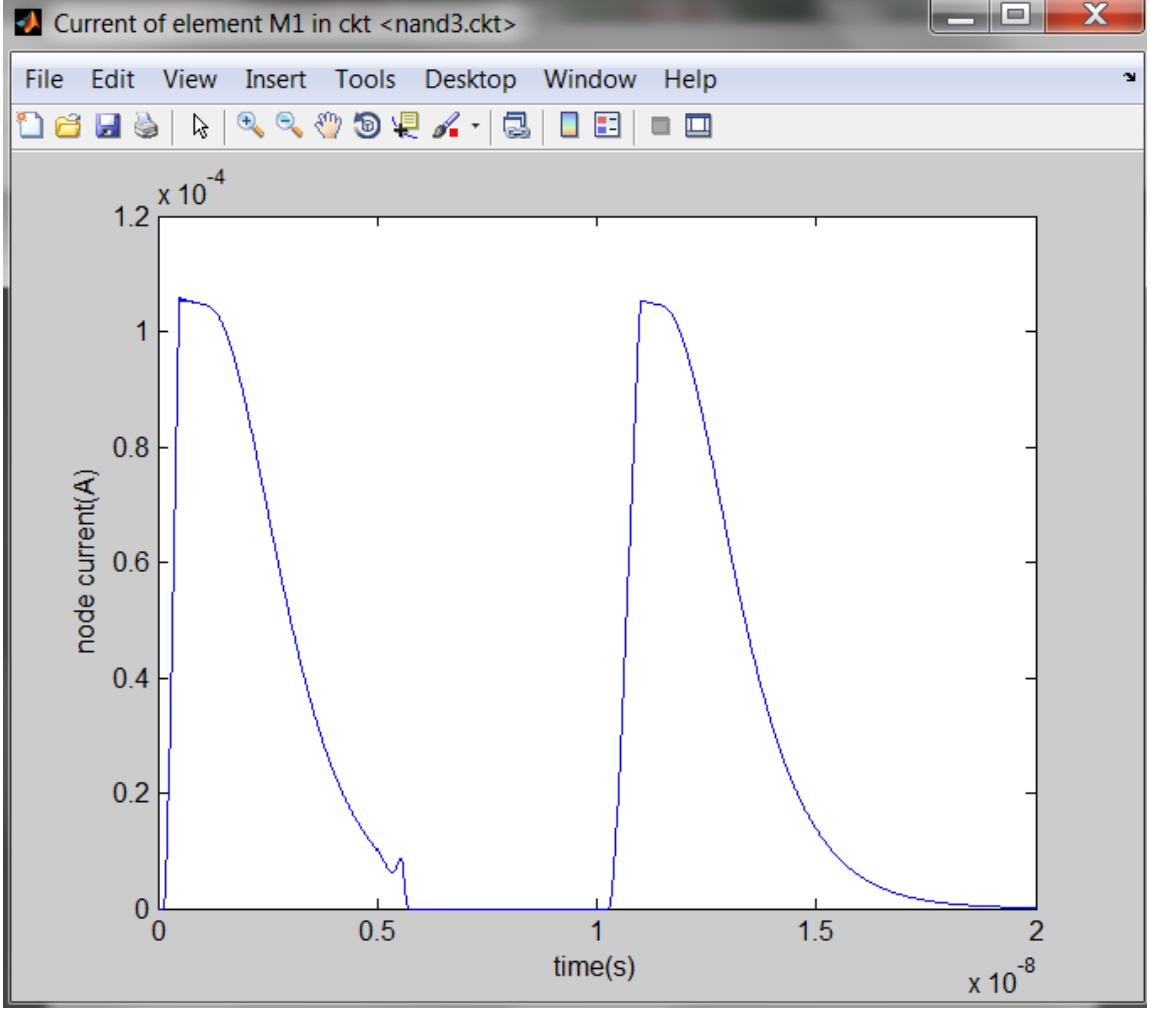
result:

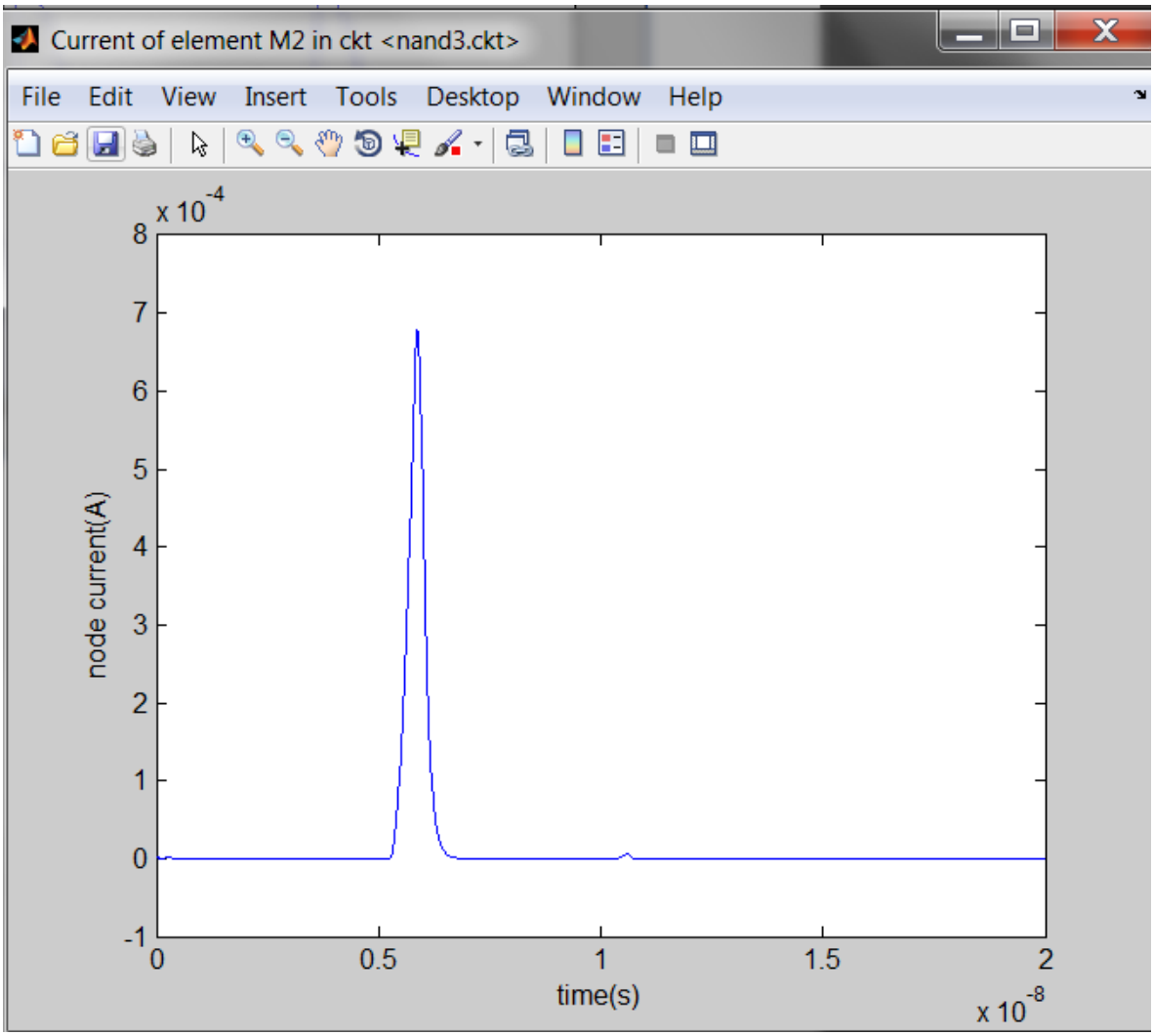
DC result:

