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3
4 # importing python modules
5 import matplotlib.pyplot as plt
6 import numpy as np
7 from scipy.fft import fft, fftshift, ifftshift, ifft
8
9 # vm1: Amplitude of Message Signal 1
10 # vm2: Amplitude of Message Signal 2
11 # fm1: frequency(Hz) of Message Signal 1
12 # fm2: frequency(Hz) of Message Signal 2
13
14 def values(vm1, vm2, fm1, fm2):
15
16     fs = 60000 #sampling frequency
17     dt = 1/fs #sample time interval or time-steps for time-domain signal
18     t = np.arange(0, 0.2, dt) #time indices for time-domain signal
19     n = np.size(t) #number of samples
20     df = fs/n #frequency interval or frequency-steps for frequency-spectrum
21     f = np.arange(-fs/2, fs/2, df) #frequency indices for frequency-spectrum
22
23     # plot1: Message Signal 1/Sinusoid(Volts) v/s Time(sec)
24     v1 = vm1*np.cos(2*np.pi*fm1*t)
25     plt.subplot(3, 3, 1)
26     plt.plot(t, v1)
27     plt.title("Message Signal 1", loc='left')
28     plt.xlabel("t(sec)", loc='right')
29     plt.ylabel("v1(Volts)")
30
31     # plot2: Message Signal 2/Sinusoid(Volts) v/s Time(sec)
32     v2 = vm2*np.cos(2*np.pi*fm2*t)
33     plt.subplot(3, 3, 2)
34     plt.plot(t, v2)
35     plt.title("Message Signal 2", loc='left')
36     plt.xlabel("t(sec)", loc='right')
37     plt.ylabel("v2(Volts)")
38
39     # plot3: Spectrum of Message Signal 1(Magnitude) v/s Frequency(Hz)
40     xf1 = fftshift(fft(v1)) #FFT of Message Signal 1(Complex in nature)
41     plt.subplot(3, 3, 3)
42     plt.plot(f, abs(xf1)/n) #Plotting frequency indices v/s Normalised magnitude of
43     FFT Message signal 1
44     plt.xlim(400, -400)
45     plt.title("Message 1 frequency Spectrum", loc='left')
46     plt.xlabel("frequency(Hz)", loc='right')
47     plt.ylabel("Magnitude")
48
49     # plot4: Spectrum off Message Signal 2(Magnitude) v/s Frequency(Hz)
50     xf2 = fftshift(fft(v2)) #FFT of Message Signal 2(Complex in nature)
51     plt.subplot(3, 3, 4)
52     plt.plot(f, abs(xf2)/n) #Plotting frequency indices v/s Normalised magnitude of
53     FFT Message signal 2
54     plt.xlim(400, -400)
55     plt.title("Message 2 frequency Spectrum", loc='left')
56     plt.xlabel("frequency(Hz)", loc='right')
57     plt.ylabel("Magnitude")
58
59     # plot5: Spectrum of FDM Signal v/s Frequency(Hz)

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58     xf3 = xf1 + xf2 #Frequency Division Multiplexing both Message Signals
59     plt.subplot(3, 3, 5)
60     plt.plot(f, abs(xf3)/n) #Plotting frequency indices v/s Normalised magnitude of
FDM Signal
61     plt.xlim(400, -400)
62     plt.title("Spectrum of FDM Signal", loc='left')
63     plt.xlabel("frequency(Hz)", loc='right')
64     plt.ylabel("Magnitude")
65
66     # plot6: Demultiplexed signals v/s Time(sec)
67
68     # filter 1 Designing
69     bpf1 = [] #List having array of 0's and 1's
70
71     for x in f:
72         if x < fm1+5 and x > -fm1-5:
73             x = 1
74             bpf1.append(x) #Assigning 1 to frequencies in the Range/Band
75         else:
76             x = 0
77             bpf1.append(x) #Assigning 0 to frequencies not the Range/Band
78
79     #Demultiplexing to get Message Signal 1
80     y1 = xf3*bpf1 #Multiplying Filter 1 with FDM Signal to Aquire Original Message 1
Signal
81     dm1 = ifft(fftshift(y1)) #Inverse FFT to get Original Message signal 1(time-
domain)
82     plt.subplot(3, 3, 6)
83     plt.plot(t, dm1)
84     plt.title("Demultiplexed Message Signal 1", loc='left')
85     plt.xlabel("t(sec)", loc='right')
86     plt.ylabel("v1(Volts)")
87
88     # filter 2 Designing
89     bpf2 = [] #List having array of 0's and 1's
90
91     for x in f:
92         if x > -(fm2+5) and x < -(fm1+5) or x < (fm2+5) and x > (fm1+5):
93             x = 1
94             bpf2.append(x) #Assigning 1 to frequencies in the Range/Band
95         else:
96             x = 0
97             bpf2.append(x) #Assigning 0 to frequencies not the Range/Band
98
99     # Demultiplexing to get Message Signal 2
100    y2 = xf3*bpf2 #Multiplying Filter 2 with FDM Signal to Aquire Original Message 2
Signal
101    dm2 = ifft(fftshift(y2)) #Inverse FFT to get Original Message signal 2(time-
domain)
102    plt.subplot(3, 3, 7)
103    plt.plot(t, dm2)
104    plt.title("Demultiplexed Message Signal 2", loc='left')
105    plt.xlabel("t(sec)", loc='right')
106    plt.ylabel("v2(Volts)")
107
108    plt.subplot_tool()
109    plt.show()
110
111    values(1, 1, 100, 150) #Assigning Values to the parameters

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