정보통신 수학 및 실습
Lab assignment

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Chapter 11 Lab Assignment

1. Find the Fourier transform of the following function using the numerical method. x(t) = exp(-A*t)u(t); t>0

$$\int_{-\infty}^{\infty} f(t)e^{-j2\pi ft}dt = \int_{-\frac{a}{2}}^{\frac{a}{2}} Ae^{-j2\pi ft}dt$$

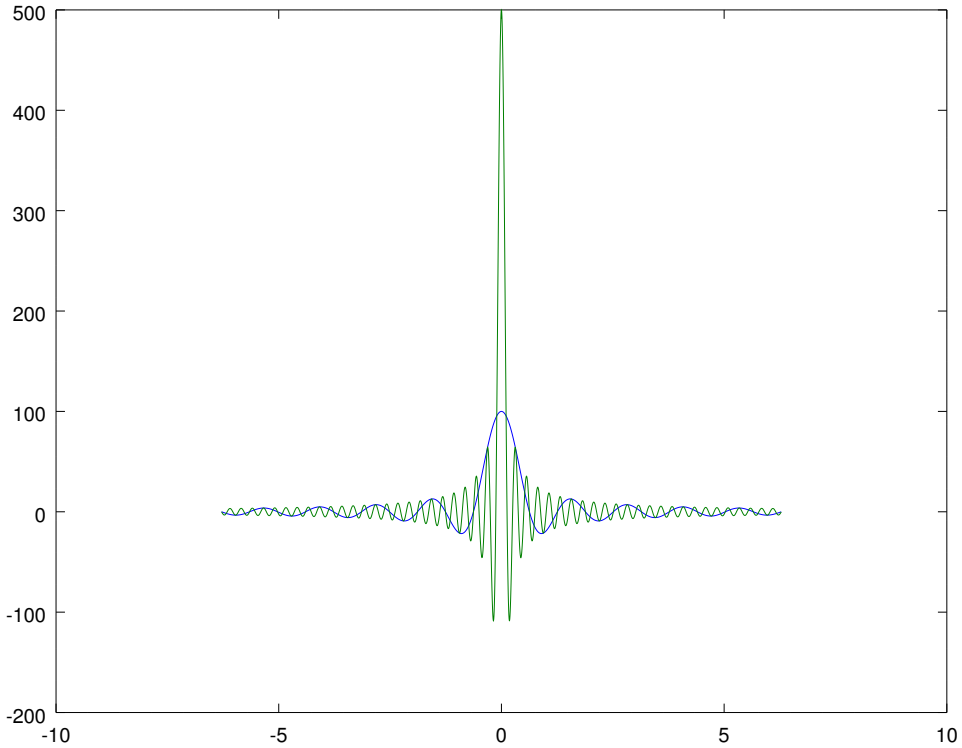
a) Plot the magnitude of the Fourier Transform of the signal when A=10, a=10.

$$\int_{-5}^{5} 10e^{-j2\pi ft}dt = \int_{-5}^{5} 10e^{-jwt}dt = 10\left[\frac{e^{-jwt}}{-jw}\right]_{-5}^{5} = \frac{10}{-jw}(e^{j5w} - e^{-j5w}) = \frac{10}{-jw} \cdot j2\sin(5w) = \frac{100\sin(5w)}{5w}$$

b) Plot the magnitude of the Fourier Transform of the signal when when A=10, a=50 on the top of the figure a.

위에서 5를 25로 바꾼다.

```
w = [-2*pi :0.005:2* pi ];
y = 20*sin(5* w)./ w;
z = 20*sin(25* w)./ w;
plot(w, y, w, z)
```



