Circuit Modeling

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Assignment 4
ELEC 4700 A
A2 11:30-1:30pm
10 April 2022

3.0 Report on PA 7

C =

0.2500	-0.2500	0	0	0	0	0	0
-0.2500	0.2500	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	0	0	0	0	0	0
0	0	0	0	0	0	-0.2000	0
0	0	0	0	0	0	0	0

G =

1	-1	0	0	0	1	0	0
-1	1.5000	0	0	0	0	1	0
0	0	0.0304	0	0	0	-1	0
0	0	0	10	-10	0	0	1
0	0	0	-10	10.0010	0	0	0
1	0	0	0	0	0	0	0
0	1	-1	0	0	0	0	0
0	0	-3.0395	1	0	0	0	0

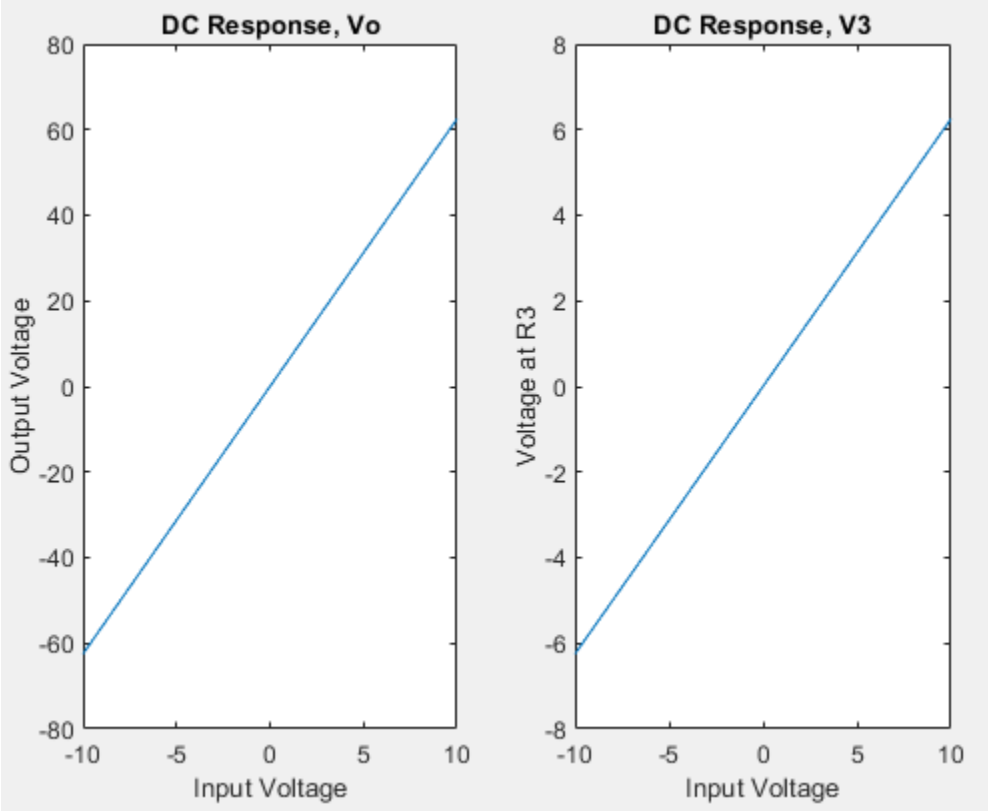


Figure 1: DC Response from PA7

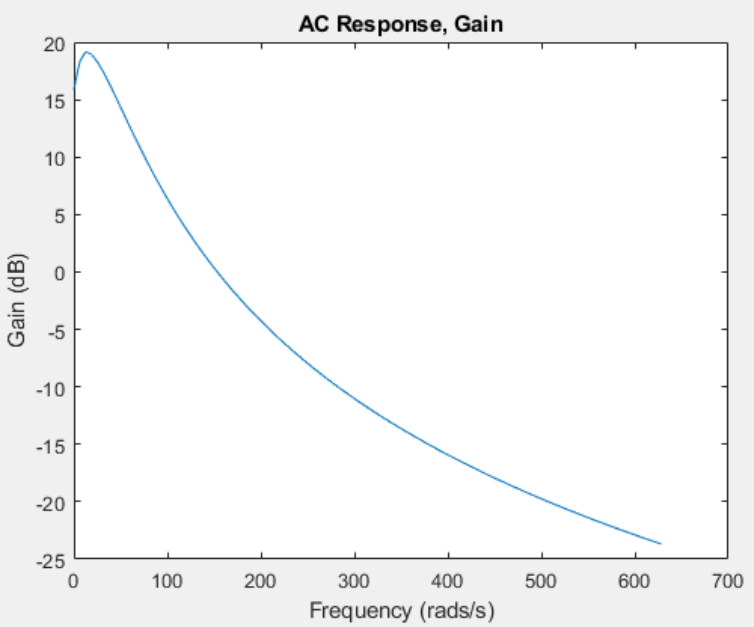


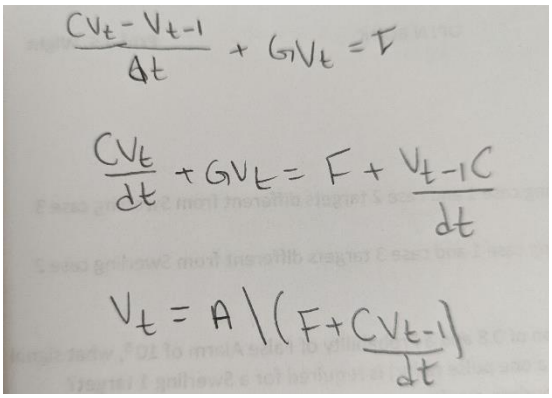
Figure 2: AC Gain from PA 7

4.0 Transient Circuit Simulation

a) The circuit is an amplifier

b) I expect a bandpass frequency response with a top and bottom cutoff frequency. The values/magnitude will depend on the input voltage.

c)



