Assignment4
Circuit Modeling

ELEC4700A
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Part1:

a) C matric

0	0	0	0	0	0	0
-0.25	0.25	0	0	0	0	0
0	0	-0.2	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

G matric

1	0	0	0	0	0	0
-0.5	1.5	-1	0	0	0	0
0	1	0	-1	0	0	0
0	0	-1	0.1	0	0	0
0	0	0	0	-100	1	0
0	0	0	0.1	-1	0	0
0	0	0	0	0	-10	10.001

b) Plot of DC sweep
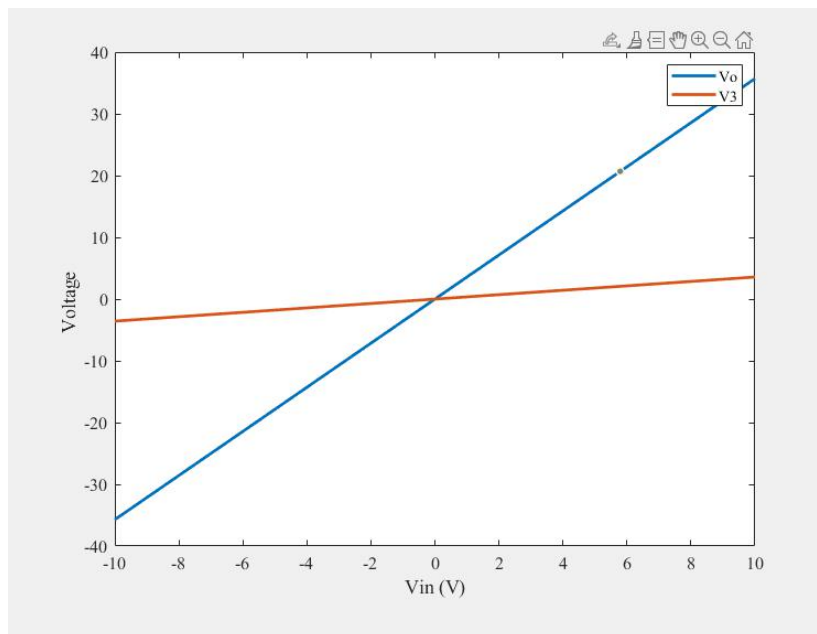

Figure1: DC sweep plot.

c) Plot of AC case of gain

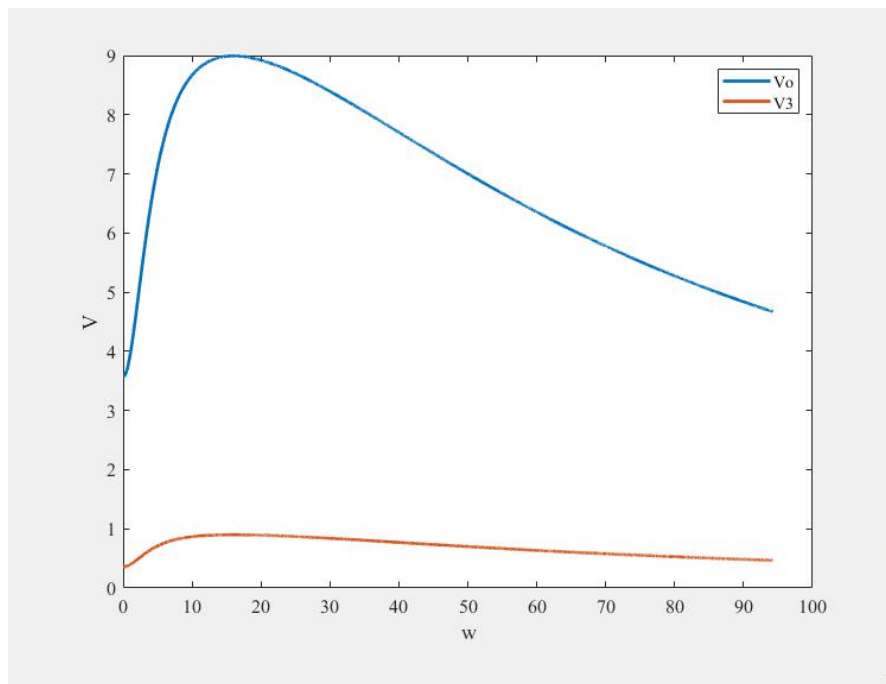

Figure2: AC case of gain plot.