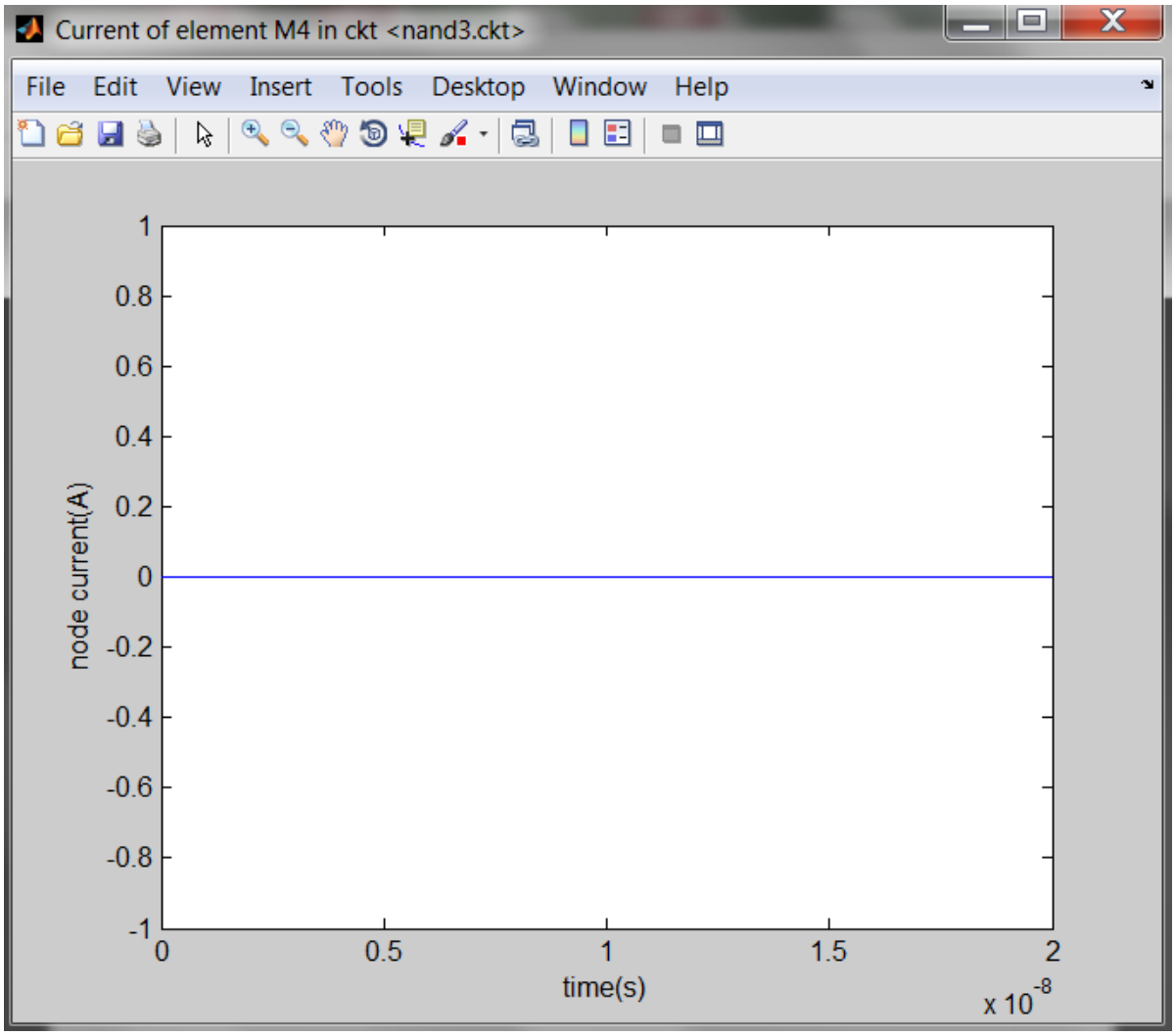
```
DC response result
Steady voltage of node 102 in ckt <nand3.ckt> is 3 V
Steady voltage of node 103 in ckt <nand3.ckt> is 0 V
Steady voltage of node 104 in ckt <nand3.ckt> is 0 V
Steady voltage of node 107 in ckt <nand3.ckt> is 3 V
Steady voltage of node 108 in ckt <nand3.ckt> is 3 V
Steady voltage of node 109 in ckt <nand3.ckt> is 0 V
Steady voltage of node 110 in ckt <nand3.ckt> is 3 V
Steady current of element VDD  in ckt <nand3.ckt> is -3e-10 A
Steady current of element Vin1 in ckt <nand3.ckt> is -3e-10 A
Steady current of element Vin2 in ckt <nand3.ckt> is -3e-10 A
Steady current of element Vin3 in ckt <nand3.ckt> is -3e-10 A
Steady current of element M1   in ckt <nand3.ckt> is 0 A
Steady current of element M2   in ckt <nand3.ckt> is 0 A
Steady current of element M3   in ckt <nand3.ckt> is 0 A
Steady current of element M4   in ckt <nand3.ckt> is 0 A
Steady current of element M5   in ckt <nand3.ckt> is 0 A
Steady current of element M6   in ckt <nand3.ckt> is 0 A
        finished!
>>
```


Voltage of node 102 in ckt <nand3.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0
0.5
1
1.5
2
2.5
3

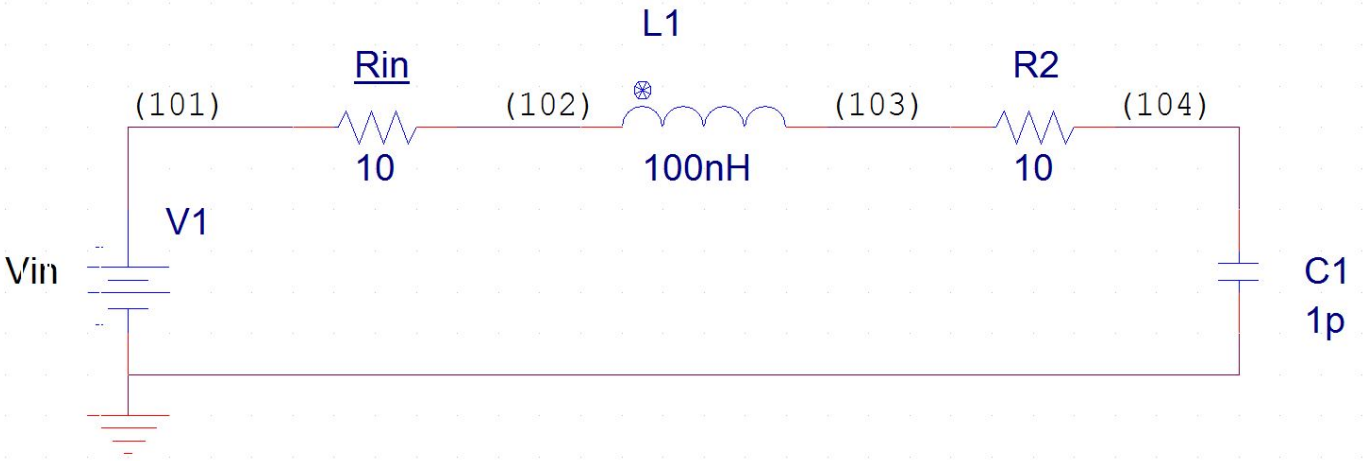

Voltage of node 104 in ckt <nand3.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0
0.5
1
1.5
2
2.5
3
3.5


Current of element M1 in ckt <nand3.ckt>
File Edit View Insert Tools Desktop Window Help
x 10^-4
1.2
1
0.8
0.6
0.4
0.2
0
node current(A)
0
0.5
1
1.5
2
time(s)
x 10^-8

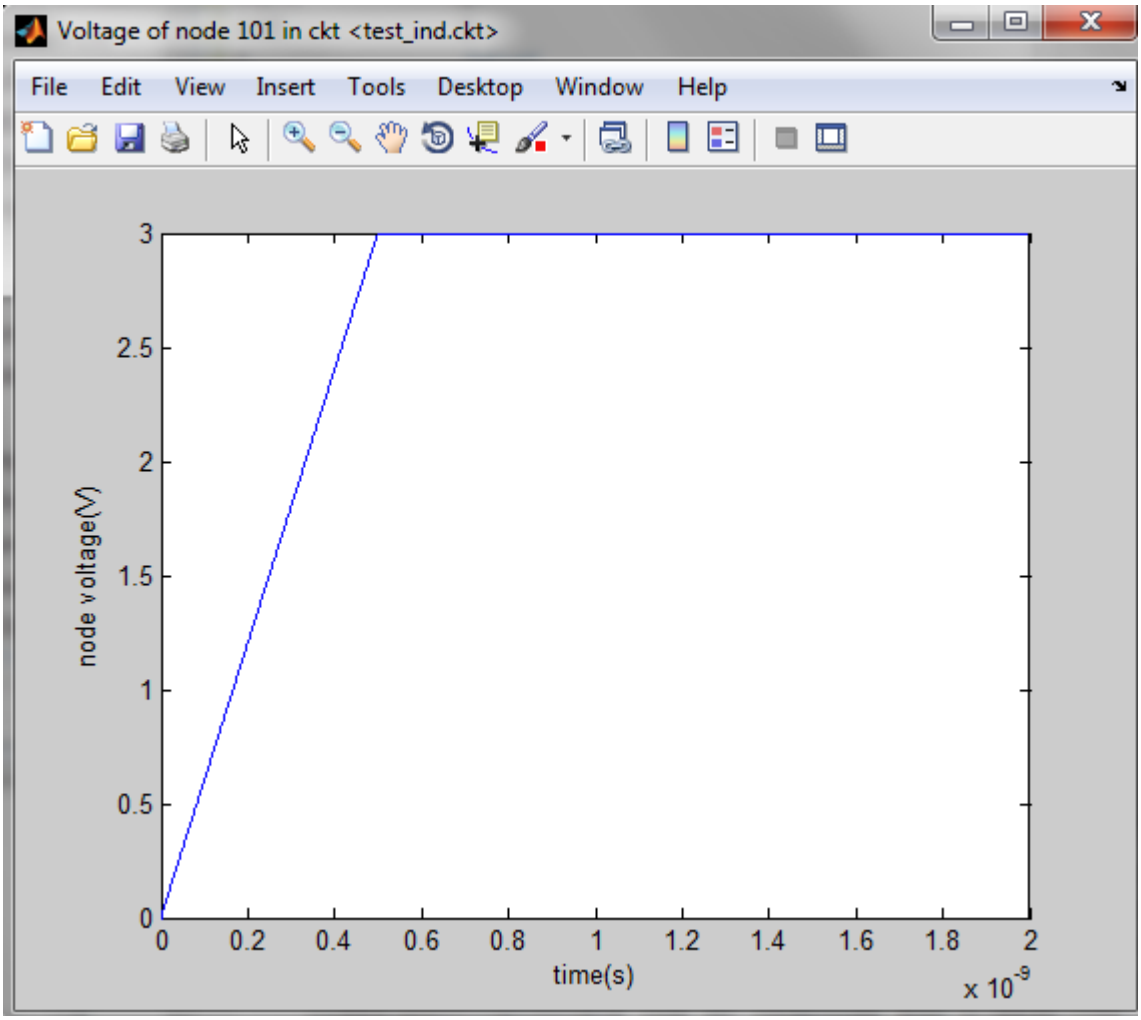

Current of element M2 in ckt <nand3.ckt>
File Edit View Insert Tools Desktop Window Help
x 10^-4
8
7
6
5
4
3
2
1
0
-1
node current(A)
0
0.5
1
1.5
2
time(s)
x 10^-8