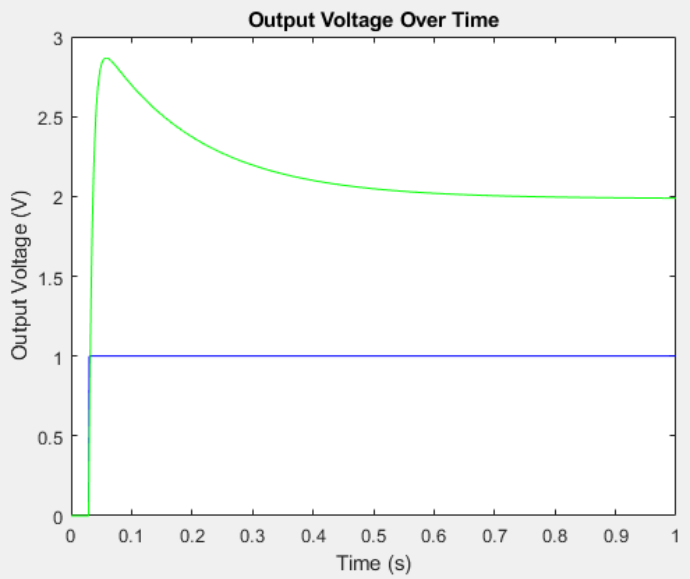


Figure 3: Step Input Numerical Solution Results

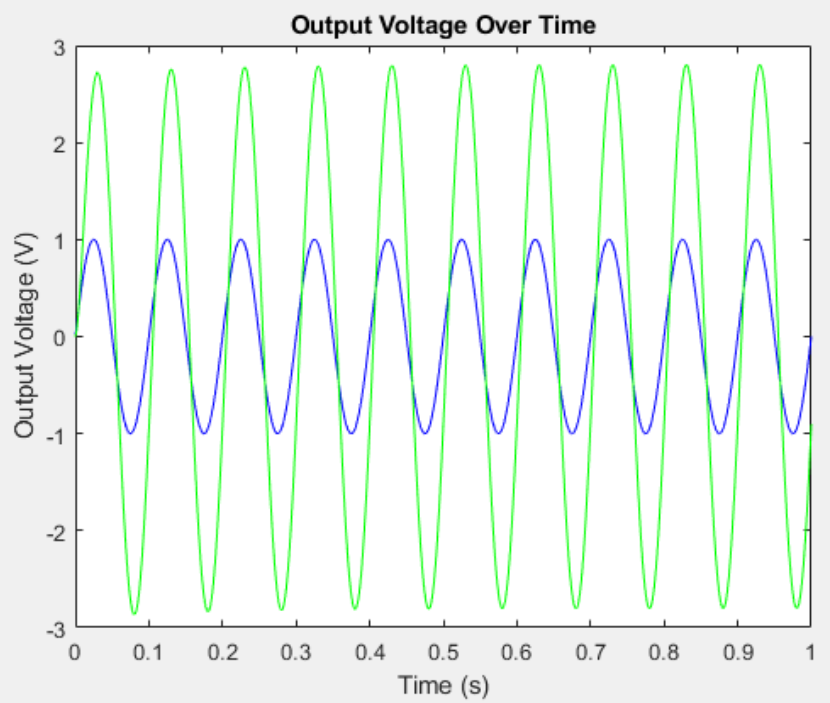


Figure 4: Sinusoidal Input Numerical Solution Results

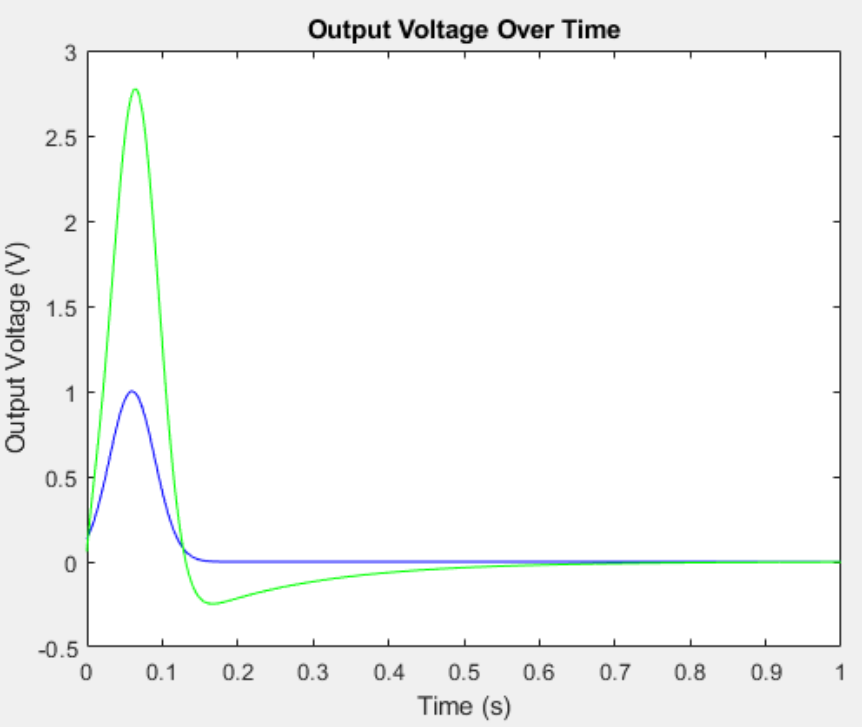