d) Plot of Vin and Vout from numerical solution in time domain
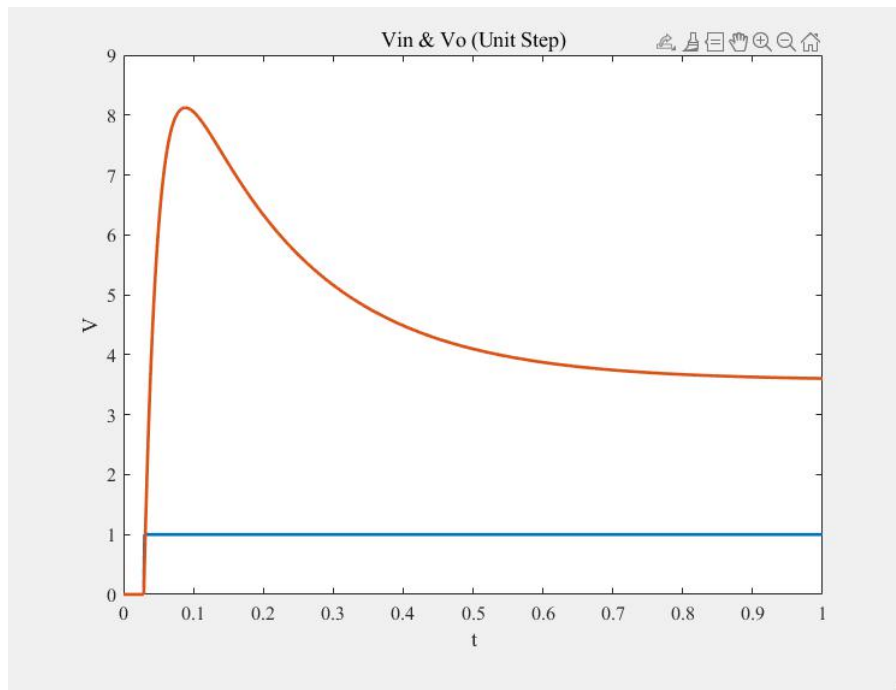

Figure3: Vin and Vout plot (Unit Step).

