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% dsb1.m
% Matlab demonstration script for DSB-AM modulation. The message signal
% is +1 for 0 < t < t0/3, -2 for t0/3 < t < 2t0/3 and zero otherwise.
echo on
t0=.15;                                 % signal duration
ts=0.001;                               % sampling interval
fc=250;                                 % carrier frequency
snr=20;                                 % SNR in dB (logarithmic)
fs=1/ts;                                % sampling frequency
df=0.3;                                 % desired freq. resolution
t=[0:ts:t0];                            % time vector
snr_lin=10^(snr/10);                    % linear SNR
% message signal
m=[ones(1,t0/(3*ts)),-2*ones(1,t0/(3*ts)),zeros(1,t0/(3*ts)+1)];
c=cos(2*pi*fc.*t);                      % carrier signal
u=m.*c;                                 % modulated signal
[M,m,df1]=fftseq(m,ts,df);              % Fourier transform
M=M/fs;                                 % scaling
[U,u,df1]=fftseq(u,ts,df);              % Fourier transform
U=U/fs;                                 % scaling
[C,c,df1]=fftseq(c,ts,df);              % Fourier transform
f=[0:df1:df1*(length(m)-1)]-fs/2;       % freq. vector
signal_power=spower(u(1:length(t)));          % power in modulated signal
noise_power=signal_power/snr_lin;       % compute noise power
noise_std=sqrt(noise_power);            % compute noise standard deviation
noise=noise_std*randn(1,length(u));     % generate noise
r=u+noise;                              % add noise to the modulated signal
[R,r,df1]=fftseq(r,ts,df);              % spectrum of the signal+noise
R=R/fs;                                 % scaling
pause  % Press a key to show the modulated signal power
signal_power
pause  % Press any key to see a plot of the message
clf
subplot(2,2,1)
plot(t,m(1:length(t)))
xlabel('Time')
title('The message signal')
pause  % Press any key to see a plot of the carrier
subplot(2,2,2)
plot(t,c(1:length(t)))
xlabel('Time')
title('The carrier')
pause  % Press any key to see a plot of the modulated signal
subplot(2,2,3)
plot(t,u(1:length(t)))
xlabel('Time')
title('The modulated signal')
pause   % Press any key to see a plots of the magnitude of the message and
the
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       % modulated signal in the frequency domain.
subplot(2,1,1)
plot(f,abs(fftshift(M)))
xlabel('Frequency')
title('Spectrum of the message signal')
subplot(2,1,2)
plot(f,abs(fftshift(U)))
title('Spectrum of the modulated signal')
xlabel('Frequency')
pause  % Press a key to see a noise sample
subplot(2,1,1)
plot(t,noise(1:length(t)))
title('noise sample')
xlabel('Time')
pause  % Press a key to see the modulated signal and noise
subplot(2,1,2)
plot(t,r(1:length(t)))
title('Signal and noise')
xlabel('Time')
pause  % Press a key to see the modulated signal and noise in freq. domain
subplot(2,1,1)
plot(f,abs(fftshift(U)))
title('Signal spectrum')
xlabel('Frequency')
subplot(2,1,2)
plot(f,abs(fftshift(R)))
title('Signal and noise spectrum')
xlabel('Frequency')
```