Figure 5: Gaussian Input Numerical Solution Results

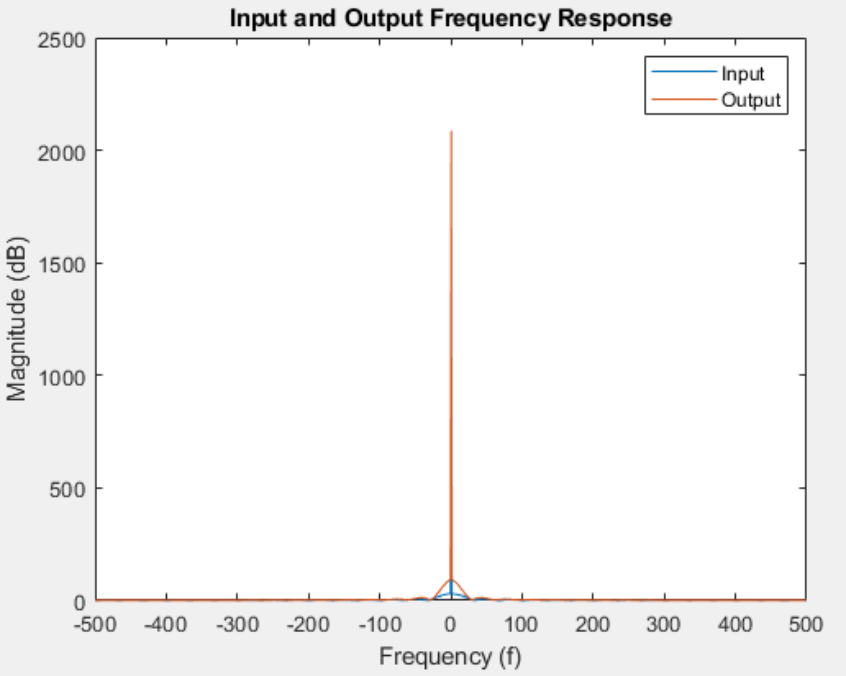


Figure 6: Step Frequency Response

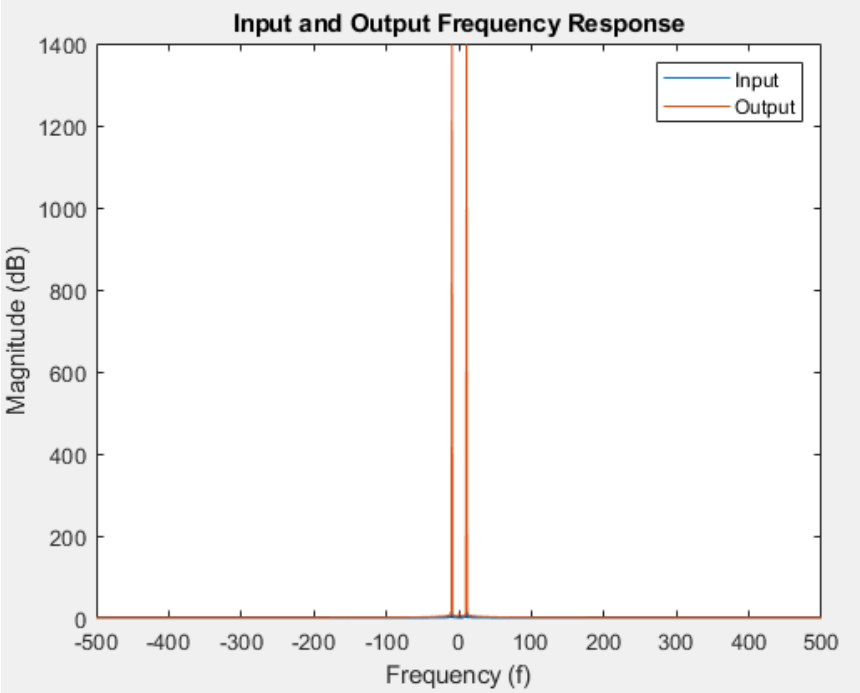