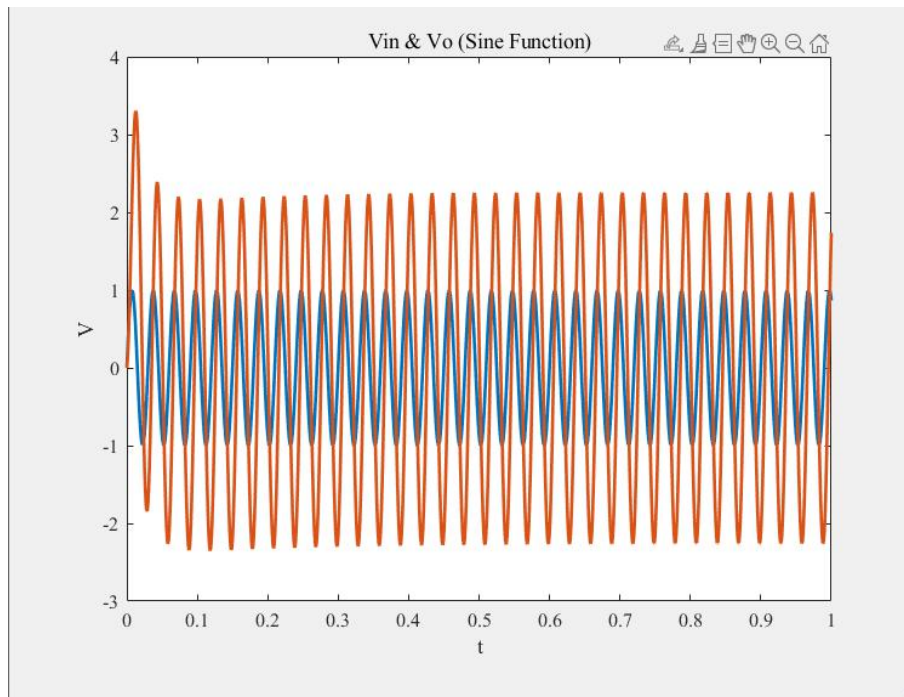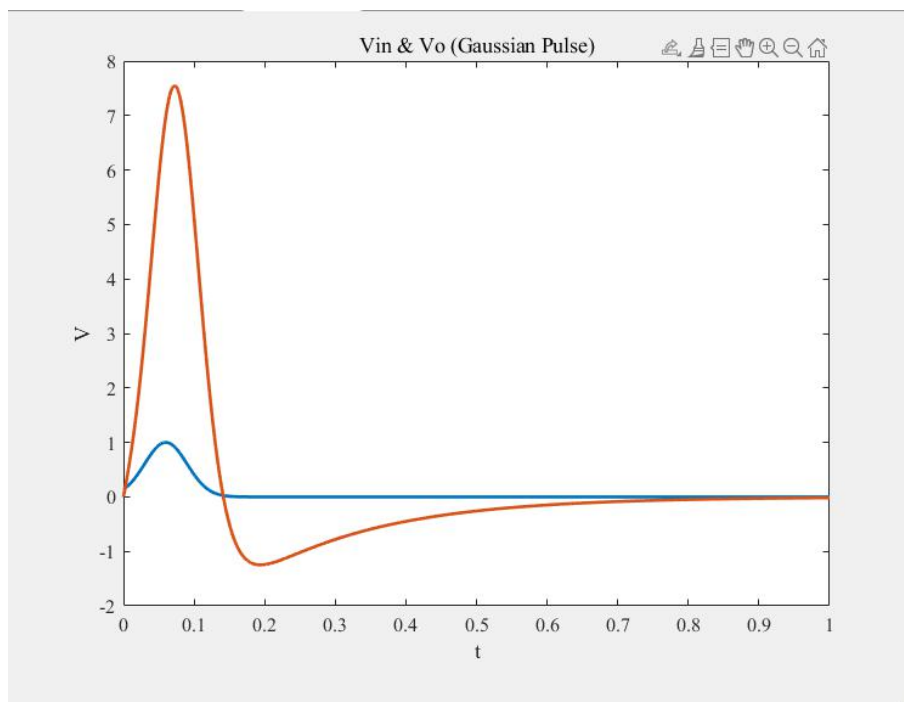Figure4: Vin and Vout plot (Sine Function).

