```
clear all;
close all;
clc;
low_freq = 100; high_freq = 500;

down_factor = 100;
[x,fs,t, y2, w, N] = input_audio(low_freq, high_freq,down_factor);

[nqr] = source(y2,w,fs,x,N);

[quantized, symbol, symbols_rowVector, quantized_unique] =
 quantize(x,t);

[encoded_data, final_codebook, long_bitstream] = encode(quantized,
 symbol, symbols_rowVector);


roll_off_factors=[0 0.3 0.6 0.99];
[encoded_final_rc1, t2, Tb] = pulseshaping(long_bitstream,
 roll_off_factors);

[decode] = receiveddecode(encoded_final_rc1,t2, Tb);

f_aud = fs;
[final_sig] = tablelookup(decode, final_codebook, quantized_unique, t,
 f_aud);
```

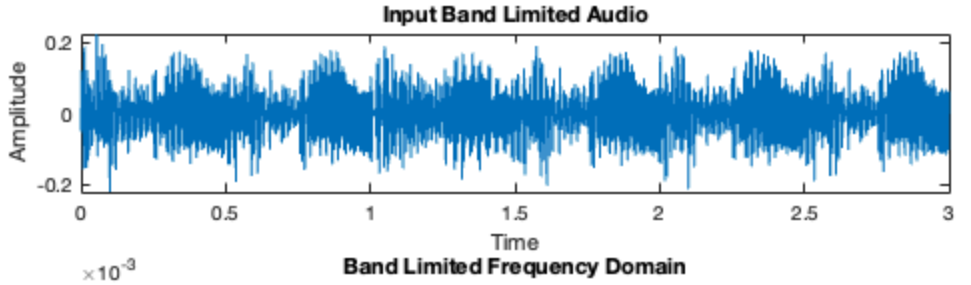
```
Warning: Specified passband
frequency is beyond the Nyquist
range so signal has been filtered
with a highpass filter.
Bitstream of the encoded sample(5 bits per symbol)

str_bit =


 "0101010001101011000100001100010000100011001111110010101110110100110011100110011100
```

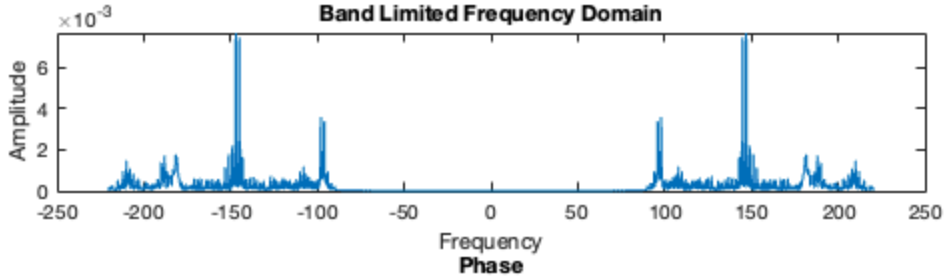
```
mse =

   3.9569e-04

bitstream size after quantization(5 bits per level)
        6620

Empirical Probability distribution of occurence of symbols coming out
 of the quantizer

out =

         0    0.0008
    1.0000    0.0015
```

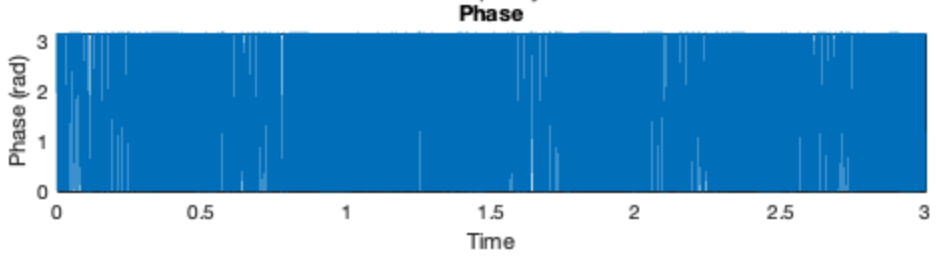
2.0000	0.0023
3.0000	0.0068
4.0000	0.0091
5.0000	0.0159
6.0000	0.0310
7.0000	0.0468
8.0000	0.0400
9.0000	0.0483
10.0000	0.0521
11.0000	0.0612
12.0000	0.0559
13.0000	0.0544
14.0000	0.0521
15.0000	0.0619
16.0000	0.0506
17.0000	0.0529
18.0000	0.0627
19.0000	0.0680
20.0000	0.0461
21.0000	0.0370
22.0000	0.0347
23.0000	0.0310
24.0000	0.0227
25.0000	0.0128
26.0000	0.0204
27.0000	0.0159
28.0000	0.0030
29.0000	0.0008
30.0000	0.0008
31.0000	0.0008