Figure 7: Sinusoidal Frequency Response

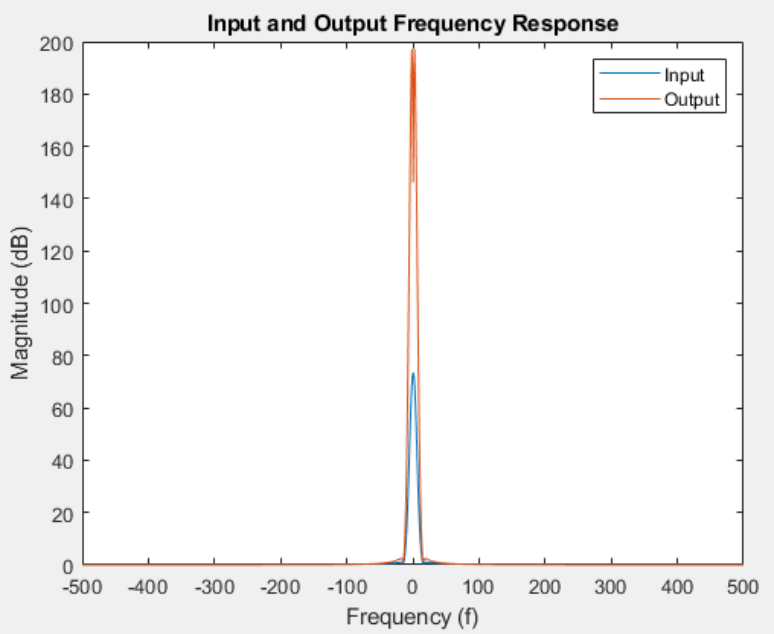


Figure 8: Gaussian Frequency Response

When I increase the time step then the curves get narrower and very slightly less smooth as the others.

