**例 5‑1**

%数字基带信号的功率谱密度 digit\_baseband.m

clear all; close all;

Ts=1;

N\_sample = 8; %每个码元的抽样点数

dt = Ts/N\_sample; %抽样时间间隔

N = 1000; %码元数

t = 0:dt:(N\*N\_sample-1)\*dt;

gt1 = ones(1,N\_sample); %NRZ非归零波形

gt2 = ones(1,N\_sample/2); %RZ归零波形

gt2 = [gt2 zeros(1,N\_sample/2)];

mt3 = sinc((t-5)/Ts); % sin(pi\*t/Ts)/(pi\*t/Ts)波形，截段取10个码元

gt3 = mt3(1:10\*N\_sample);

d = ( sign( randn(1,N) ) +1 )/2;

data = sigexpand(d,N\_sample); %对序列间隔插入N\_sample-1个0

st1 = conv(data,gt1); %Matlab自带卷积函数

st2 = conv(data,gt2);

d = 2\*d-1; %变成双极性序列

data= sigexpand(d,N\_sample);

st3 = conv(data,gt3);

[f,st1f] = T2F(t,[st1(1:length(t))]);

[f,st2f] = T2F(t,[st2(1:length(t))]);

[f,st3f] = T2F(t,[st3(1:length(t))]);

figure(1)

subplot(321)

plot(t,[st1(1:length(t))] );grid

axis([0 20 -1.5 1.5]);ylabel('单极性NRZ波形');

subplot(322);

plot(f,10\*log10(abs(st1f).^2/T) );grid

axis([-5 5 -40 10]); ylabel('单极性NRZ功率谱密度(dB/Hz)');

subplot(323)

plot(t,[st2(1:length(t))] );

axis([0 20 -1.5 1.5]);grid

ylabel('单极性RZ波形');

subplot(324)

plot(f,10\*log10(abs(st2f).^2/T));

axis([-5 5 -40 10]);grid

ylabel('单极性RZ功率谱密度(dB/Hz)');

subplot(325)

plot(t-5,[st3(1:length(t))] );

axis([0 20 -2 2]);grid

ylabel('双极性sinc波形');xlabel('t/Ts');

subplot(326)

plot(f,10\*log10(abs(st3f).^2/T));

axis([-5 5 -40 10]);grid

ylabel('sinc波形功率谱密度(dB/Hz)');xlabel('f\*Ts');

function [out]=sigexpand(d,M)

%将输入的序列扩展成间隔为N-1个0的序列

N = length(d);

out = zeros(M,N);

out(1,:) = d;

out = reshape(out,1,M\*N);

**例 5‑2**

%数字基带信号接收示意 digit\_receive.m

clear all;

close all;

N =100;

N\_sample=8; %每码元抽样点数

Ts=1;

dt = Ts/N\_sample;

t=0:dt:(N\*N\_sample-1)\*dt;

gt = ones(1,N\_sample); %数字基带波形

d = sign(randn(1,N)); %输入数字序列

a = sigexpand(d,N\_sample);

st = conv(a,gt); %数字基带信号

ht1 = gt;

rt1 = conv(st,ht1);

ht2 = 5\*sinc(5\*(t-5)/Ts);

rt2 = conv(st,ht2);

figure(1)

subplot(321)

plot( t,st(1:length(t)) );

axis([0 20 -1.5 1.5]); ylabel('输入双极性NRZ数字基带波形');

subplot(322)

stem( t,a);

axis([0 20 -1.5 1.5]); ylabel('输入数字序列')

subplot(323)

plot( t,[0 rt1(1:length(t)-1)]/8 );

axis([0 20 -1.5 1.5]);ylabel('方波滤波后输出');

subplot(324)

dd = rt1(N\_sample:N\_sample:end);

ddd= sigexpand(dd,N\_sample);

stem( t,ddd(1:length(t))/8 );

axis([0 20 -1.5 1.5]);ylabel('方波滤波后抽样输出');

subplot(325)

plot(t-5, [0 rt2(1:length(t)-1)]/8 );

axis([0 20 -1.5 1.5]);

xlabel('t/Ts'); ylabel('理想低通滤波后输出');

subplot(326)

dd = rt2(N\_sample-1:N\_sample:end);

ddd=sigexpand(dd,N\_sample);

stem( t-5,ddd(1:length(t))/8 );

axis([0 20 -1.5 1.5]);

xlabel('t/Ts'); ylabel('理想低通滤波后抽样输出');