Figure5: Vin and Vout plot (Gaussian Pulse).
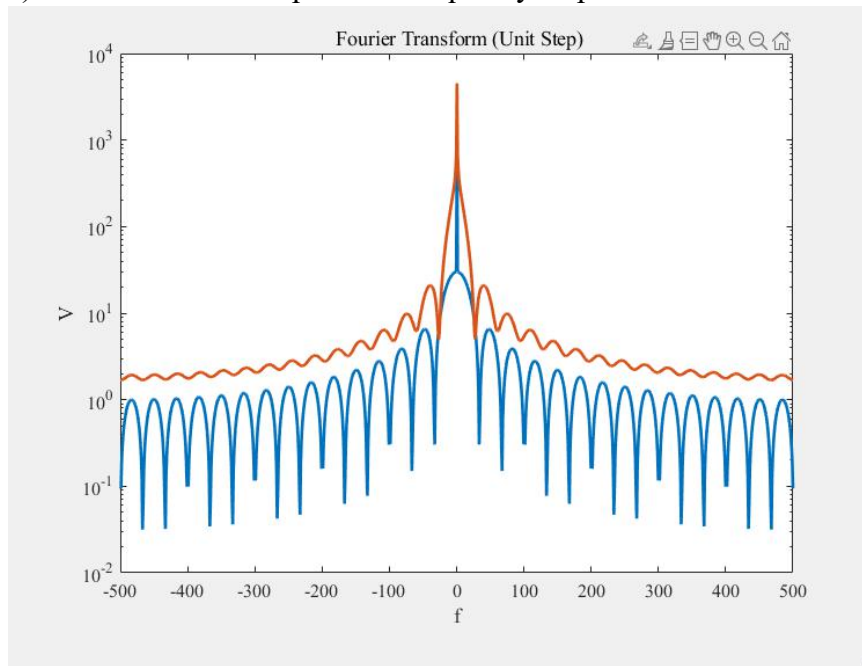
e) Fourier Transform plots of Frequency response
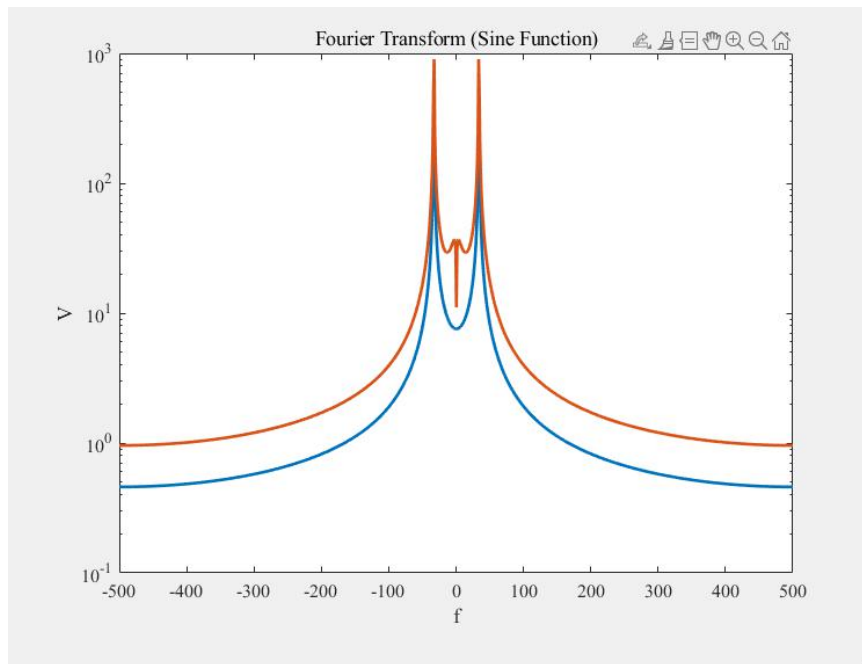

Figure6: Fourier Transform plot (Unit Step).

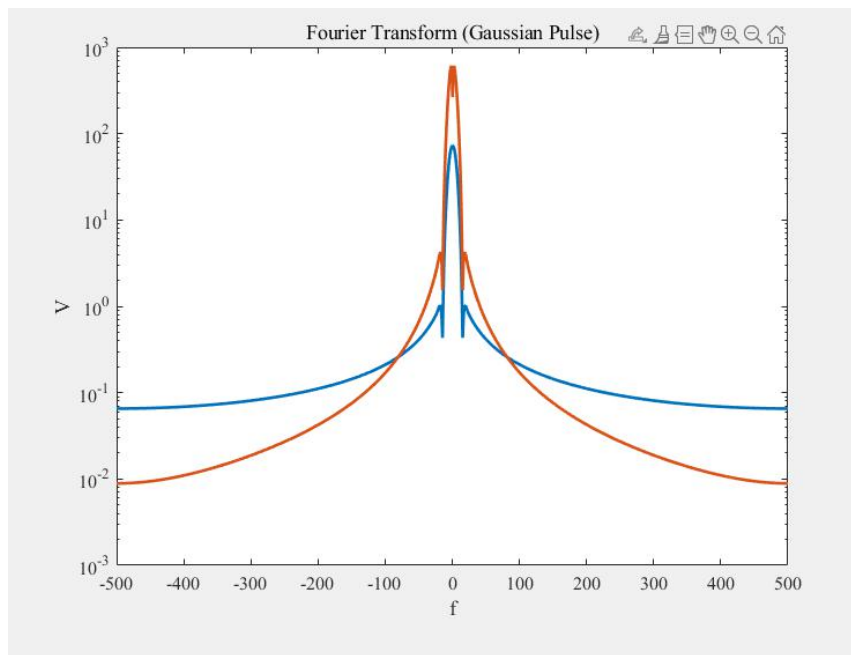Figure7: Fourier Transform plot (Sine Function).