5.0 Circuit with Noise

C =

0.2500	-0.2500	0	0	0	0	0	0
-0.2500	0.2500	0	0	0	0	0	0
0	0	1.0000e-05	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	0	0	0	-0.2000	0
0	0	0	0	0	0	0	0

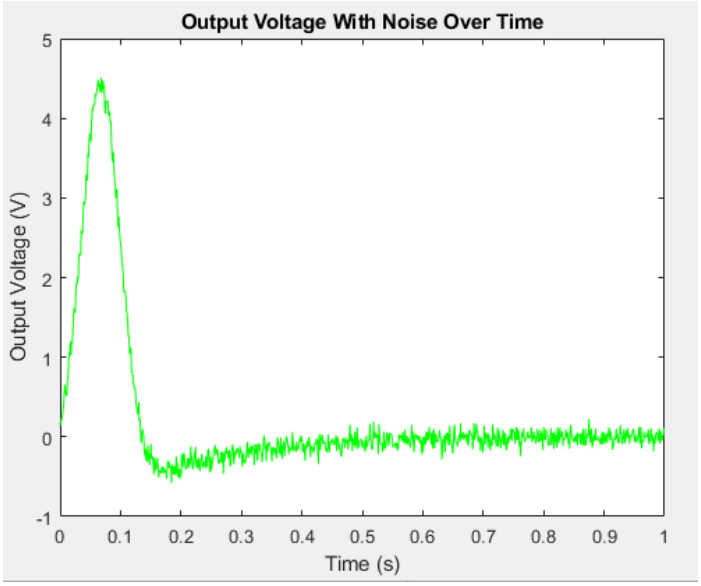


Figure 9: Output Voltage with Noise

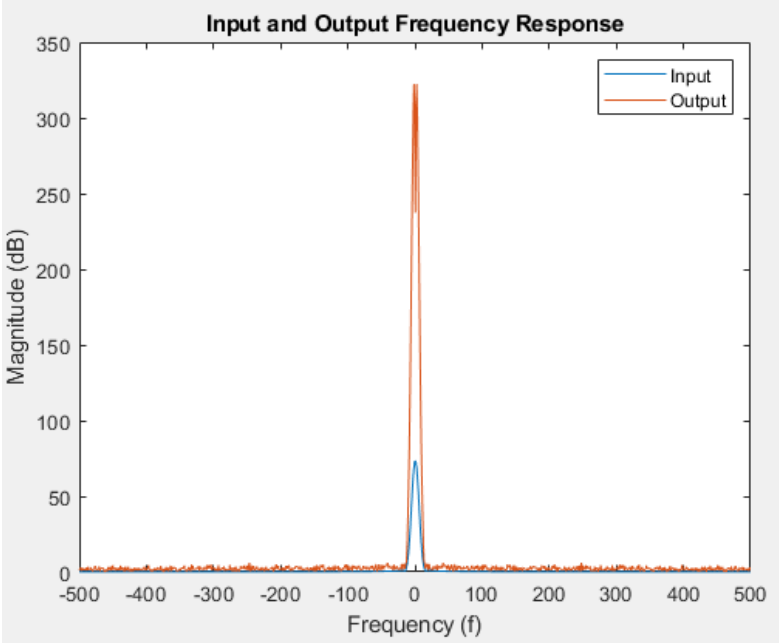


Figure 10: Gaussian Frequency Response with Noise