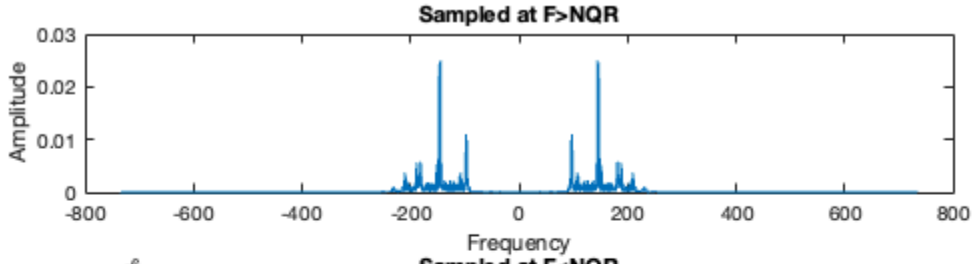
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

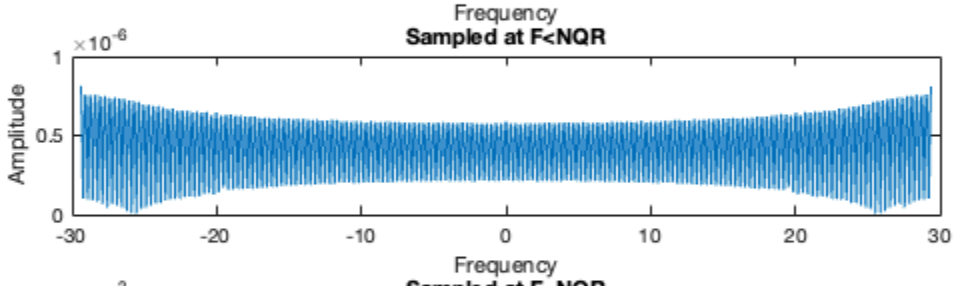
```
23
24
25
26
27
28
29
30
31
Codebook after Huffman Encoding

code_book_symbols =

  32×2 string array

    "A"    "00010010000"
    "B"    "0001001001"
    "C"    "000100110"
    "D"    "0010111"
    "E"    "0010110"
    "F"    "010010"
    "G"    "01100"
    "H"    "00000"
    "I"    "00011"
    "J"    "1111"
    "K"    "1100"
    "L"    "1000"
    "M"    "1001"
    "N"    "1010"
    "O"    "1101"
    "P"    "0111"
    "Q"    "1110"
    "R"    "1011"
    "S"    "0101"
    "T"    "0011"
    "U"    "00001"
    "V"    "00100"
    "W"    "01000"
    "X"    "01101"
    "Y"    "000101"
    "Z"    "0001000"
    "a"    "001010"
    "b"    "010011"
    "c"    "000100101"
    "d"    "00010010001"
    "e"    "0001001110"
    "f"    "0001001111"

Bitstream size after Huffman encoding =
        6034
```