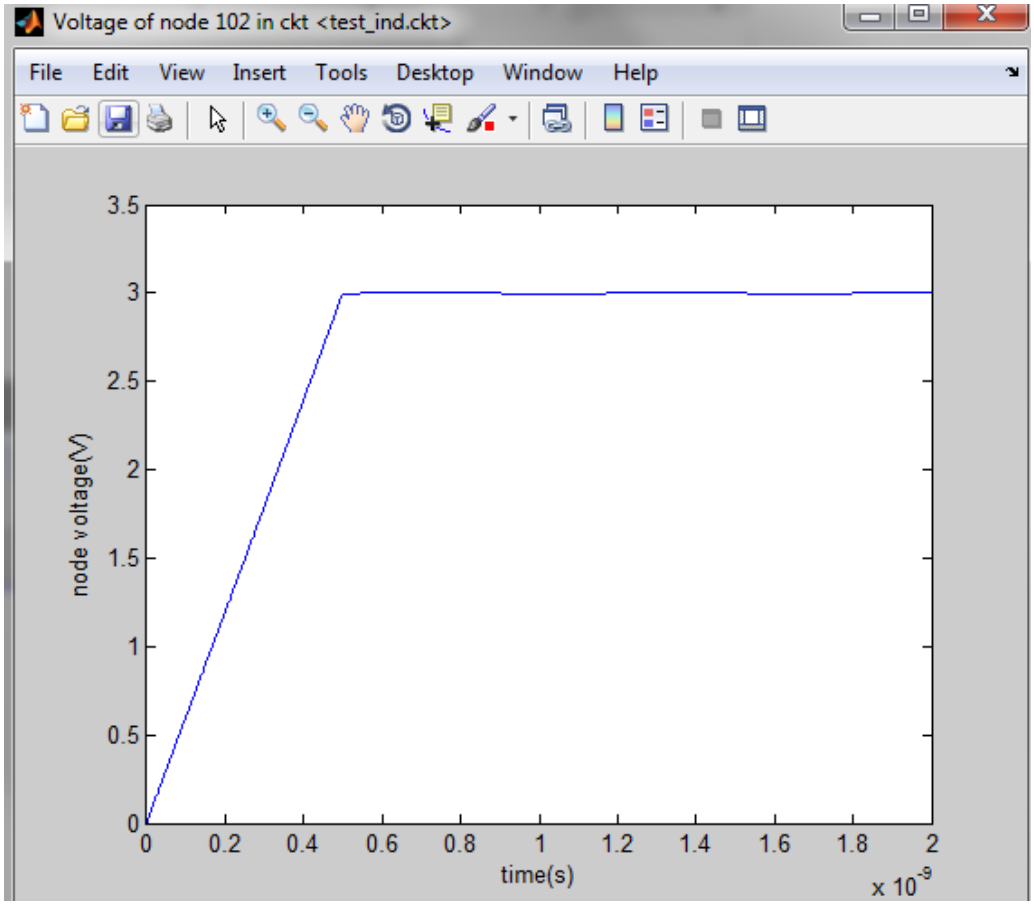

Current of element M4 in ckt <nand3.ckt>
File Edit View Insert Tools Desktop Window Help
node current(A)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
0.5
1
1.5
2
time(s)
x 10^-8

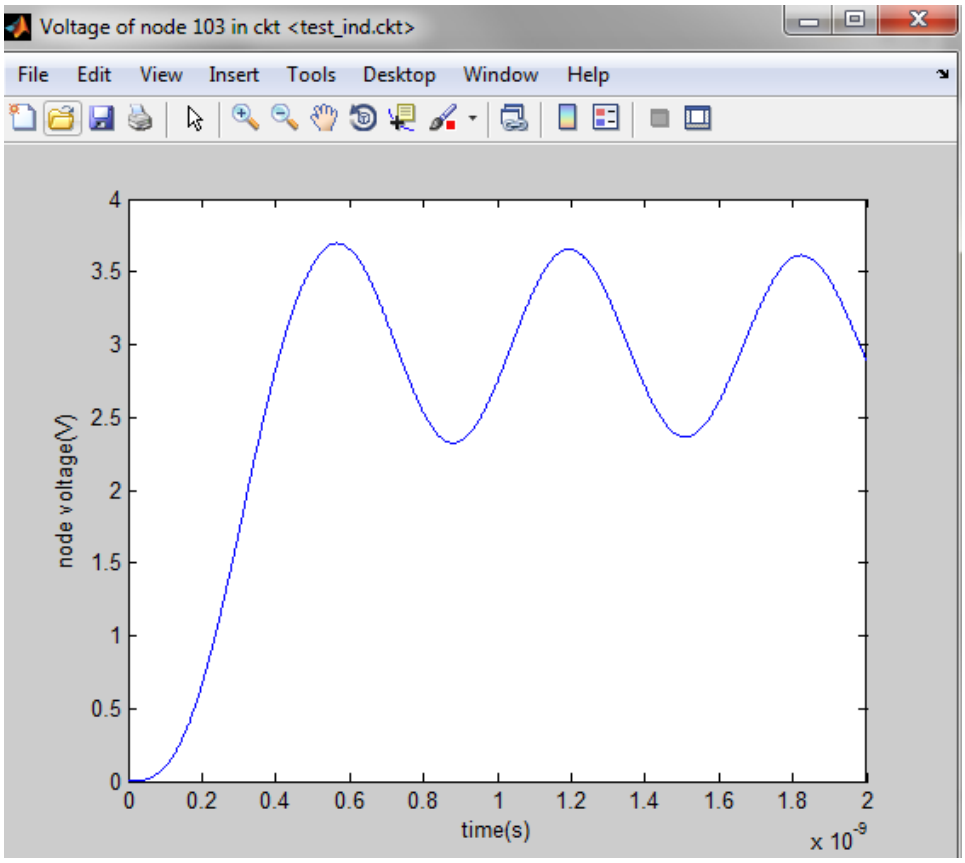
test_ind.ckt

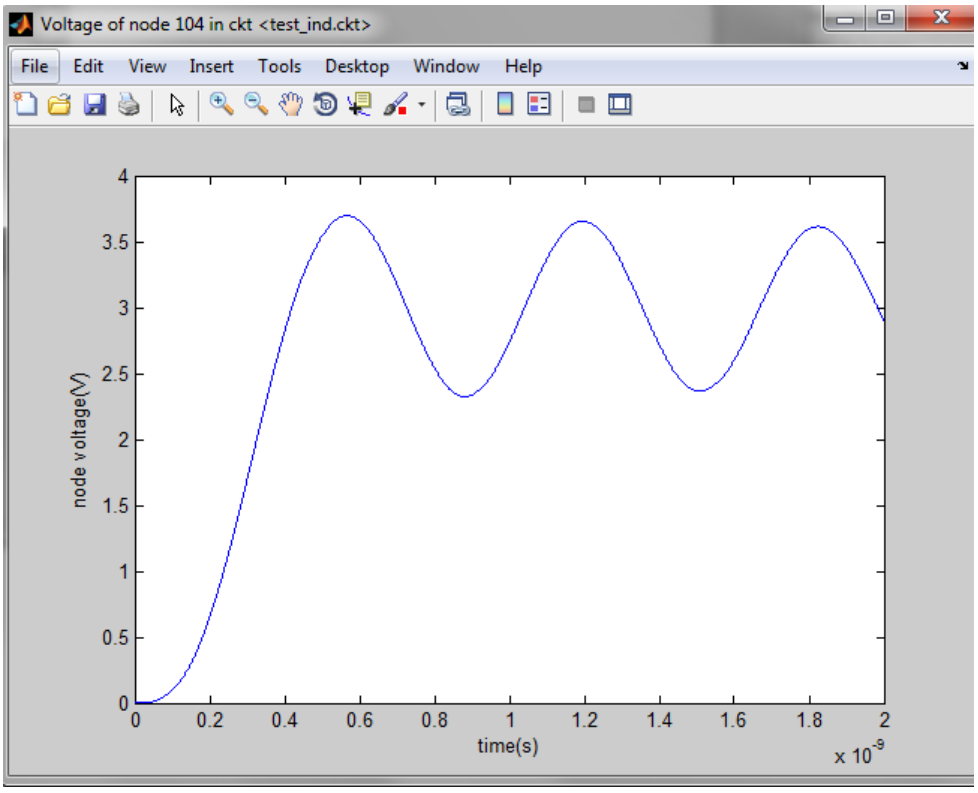


Result:

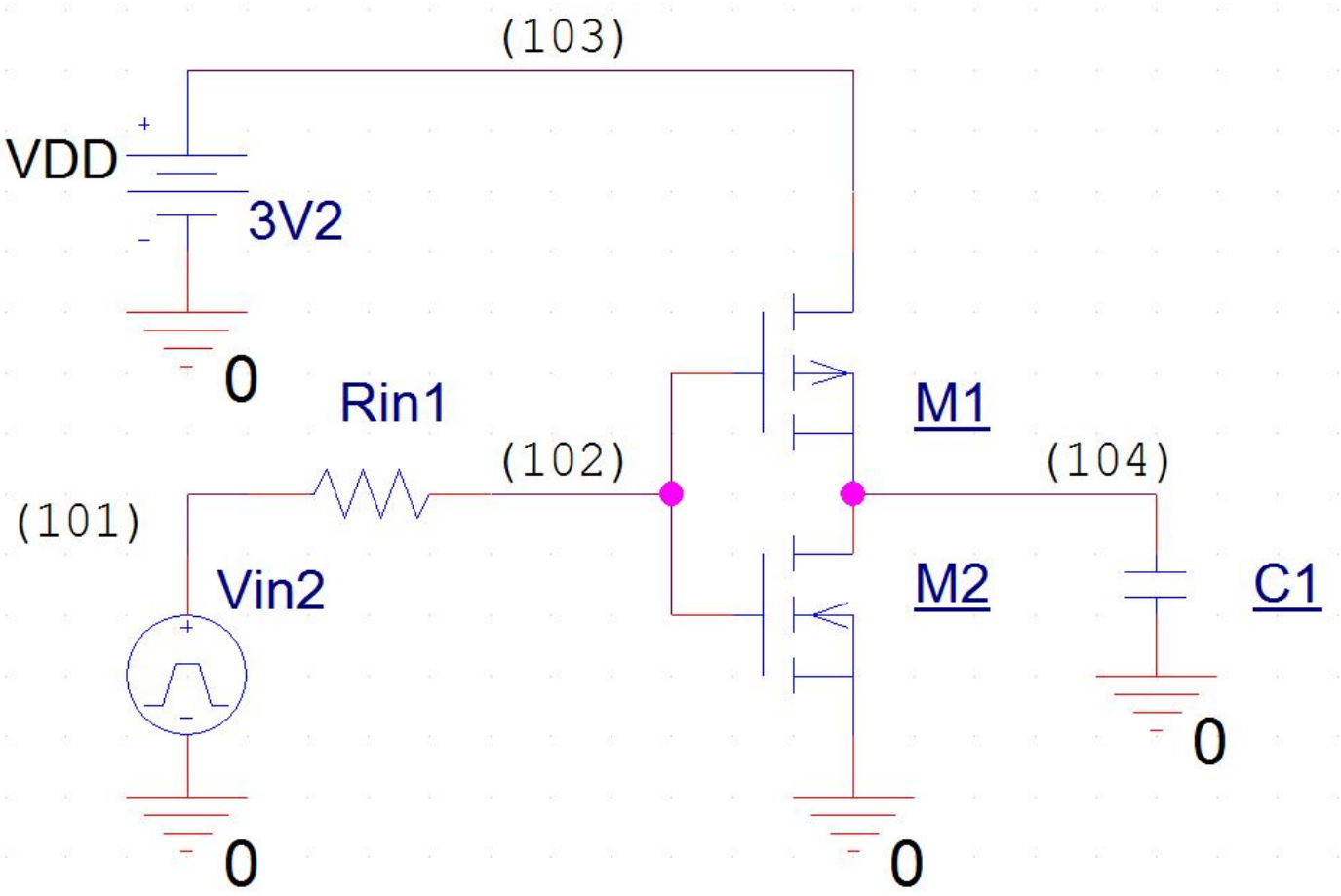



Voltage of node 102 in ckt <test_ind.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-9
0 0.5 1 1.5 2 2.5 3 3.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2


Voltage of node 103 in ckt <test_ind.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-9
0 0.5 1 1.5 2 2.5 3 3.5 4
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

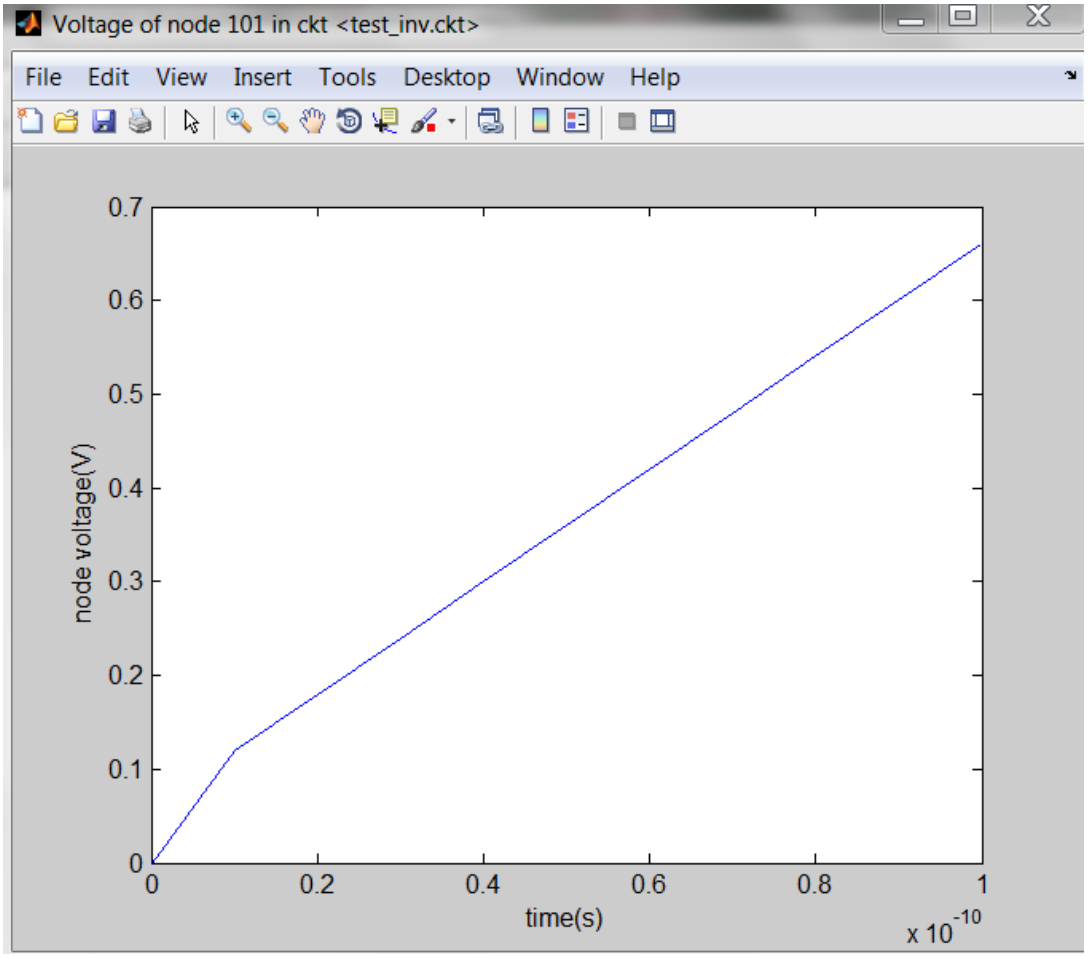

Voltage of node 104 in ckt <test_ind.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-9
0 0.5 1 1.5 2 2.5 3 3.5 4
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