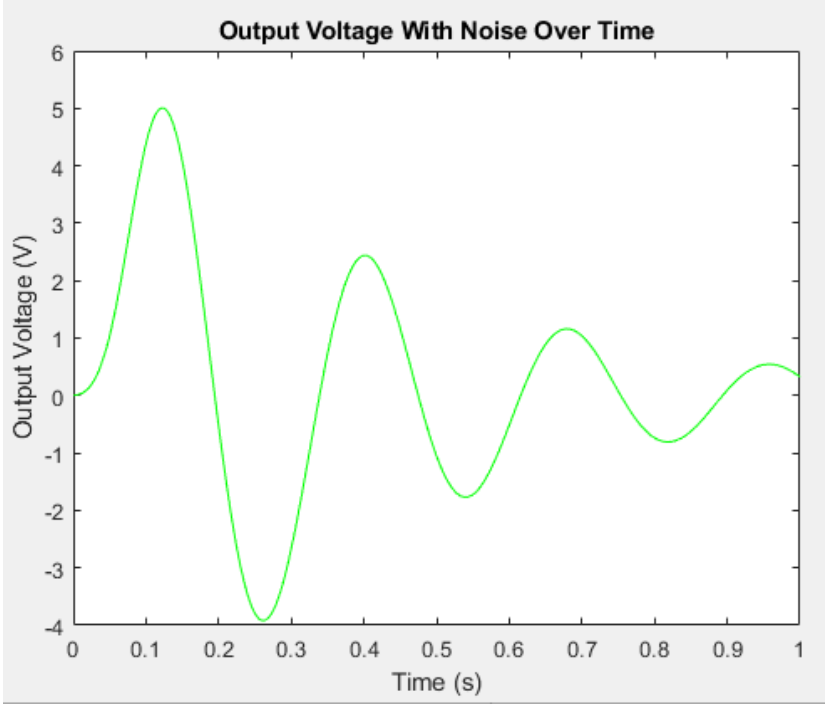


Figure 11: Output Voltage for Cn = 10e-3

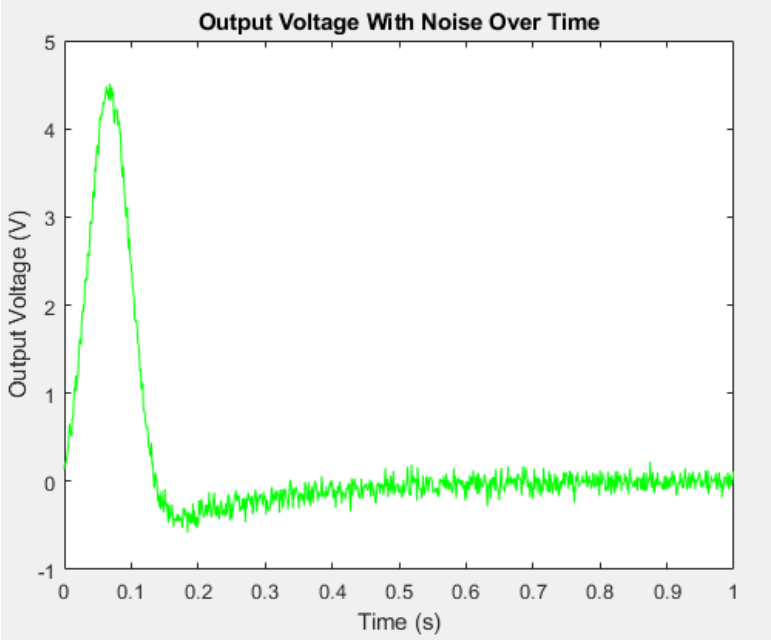


Figure 12: Output Voltage for Cn = 10e-6

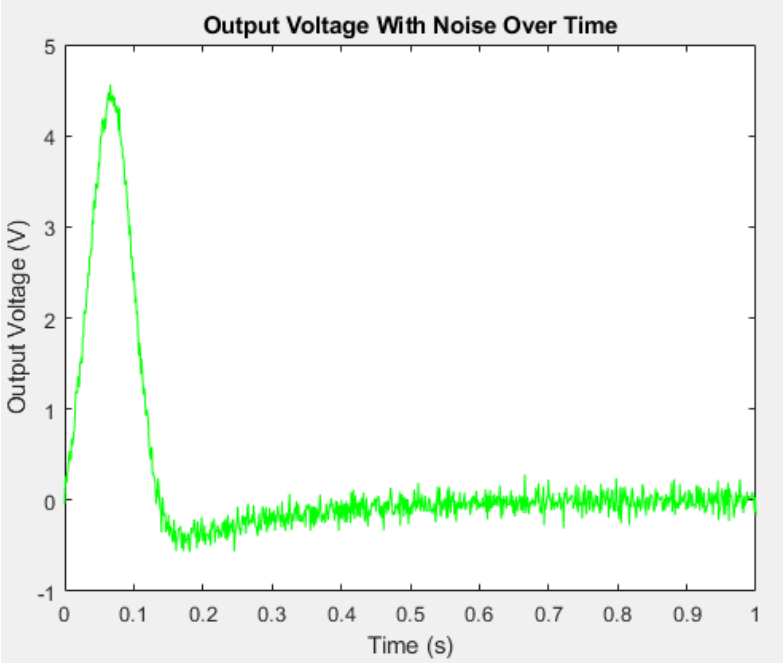


Figure 13: Output Voltage for Cn = 10e-9

As the capacitor changes, we get RC behaviour (Bigger cap) and we get more noise (Smaller cap).

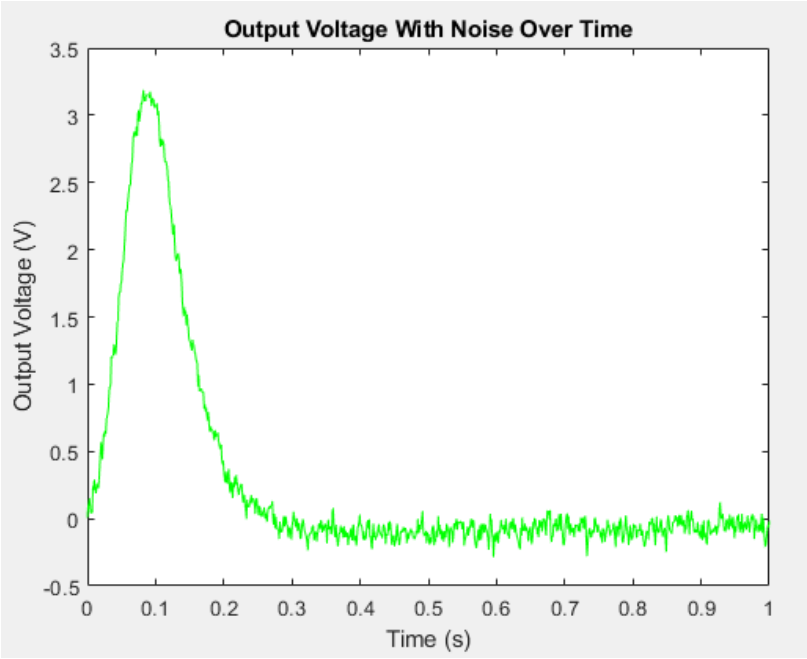