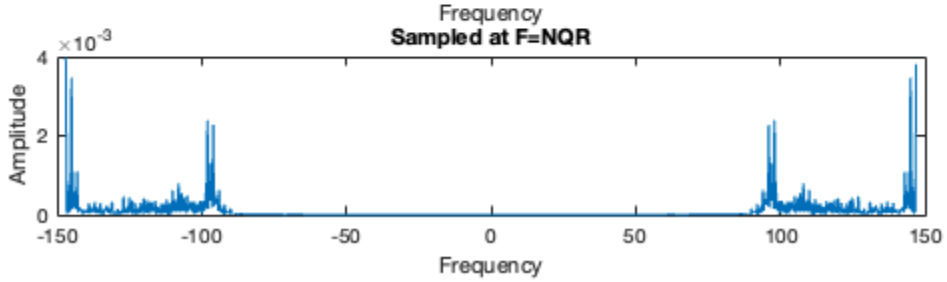

Input Band Limited Audio
Amplitude
Time

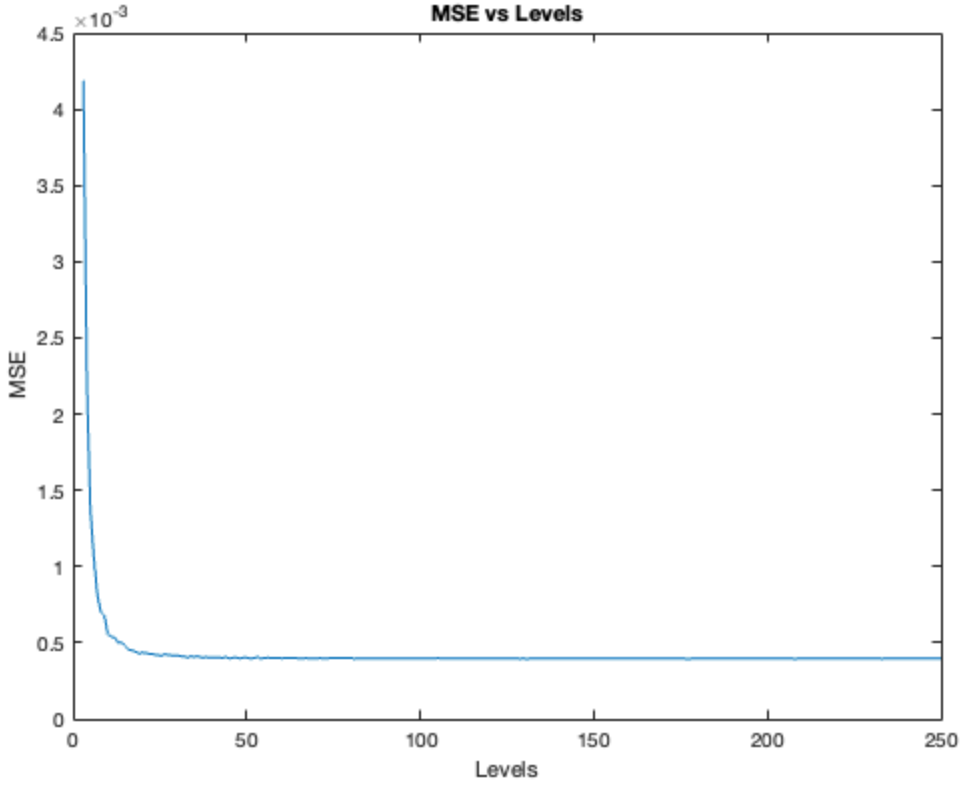

Band Limited Frequency Domain
