Communication Theory Report 3

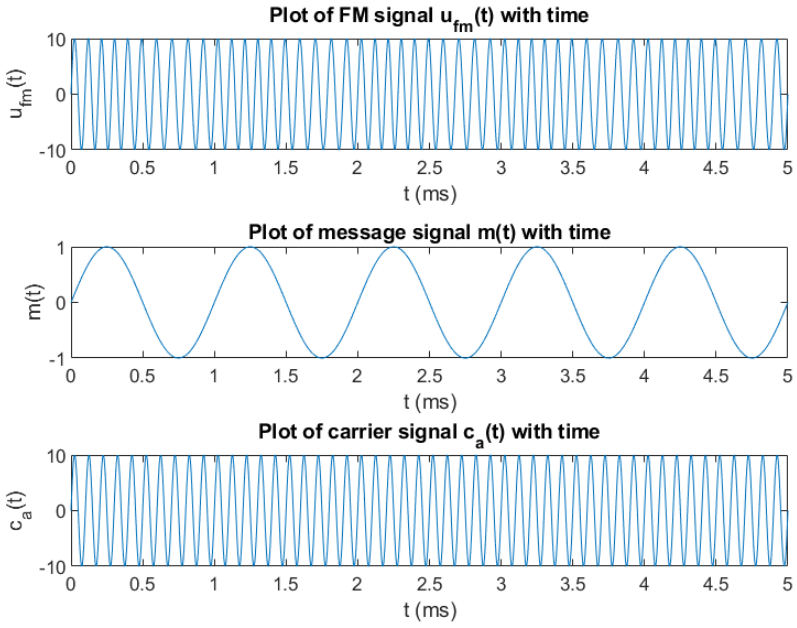
Ashuthosh Bharadwaj 2019112003

February 15, 2021

4 MATLAB simulation

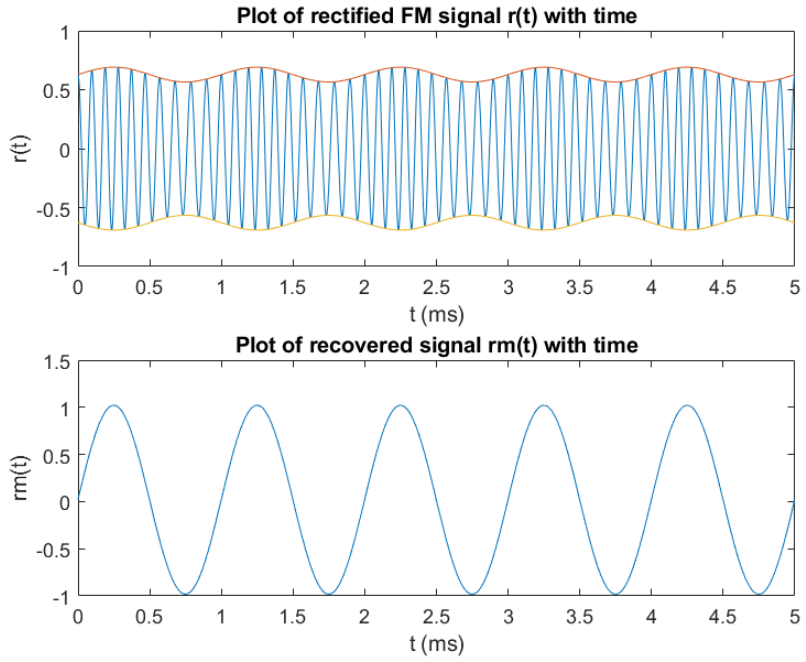
4.1 (a)

Sinusoid Message of frequency 1 KHz and amplitude 1 was created. The Carrier signal of frequency 10kHz and amplitude 10 was created. The final FM signal was created by adding the phase component which was the time integral of the message signal multiplied by 2 π and K_f which was given to be 1.