Figure8: Fourier Transform plot (Gaussian Pulse).

Part2:

a) Updated C matrix

0	0	0	0	0	0	0
-0.25	0.25	0	0	0	0	0
0	0	-0.2	0	0	0	0
0	0	0	0.00001	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

b) Plot of Vout with noise source
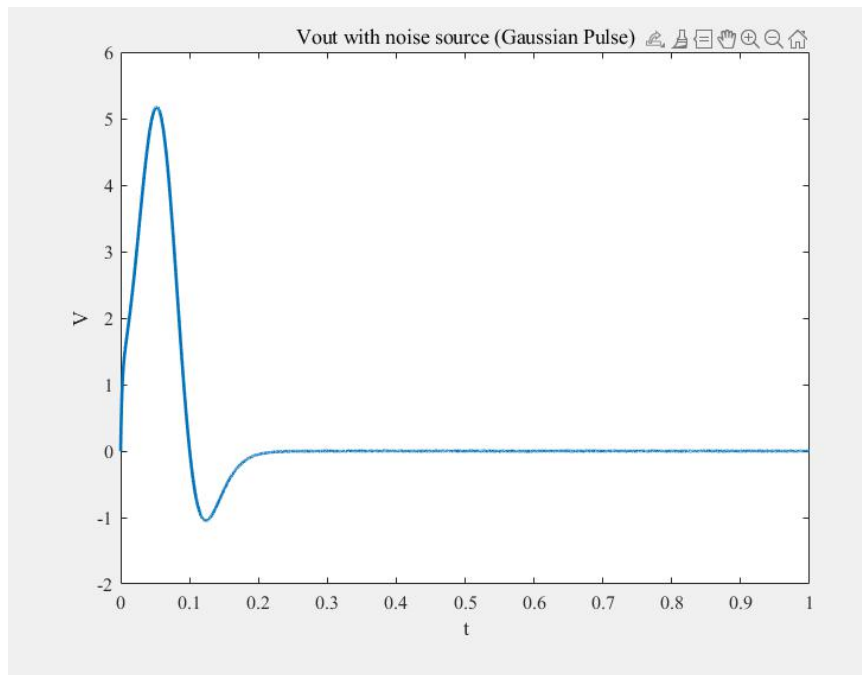

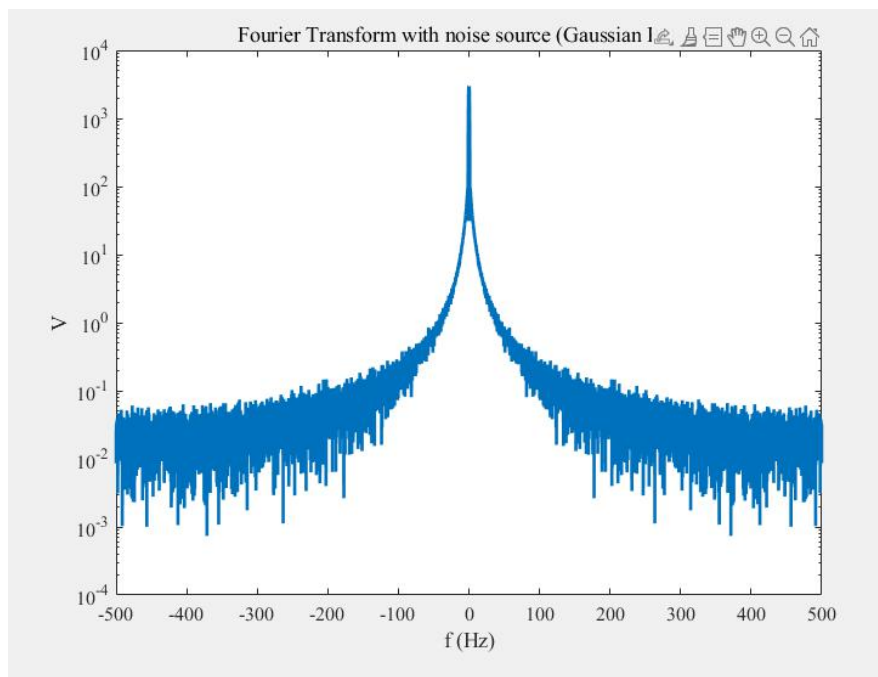Figure9: Vout with noise source (Gaussian Pulse).