Amplitude
Frequency

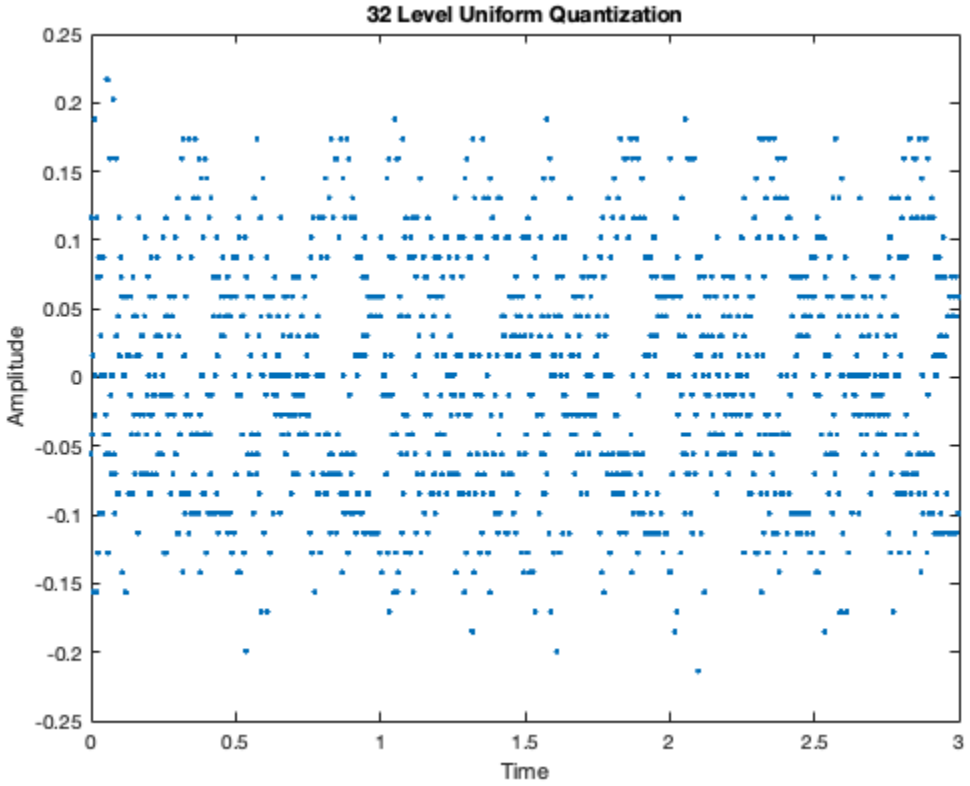

Phase
Phase (rad)
Time

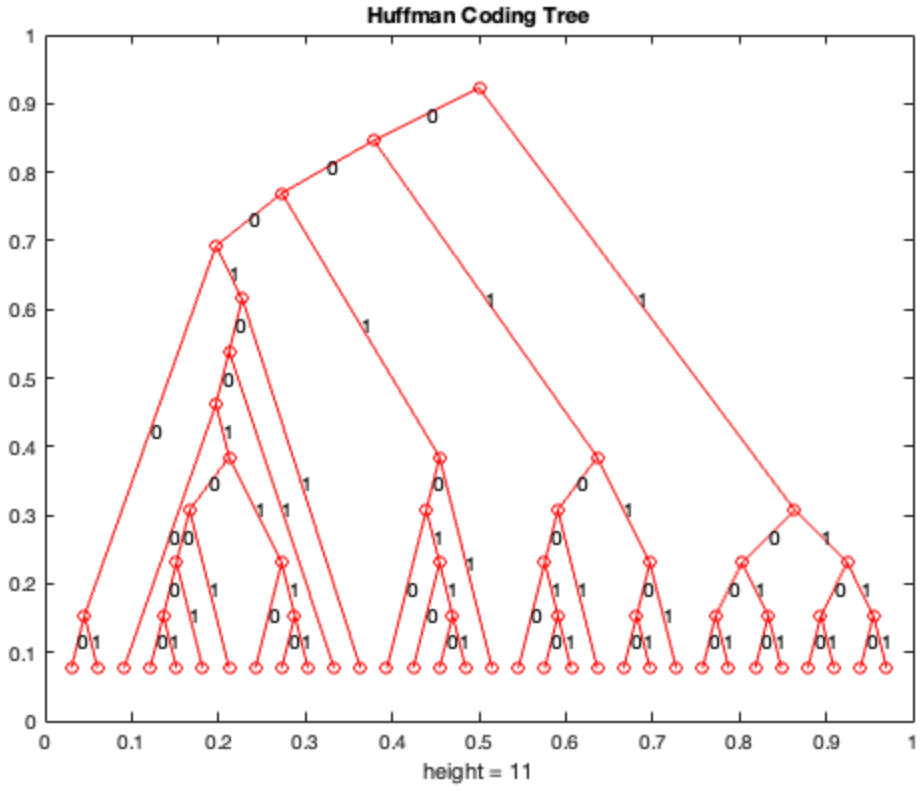

Sampled at F>NQR
Amplitude