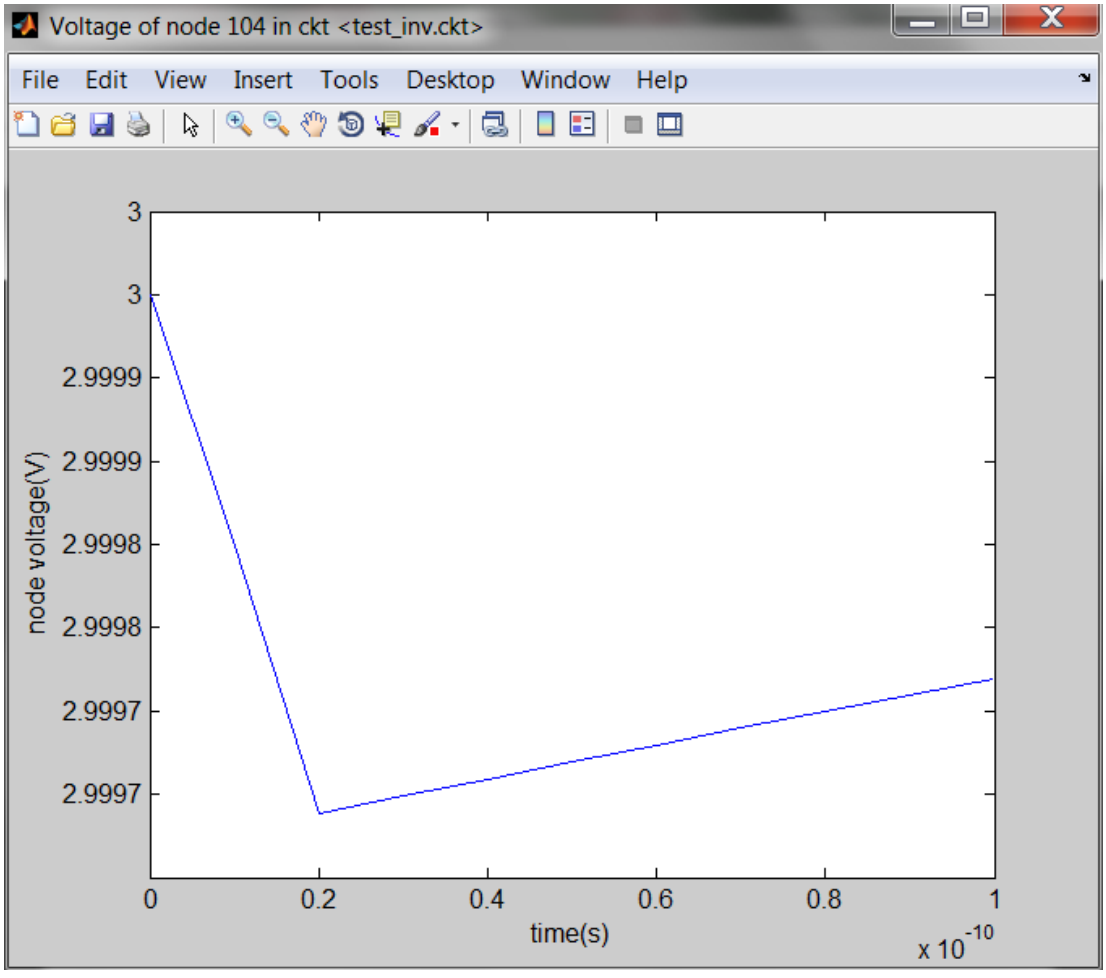
test_inv.ckt

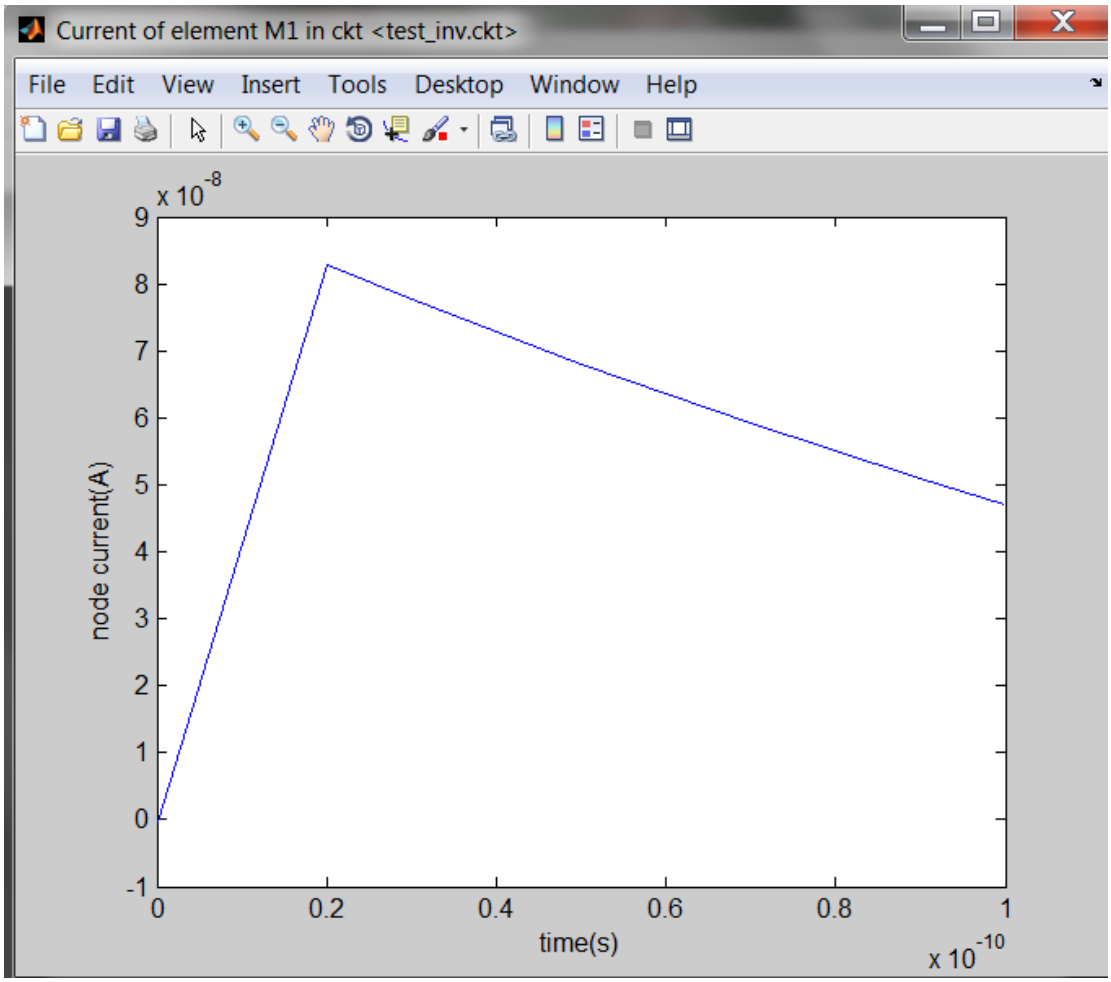


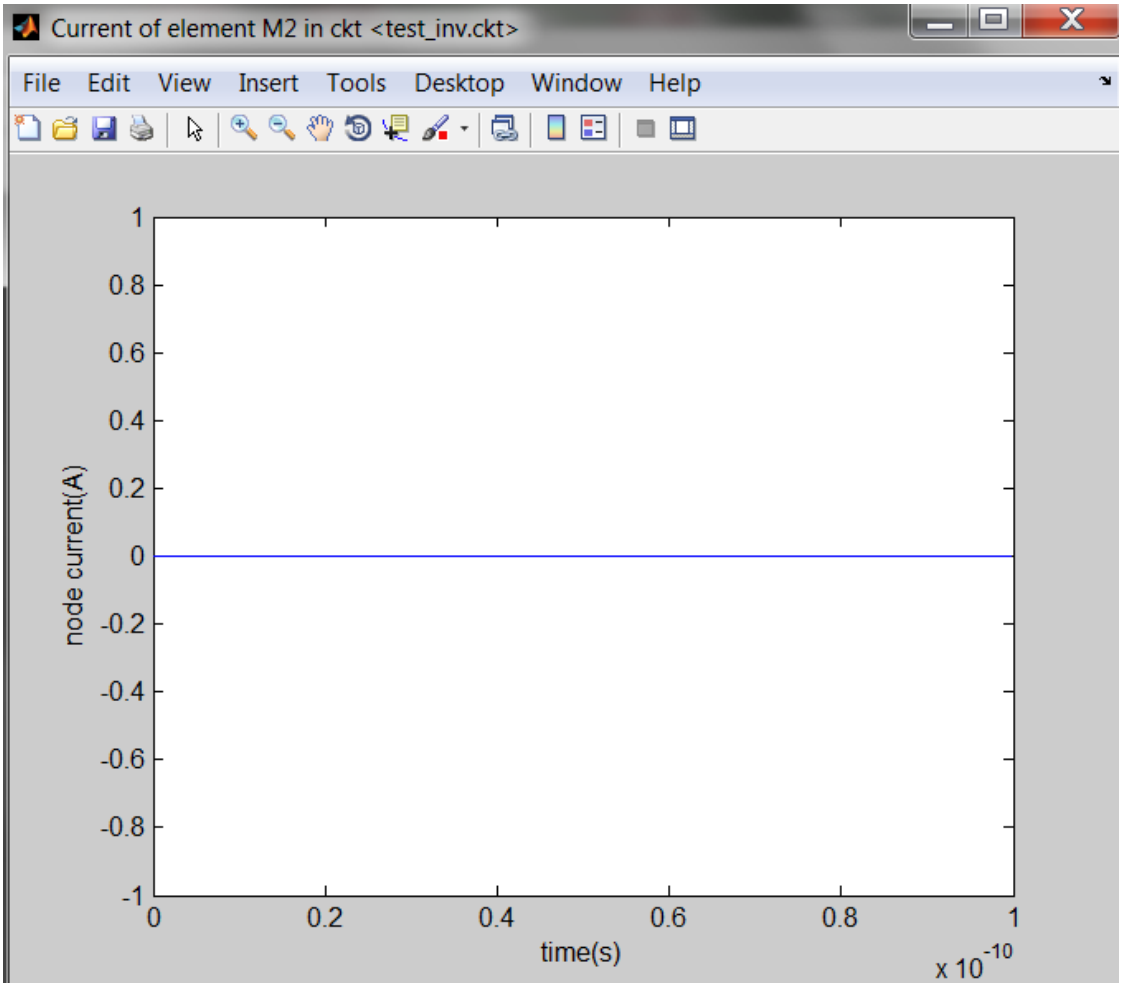
DC response print out:

```
DC response result
Steady voltage of node 101 in ckt <test_inv.ckt> is 3 V
Steady voltage of node 102 in ckt <test_inv.ckt> is 3 V
Steady voltage of node 103 in ckt <test_inv.ckt> is 3 V
Steady voltage of node 104 in ckt <test_inv.ckt> is 0 V
Steady current of element Rin in ckt <test_inv.ckt> is 3e-10 A
Steady current of element VDD in ckt <test_inv.ckt> is -3e-10 A
Steady current of element Vin in ckt <test_inv.ckt> is -6e-10 A
Steady current of element M1  in ckt <test_inv.ckt> is 0 A
Steady current of element M2  in ckt <test_inv.ckt> is 0 A
        finished!
```

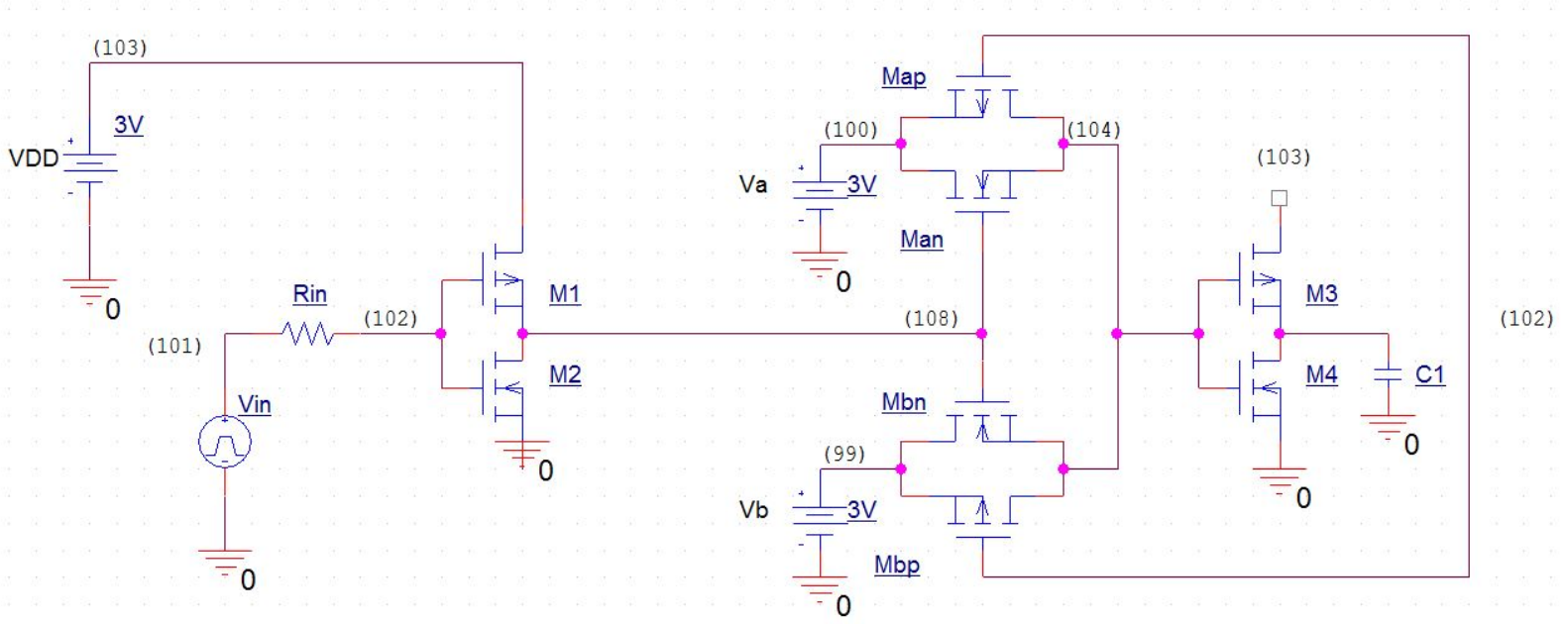

Voltage of node 101 in ckt <test_inv.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.2
0.4
0.6
0.8
1