c) Fourier Transform plot

Figure10: Fourier Transform with noise source (Gaussian Pulse).

d) 3 Plots of Vout with different values of Cout
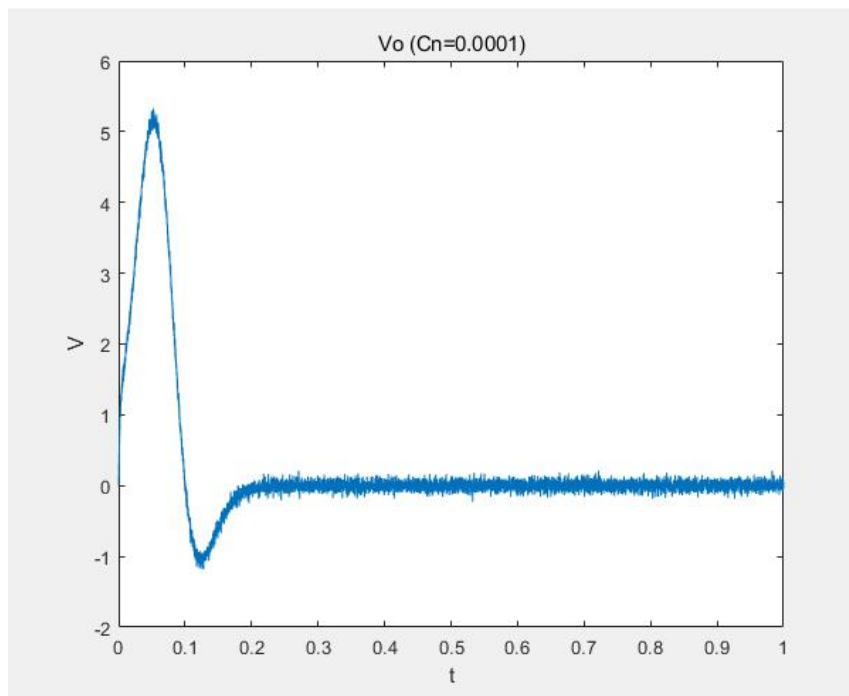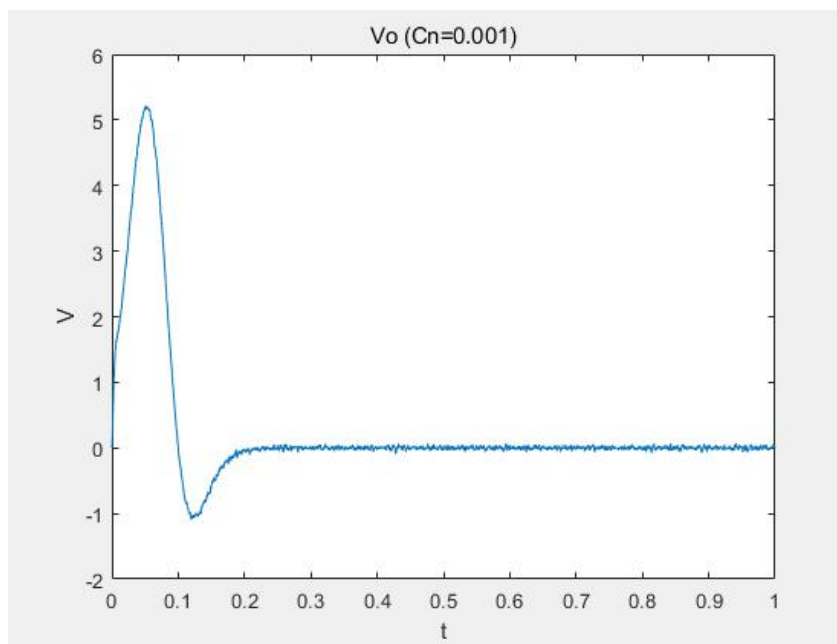