Frequency

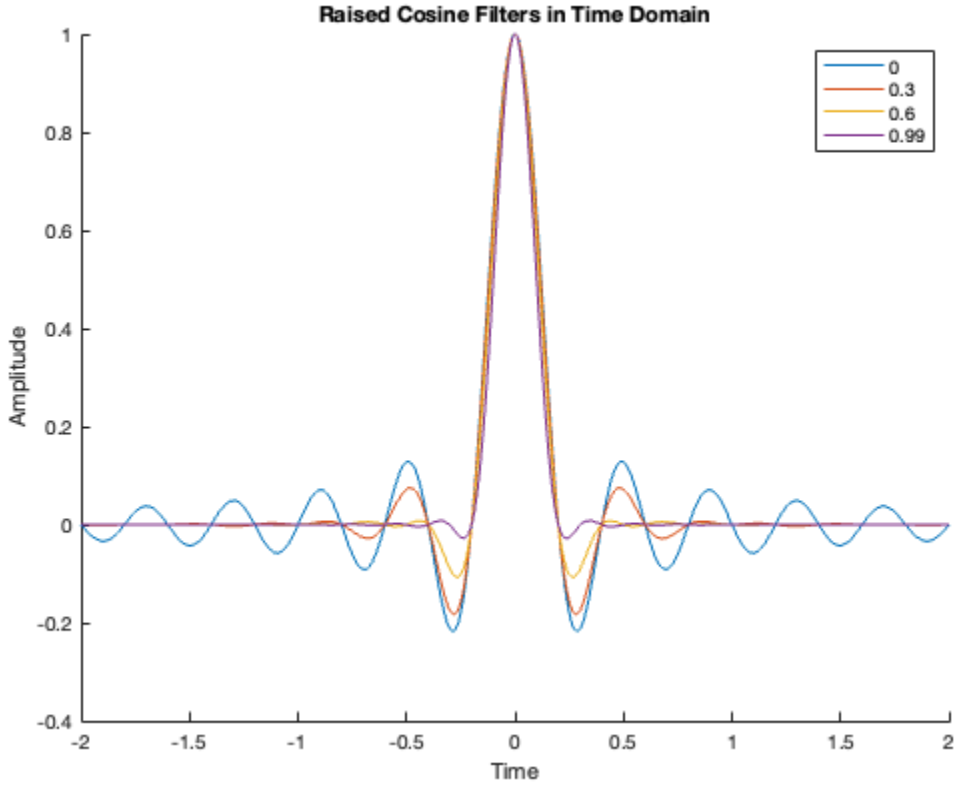

Sampled at F<NQR
Amplitude
Frequency

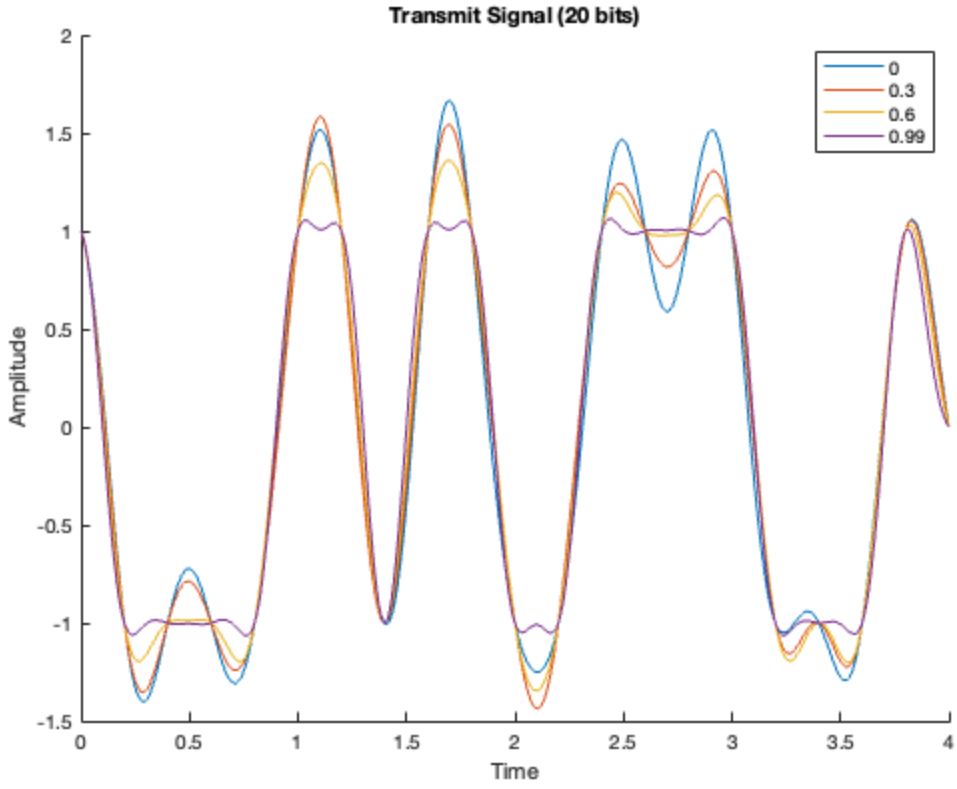

Sampled at F=NQR
Amplitude