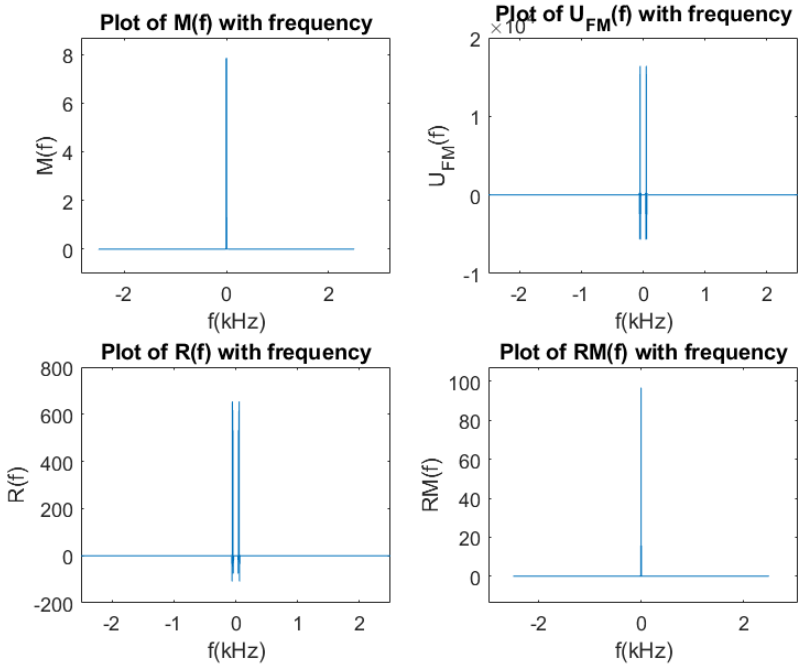
4.2 (b)

The generated FM signal was demodulated by running it through a diffrentiator block and then removing the DC and re-scaling the rectified signal.This is done by detecting the envelope of the rectified FM signal and then applying required scaling and shifting in DC.The following plot shows the rectified FM signal and the received message signal.



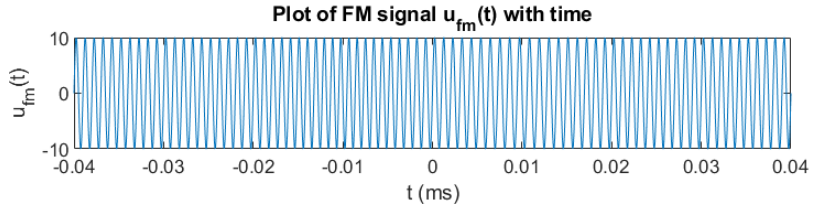
4.3 (c)

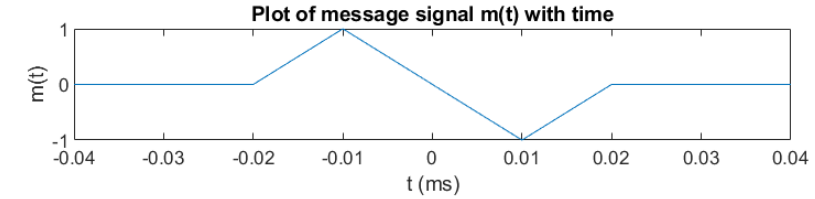
The following plot shows us the Frequency domain of the original message signal, Frequency modulated signal, the rectified FM signal and finally the recovered message signal.

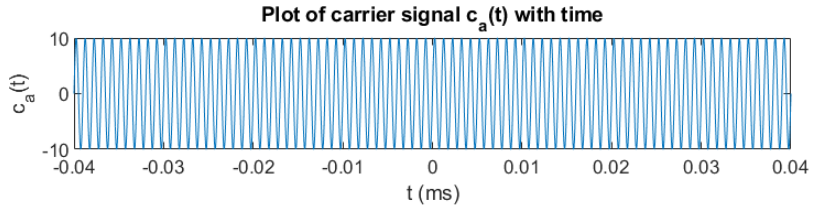


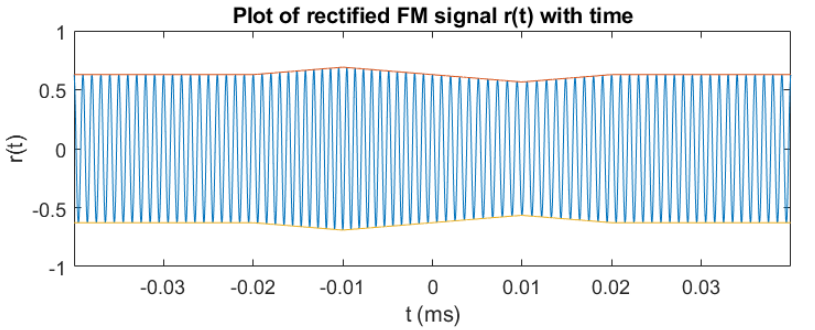
4.4 (d)