Figure11: Vout Plot (Cn=0.0001).
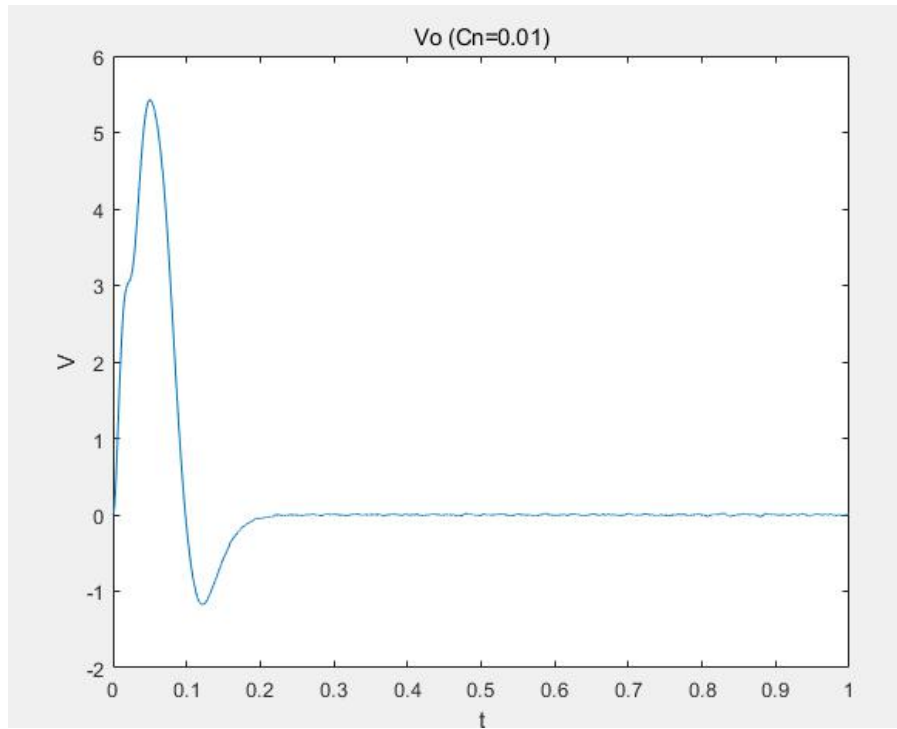

Figure12: Vout Plot (Cn=0.001).

Figure13: Vout Plot (Cn=0.01).