Figure 14: Output Voltage for dt = 1/100

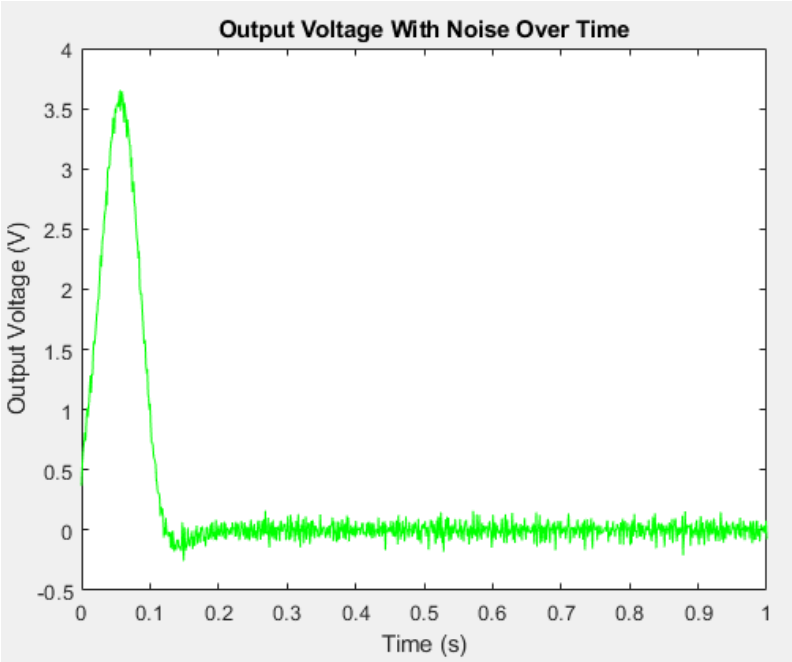


Figure 15: Output Voltage for dt = 1/5000

6.0 Non-Linearity

For my code that uses the stamps, and assuming that beta and gamma are also given to us, I would have to change the value of my voltage controlled voltage source from alpha/R3 to alpha/R3+(beta/R3)^2+(gamma/R3)^3.