Frequency

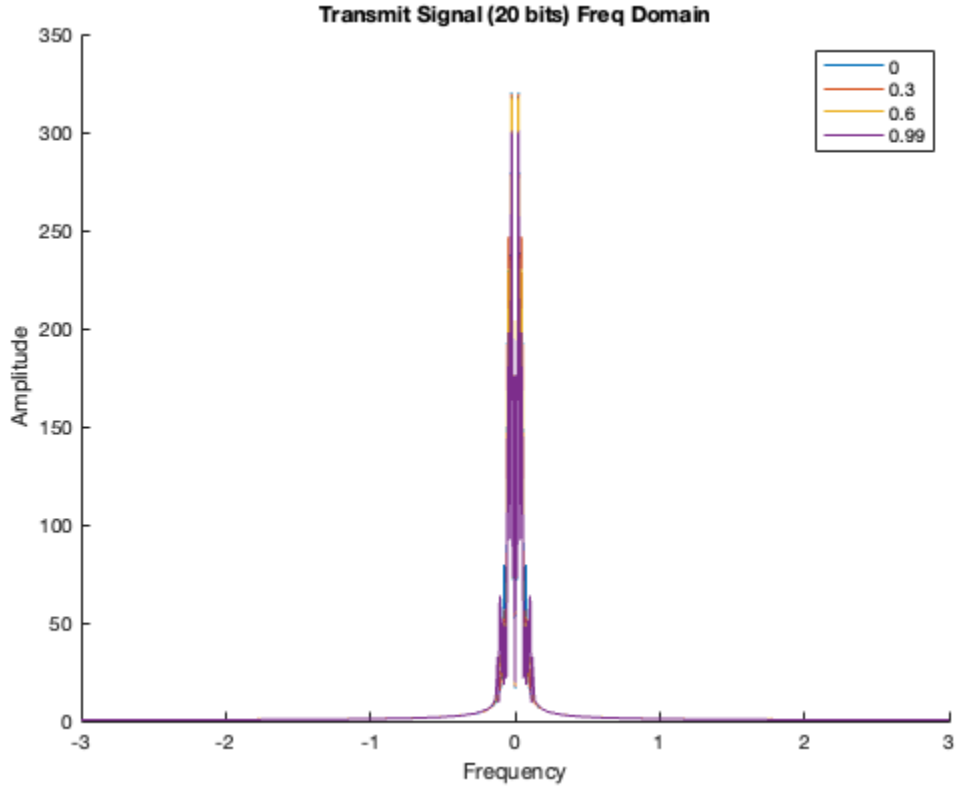

MSE vs Levels
×10^-3
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
MSE
0
50
100
150
200
250
Levels

