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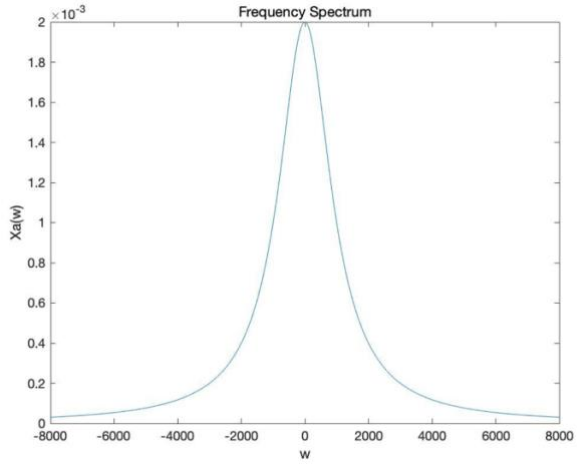
Assignment 2

Task 1：

Code：

```
a=1000;
w=linspace(-8000,8000,100000);
for k=1:length(w)
    Xa(k)=2*a/(a^2+w(k)^2);
end
plot(w,Xa);
title('Frequency Spectrum');
xlabel('w');
ylabel('Xa(w)');
```

Graph：



Comment：

The main task of Task1 is to plot the spectrum of Xa(t), also known as Xa(omega), by means of analysis.

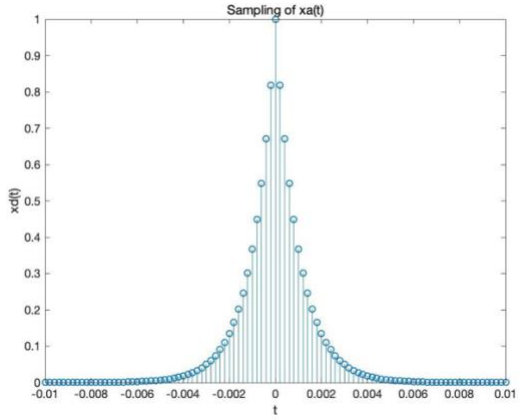
This allows us to compare it with the spectrum formed later by sampling the signal afterwards.

Task 2：

Code：

```
a=1000;
n=-50:50;
Fs=5000;
Ts=1/Fs;
t=n*Ts;
xd=exp(-a*abs(t));
stem(t,xd);
title('Sampling of xa(t)');
xlabel('t');
ylabel('xd(t)');
```

Graph：



Comment：

In Task2, I set the sampling frequency, the sampling period, and set the matrix n to form the range I am sampling.

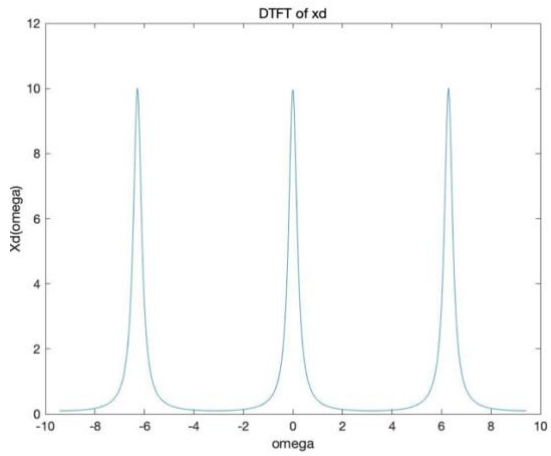
By this method, I obtain a discrete signal obtained by sampling the original signal with Xa (t).

Task 3:

Code：

```
w = linspace(-3*pi,3*pi,500);
Xd = zeros(1,length(w));
for k=1:length(w)
Xd(k)=sum(xd.*exp(-1i*w(k)*n));
end
plot(w,abs(Xd));
title('DTFT of xd');
xlabel('omega');
ylabel('Xd(omega)');
```

Graph：



Comment：

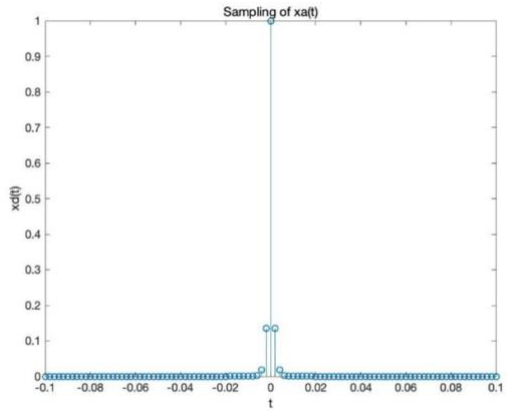
When I perform the Fourier transform on xd, I find that it is the sum of the scaled and shifted X(omega) obtained by performing the Fourier transform on xa itself. This is why the image I obtain is in period 2*pi. Comparing the plots obtained by Task3 with those obtained by Task1, I can clearly find similarities, and in terms of peaks, exactly the results that should be obtained by multiplying the set Fs.

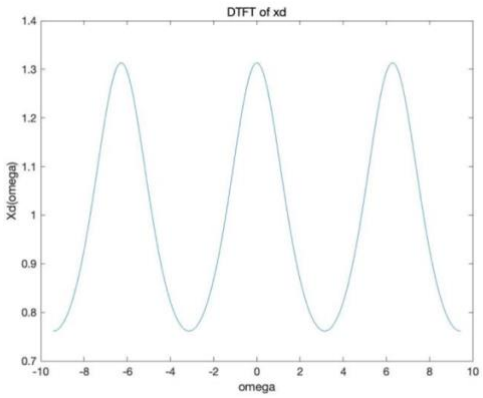
Task 4：

Code：

```
a=1000;
n=-50:50;
Fs=500;
Ts=1/Fs;
t=n*Ts;
xd=exp(-a*abs(t));
stem(t,xd);
title('Sampling of xa(t)');
xlabel('t');
ylabel('xd(t)');
```

Graph：





Comment：

1. After turning down the value of Fs, the sampled frequency is reduced and the obtained images are not as close as those obtained by Task2.

2. As the Fs decreases, the ws takes a loIr value as a result, and comparing this with the CTFT of the previous continuous signal, a more pronounced distortion can be found. This is more clearly contrasted in the upper and loIr peaks.

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