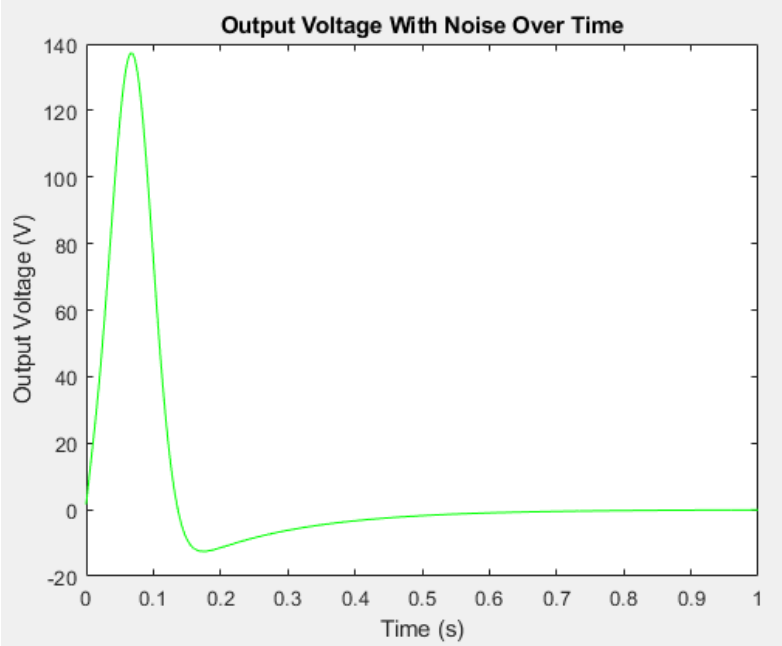


Figure 16: Output Voltage

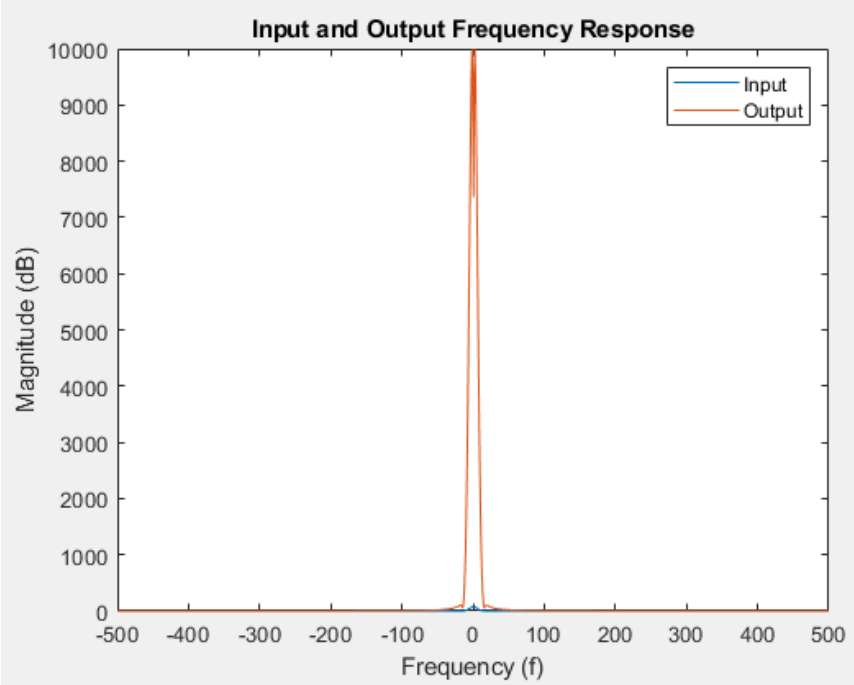


Figure 17: Frequency Response