Voltage of node 104 in ckt <test_inv.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-10
3
3
2.9999
2.9999
2.9998
2.9998
2.9997
2.9997
0.2
0.4
0.6
0.8
1

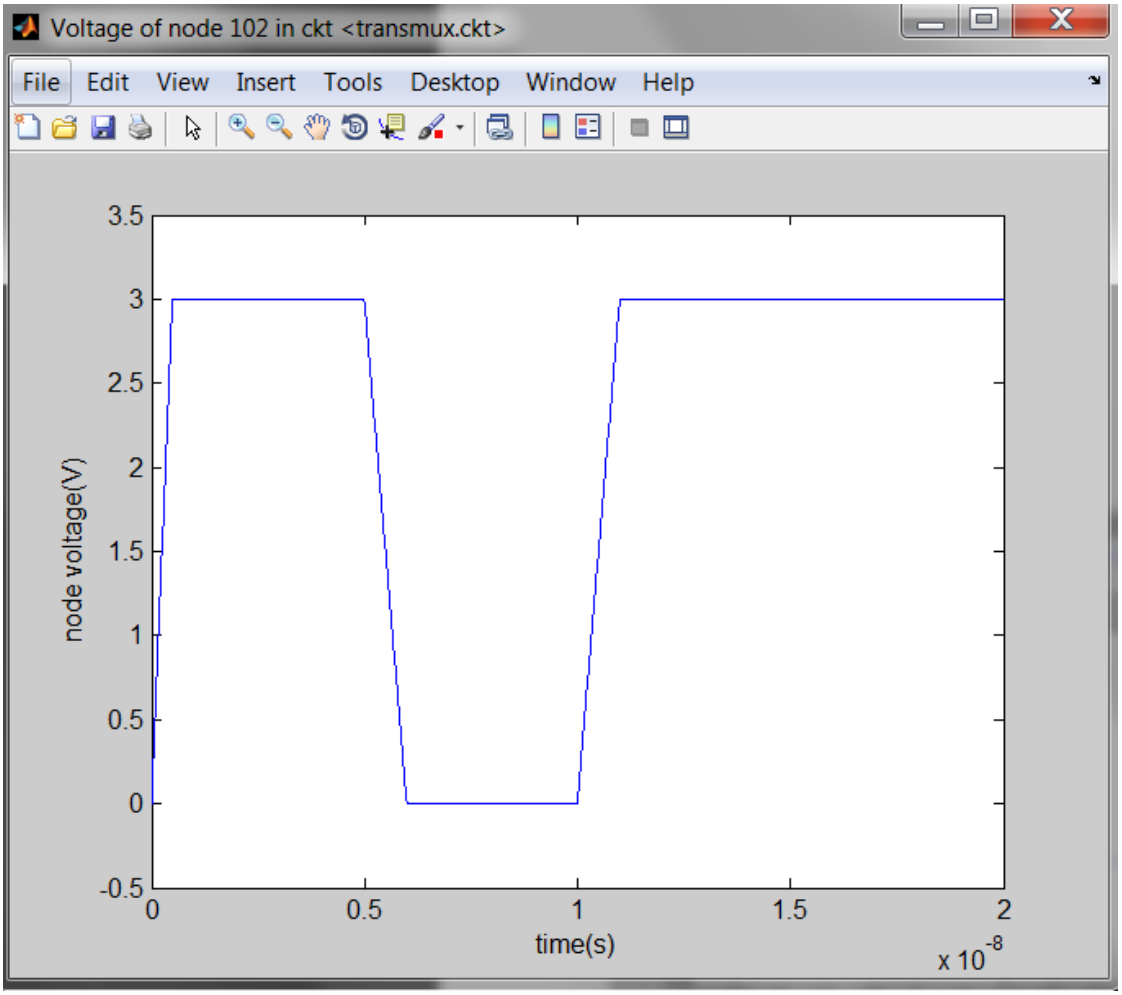

Current of element M1 in ckt <test_inv.ckt>
File Edit View Insert Tools Desktop Window Help
x 10^-8
9
8
7
6
5
4
3
2
1
0
-1
node current(A)
0
0.2
0.4
0.6
0.8
1
time(s)
x 10^-10

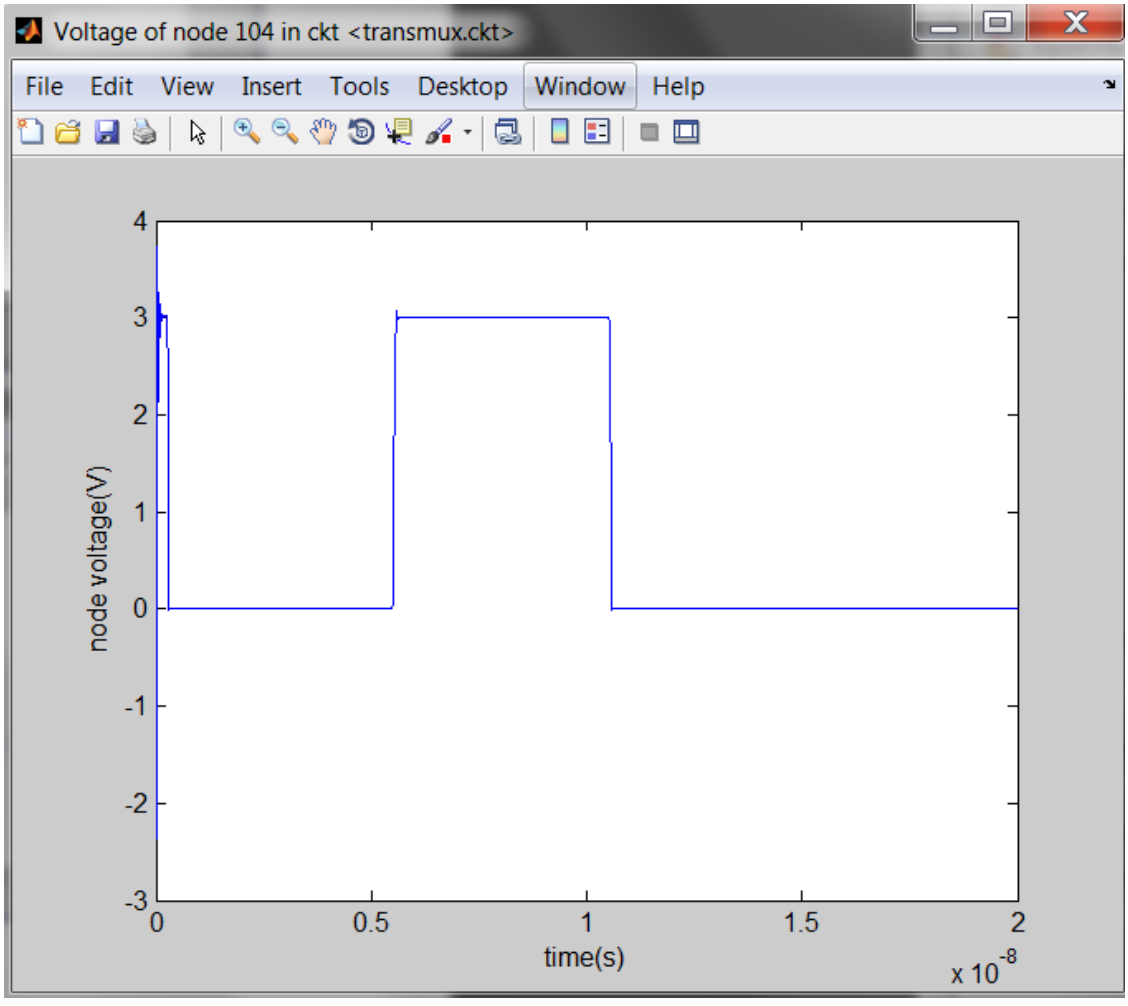

Current of element M2 in ckt <test_inv.ckt>
File Edit View Insert Tools Desktop Window Help
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
node current(A)
0
0.2
0.4
0.6
0.8
1
time(s)
x 10^-10