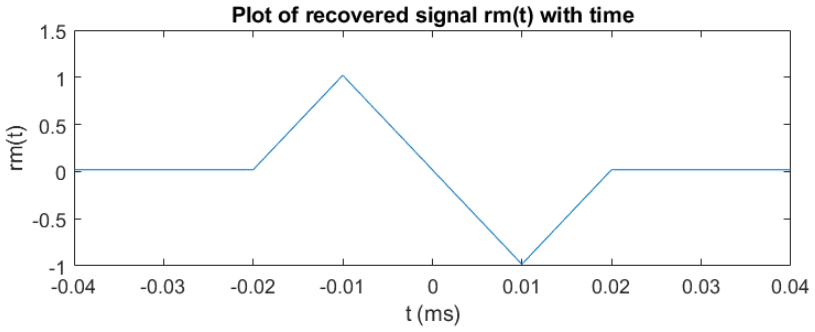
All the above steps were repeated for when the message signal was a modified sawtooth curve. The following plots show the different results got for the same.The three plots each show the same results as in (a), (b) and (c), we also see that the message signal was successfully rectified and it matches the original message signal.

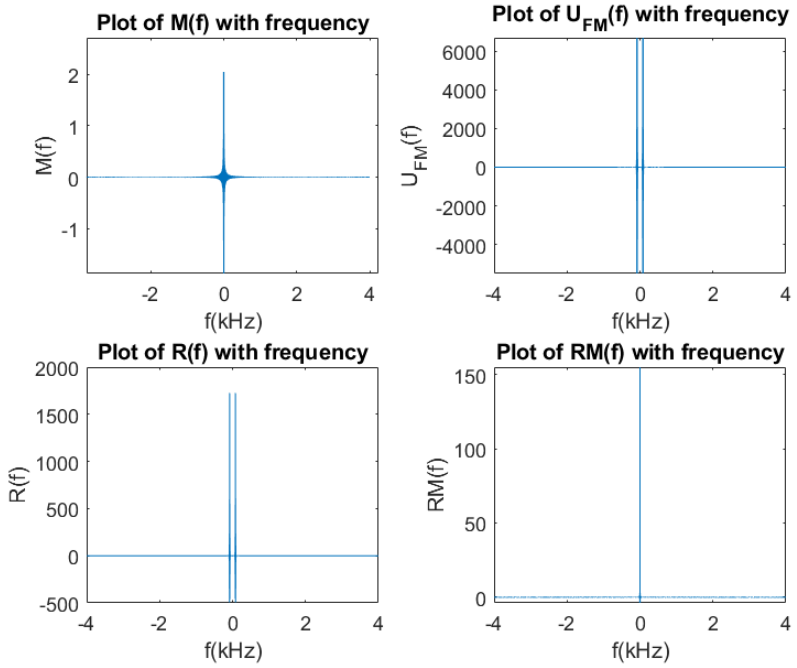

Plot of FM signal $u_{fm}(t)$ with time
$u_{fm}(t)$
10
0
-10
-0.04
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
0.04
t (ms)


Plot of message signal m(t) with time
m(t)
1
0
-1
-0.04
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
0.04
t (ms)


Plot of carrier signal $c_a(t)$ with time
$c_a(t)$
10
0
-10
-0.04
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
0.04
t (ms)


Plot of rectified FM signal r(t) with time
r(t)
1
0.5
0
-0.5
-1
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
t (ms)


Plot of recovered signal rm(t) with time
rm(t)
1.5
1
0.5
0
-0.5
-1
-0.04
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
0.04
t (ms)


Plot of M(f) with frequency
M(f)
f(kHz)
Plot of U_FM(f) with frequency
U_FM(f)
f(kHz)
Plot of R(f) with frequency
R(f)
f(kHz)
Plot of RM(f) with frequency
RM(f)
f(kHz)