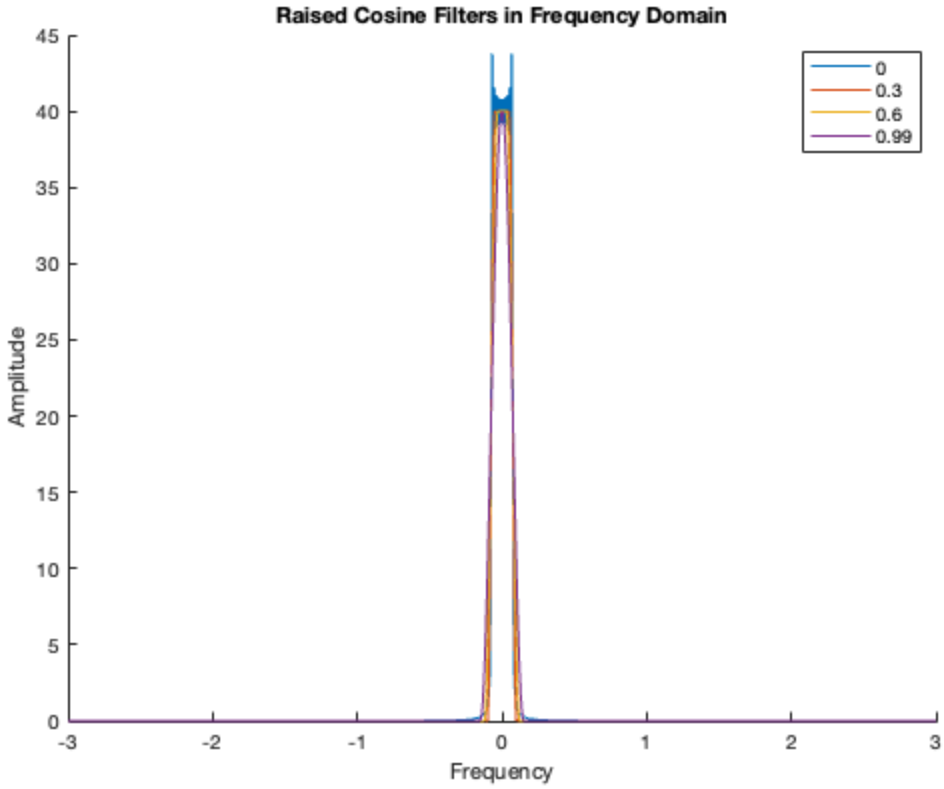

32 Level Uniform Quantization
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
Amplitude
0
0.5
1
1.5
2
2.5
3
Time

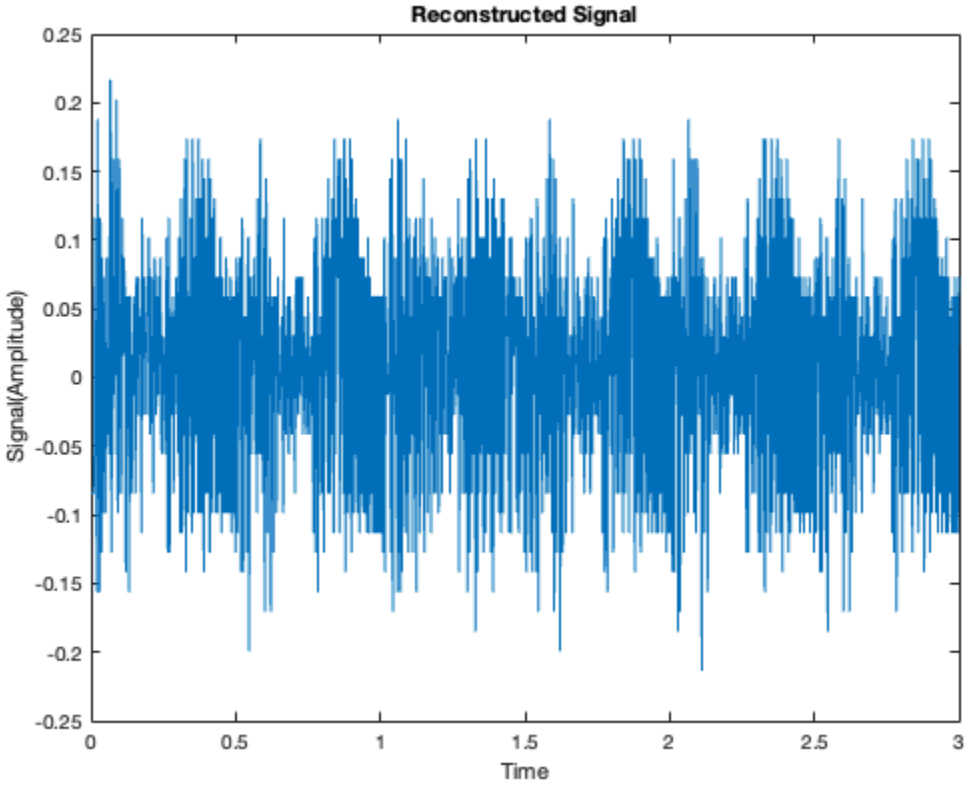

Huffman Coding Tree
height = 11


Raised Cosine Filters in Time Domain
0
0.3
0.6
0.99
Amplitude
Time


Transmit Signal (20 bits)
0
0.3
0.6
0.99
Amplitude
Time
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
3
3.5
4


Transmit Signal (20 bits) Freq Domain
0
0.3
0.6
0.99
Amplitude
Frequency
350
300
250
200
150
100
50
0
-3
-2
-1
0
1
2
3


Raised Cosine Filters in Frequency Domain
0
0.3
0.6
0.99
Amplitude
Frequency
45
40
35
30
25
20
15
10
5
0
-3
-2
-1
0
1
2
3


Reconstructed Signal
Signal(Amplitude)
Time
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
0
0.5
1
1.5
2
2.5
3

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