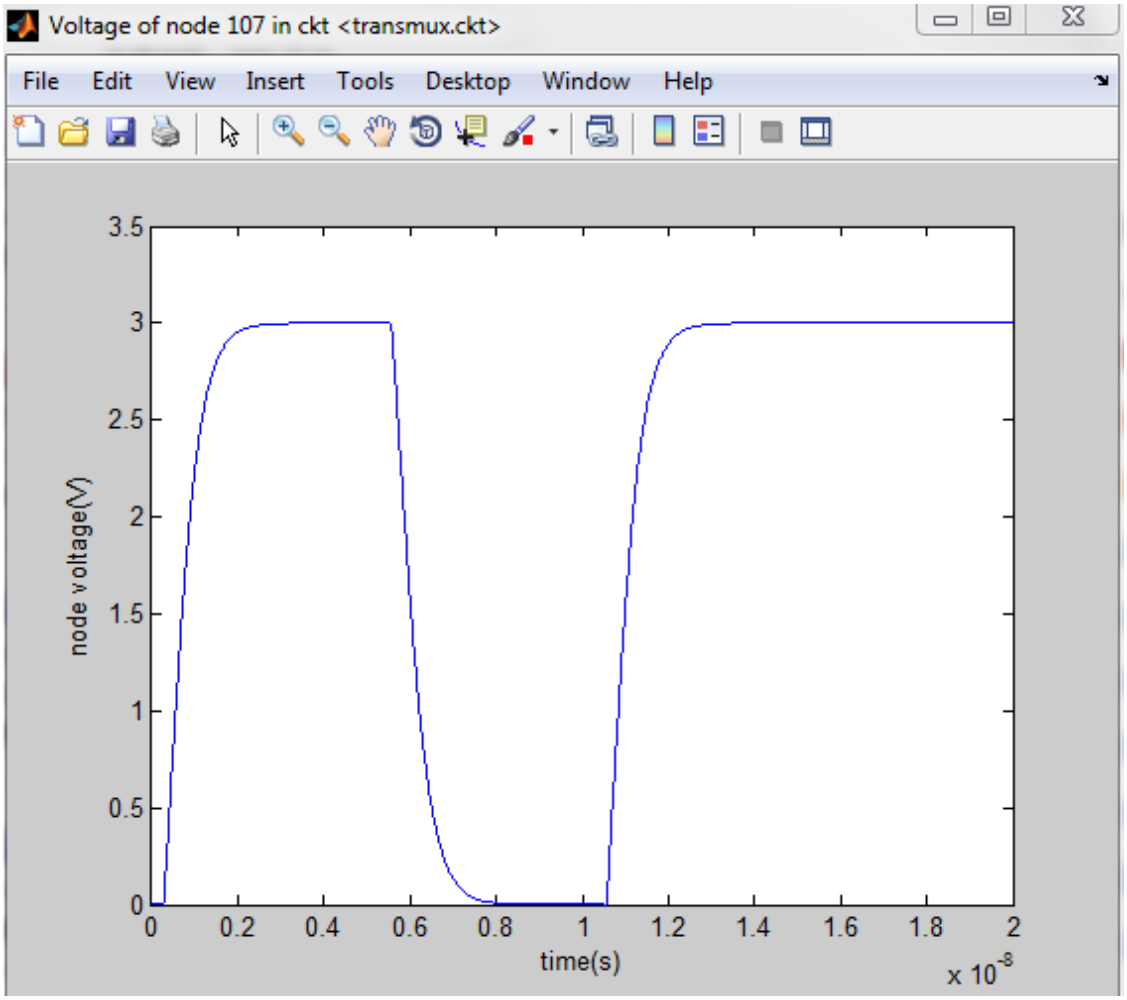
transmux.ckt

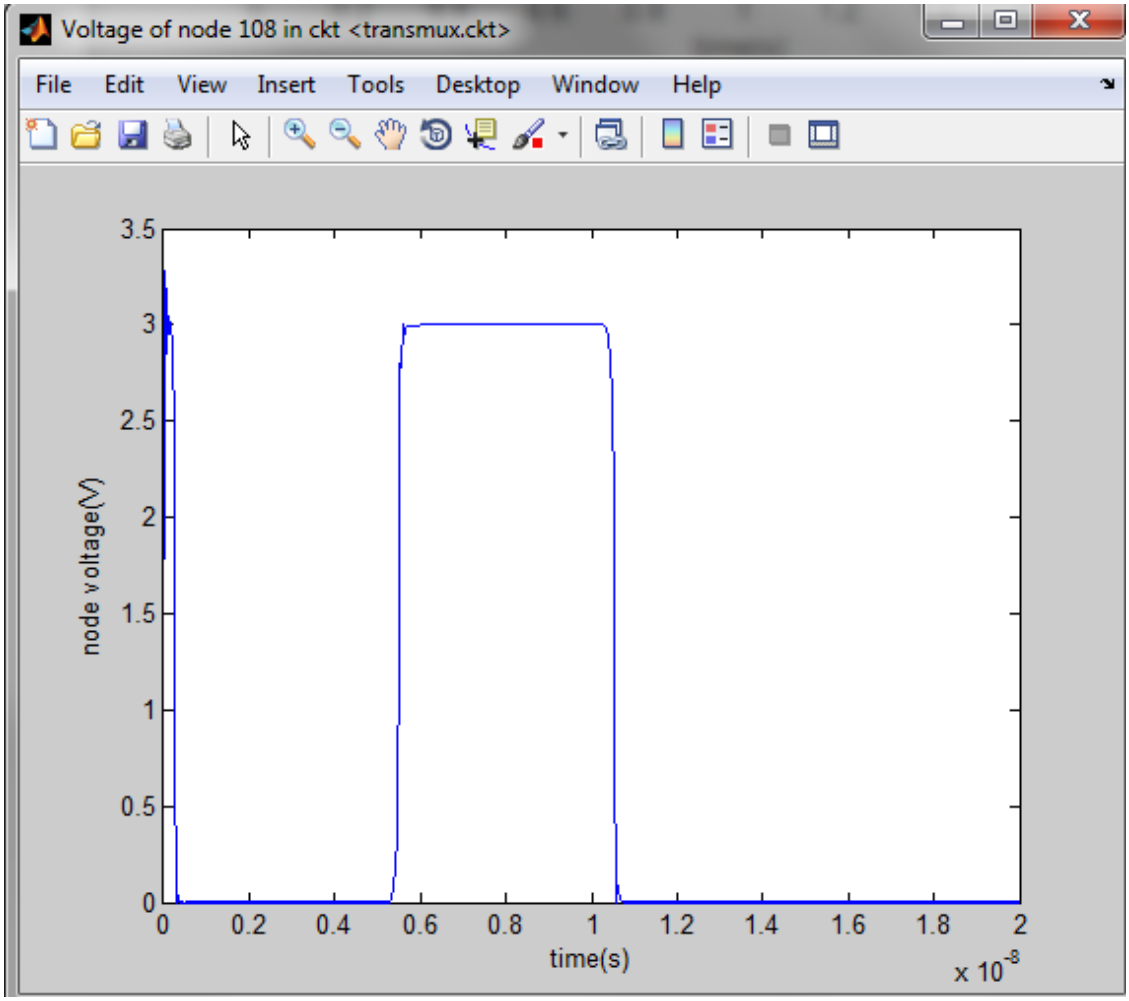



```
DC response result
Steady voltage of node 99 in ckt <transmux.ckt> is 0 V
Steady voltage of node 100 in ckt <transmux.ckt> is 3 V
Steady voltage of node 101 in ckt <transmux.ckt> is 3 V
Steady voltage of node 102 in ckt <transmux.ckt> is 3 V
Steady voltage of node 103 in ckt <transmux.ckt> is 3 V
Steady voltage of node 104 in ckt <transmux.ckt> is 0 V
Steady voltage of node 107 in ckt <transmux.ckt> is 3 V
Steady voltage of node 108 in ckt <transmux.ckt> is 0 V
Steady current of element Rin in ckt <transmux.ckt> is 3e-10 A
Steady current of element VDD in ckt <transmux.ckt> is -6e-10 A
Steady current of element Vin in ckt <transmux.ckt> is -6e-10 A
Steady current of element Va  in ckt <transmux.ckt> is -3e-10 A
Steady current of element Vb  in ckt <transmux.ckt> is 3.0003e-19 A
Steady current of element M1  in ckt <transmux.ckt> is 0 A
Steady current of element M2  in ckt <transmux.ckt> is 0 A
Steady current of element Map in ckt <transmux.ckt> is 0 A
Steady current of element Man in ckt <transmux.ckt> is 0 A
Steady current of element Mbp in ckt <transmux.ckt> is 0 A
Steady current of element Mbn in ckt <transmux.ckt> is 0 A
Steady current of element M3  in ckt <transmux.ckt> is 0 A
Steady current of element M4  in ckt <transmux.ckt> is 0 A
        finished!
```


Voltage of node 102 in ckt <transmux.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
0
0.5
1
1.5
2


Voltage of node 104 in ckt <transmux.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
4
3
2
1
0
-1
-2
-3
0
0.5
1
1.5
2

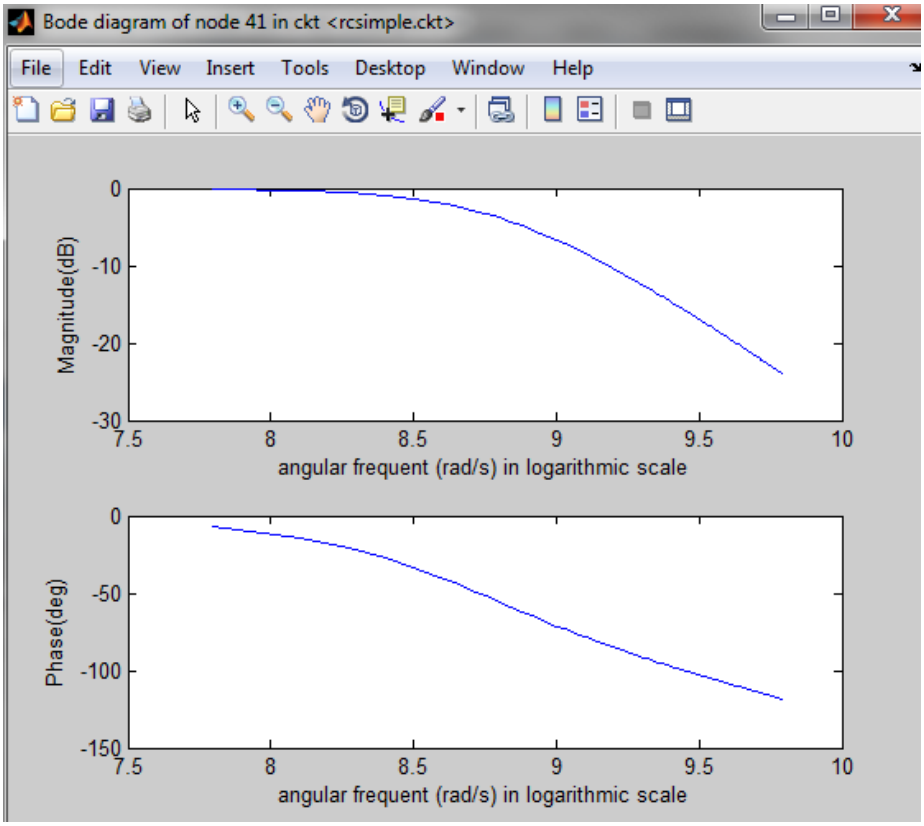

Voltage of node 107 in ckt <transmux.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0 0.5 1 1.5 2 2.5 3 3.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