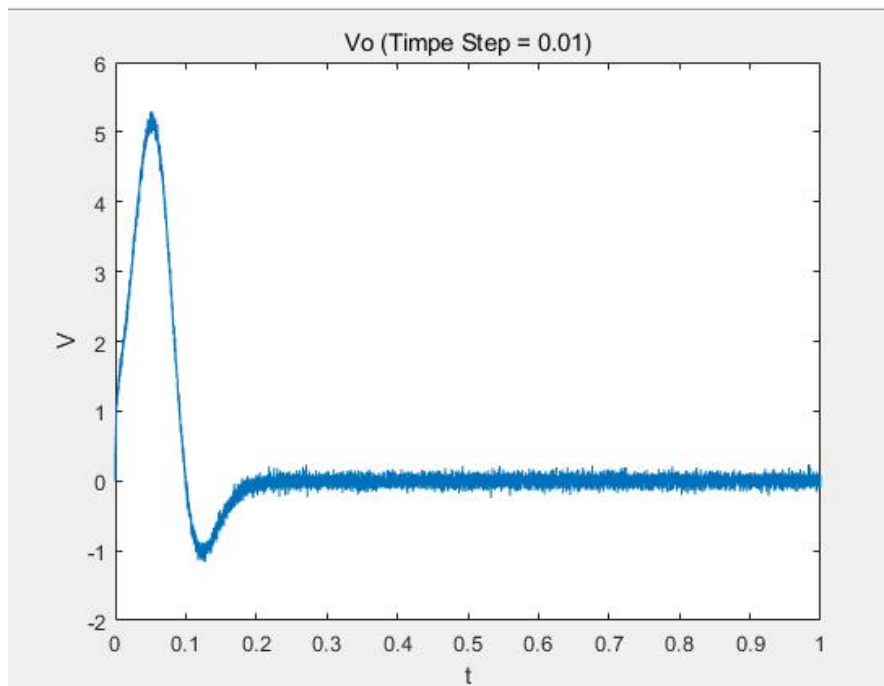e) 2 Plots of Vout with different time steps
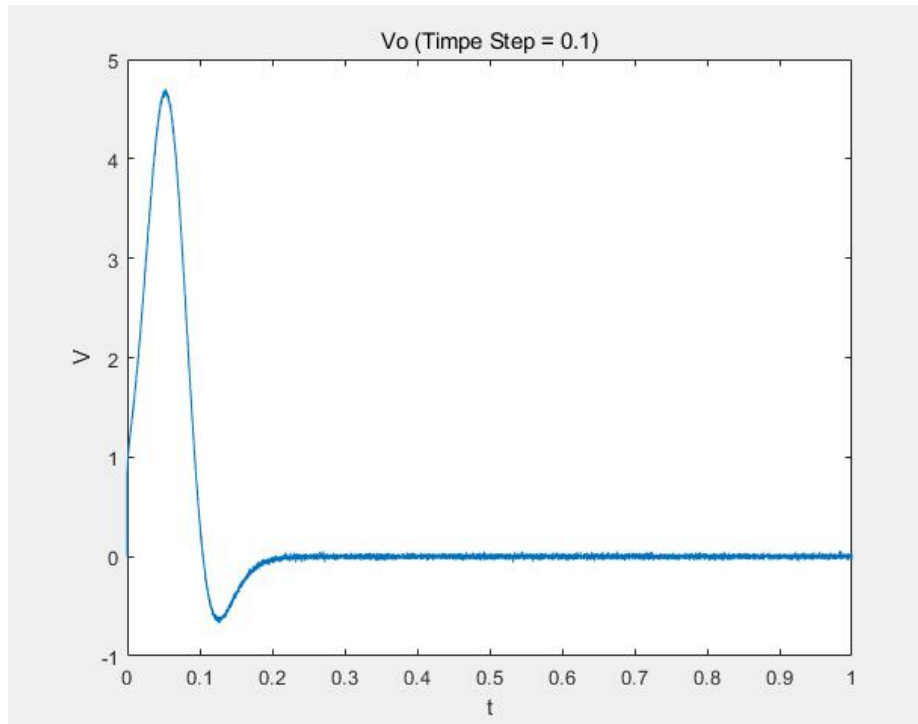

Figure14: Vout Plot (time step=0.01).

Figure15: Vout Plot (time step=0.1).

Part3:

For solving the nonlinear transconductance equation that the voltage source on the output stage, a b matrix is needed to form the MNA equation $\Phi(x) = Gx + F(x) - b = 0$. Besides, a Jacobian Matrix $M(x)$ is needed to implement the Newton's Iterations in the form $M(x^{(k)}) \times \Delta x = -\Phi(x^{(k)})$, where $x^{(k+1)} = x^{(k)} + \Delta x$.