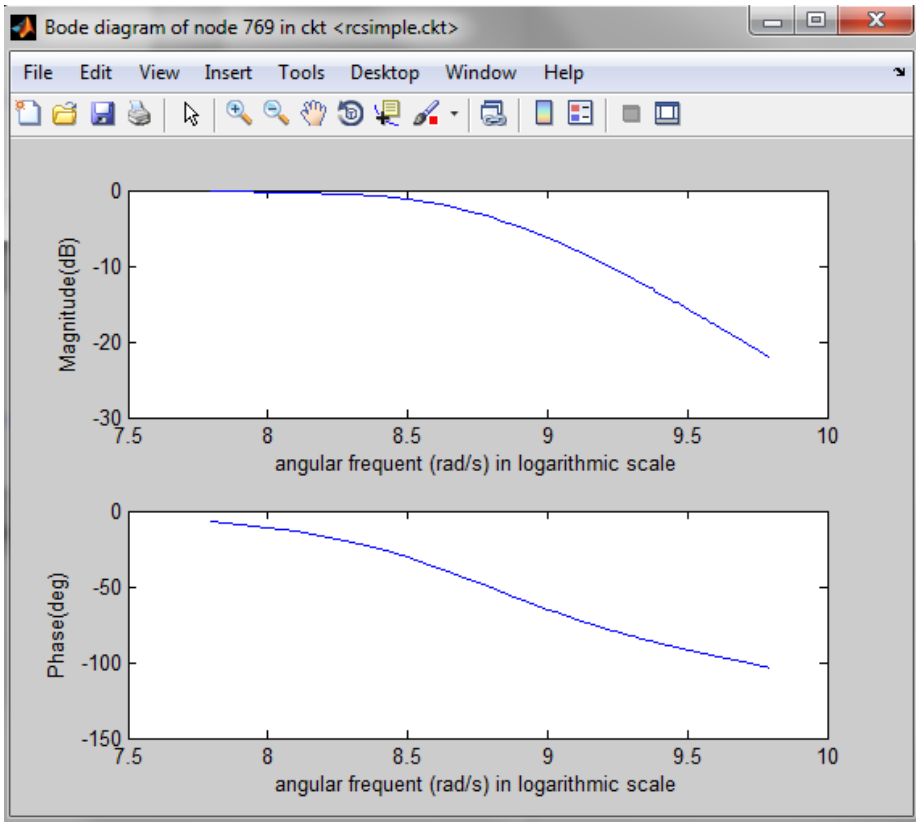

Voltage of node 108 in ckt <transmux.ckt>
File Edit View Insert Tools Desktop Window Help
node voltage(V)
time(s)
x 10^-8
0 0.5 1 1.5 2 2.5 3 3.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

AC analysis

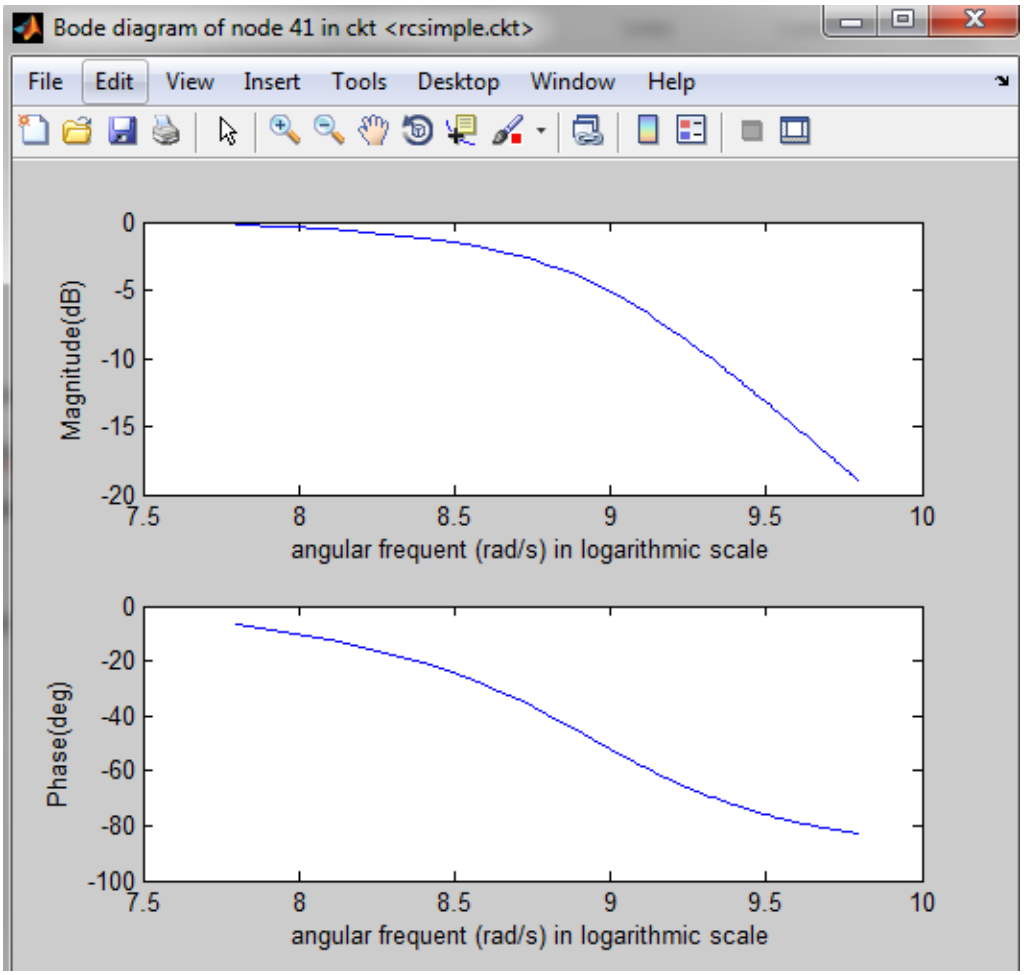
rcsimple.ckt

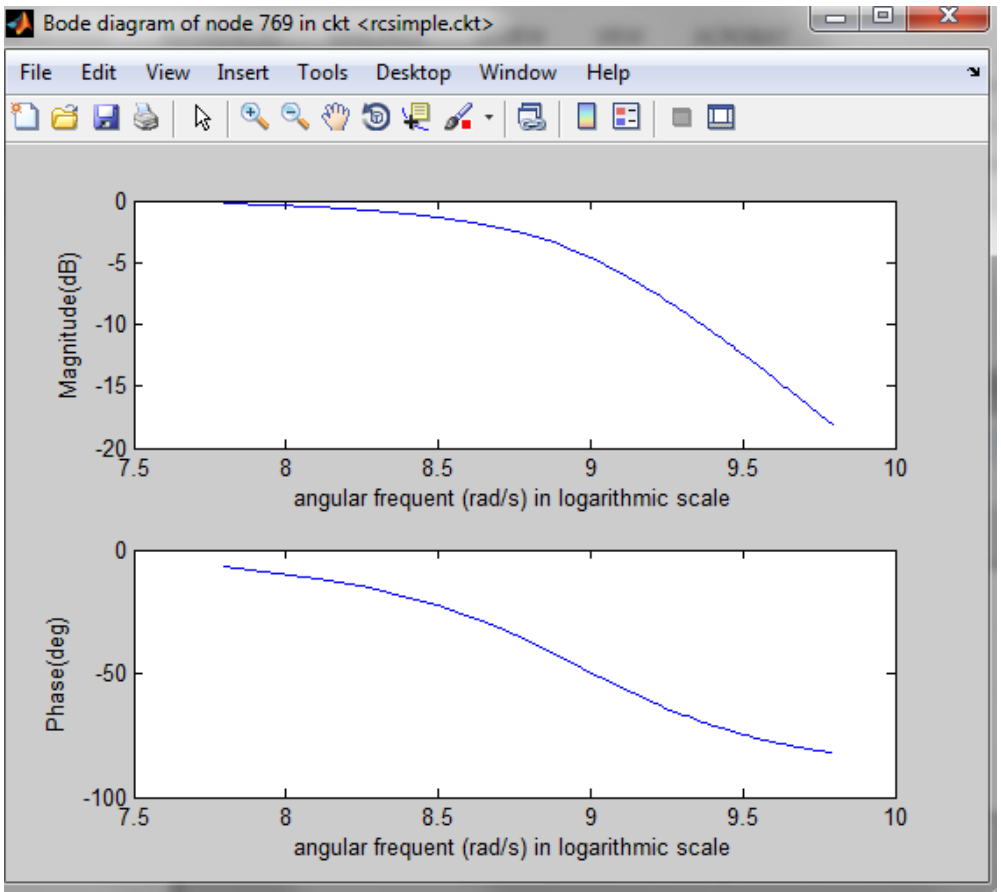
LU Method





AWE Method


Bode diagram of node 41 in ckt <rcsimple.ckt>
File Edit View Insert Tools Desktop Window Help
Magnitude(dB)
0
-5
-10
-15
-20
7.5 8 8.5 9 9.5 10
angular frequent (rad/s) in logarithmic scale
Phase(deg)
0
-20
-40
-60
-80
-100
7.5 8 8.5 9 9.5 10
angular frequent (rad/s) in logarithmic scale


Bode diagram of node 769 in ckt <rcsimple.ckt>
File Edit View Insert Tools Desktop Window Help
Magnitude(dB)
0
-5
-10
-15
-20
7.5 8 8.5 9 9.5 10
angular frequent (rad/s) in logarithmic scale
Phase(deg)
0
-50
-100
7.5 8 8.5 9 9.5 10
angular frequent (rad/s) in logarithmic scale