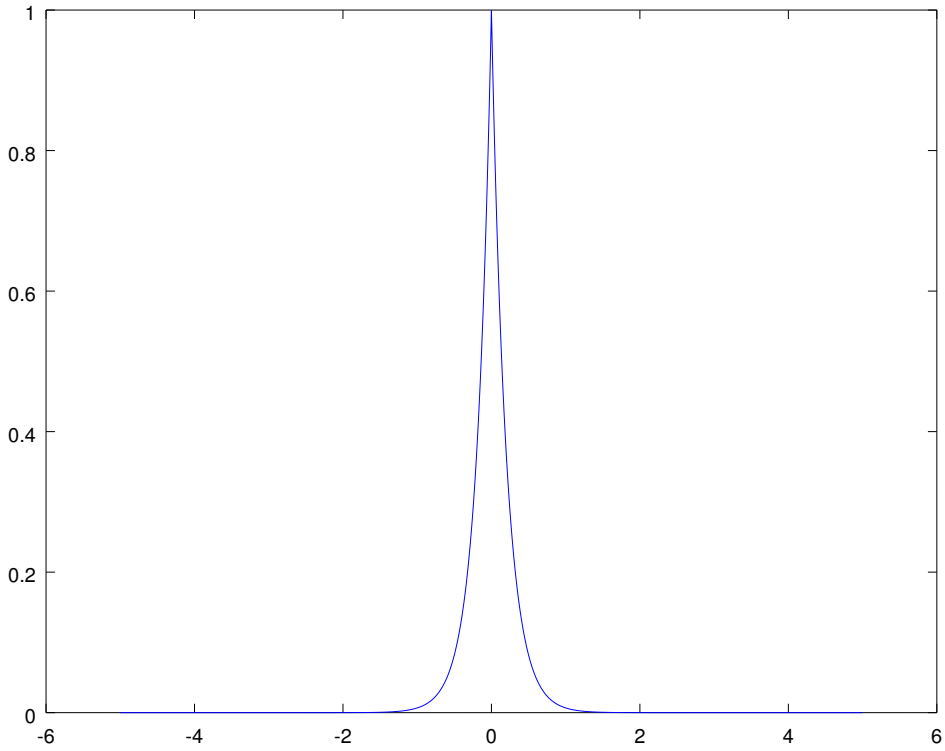
c) Describe what you find through problem a and b.

time domain에서의 넓은 간격은 frequency domain에서 좁은 저주파 성분이 강한 에너지가 낮은 모양으로 나온다.

2. Solve the following questions about the magnitude of the continuous time Fourier transform of x(t) = exp(-A* abs(t)). Use the numerical method. A is 5.

a) Plot x(t) when -5 <t <5.

```
t = [−5:0.01:5];
x = exp(−5 * abs(t));
plot(t,x)
```



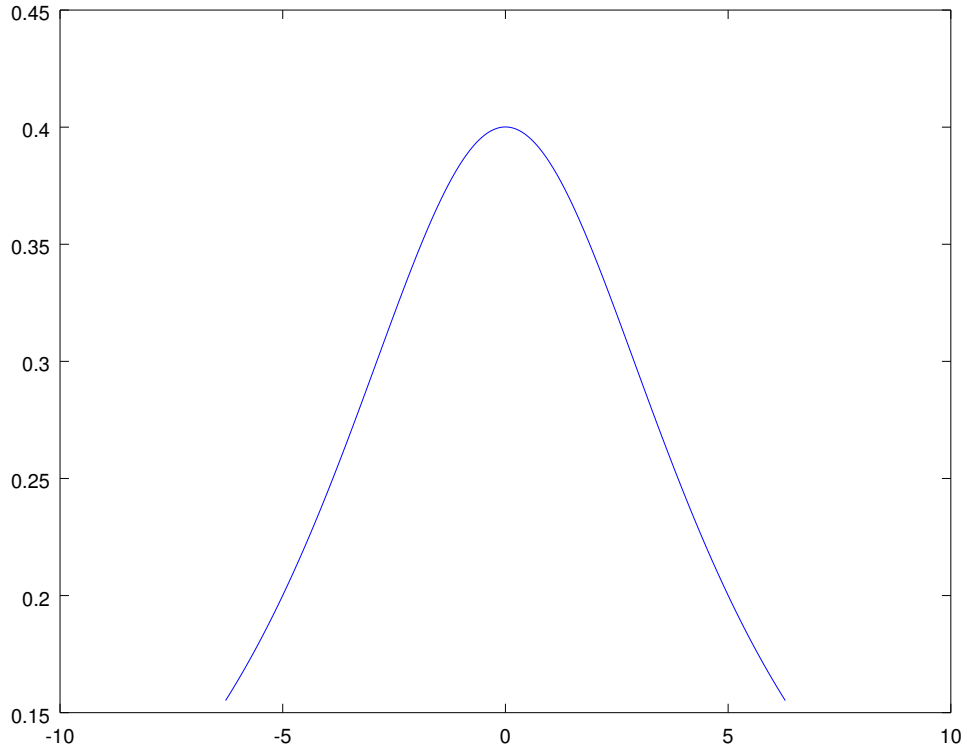
b) Plot the magnitude of the continuous time Fourier transform of x(t) = exp(-A* abs(t)).

$$F(f) = \int_{-\infty}^{\infty} e^{-5|t|} e^{-j2\pi ft} dt$$

```
function F = fourier (w)
t = [−5:0.01:5];
x = exp(−5 * abs(t));
F = sum(x .* exp(−j * w * t)) * 0.01;
end

l = length(t)
w = linspace(−2*pi, 2*pi, l);
y = w;
for n= [1:l]
y(n) = fourier (w(n));
end
```

```
plot(w, abs(y));
```

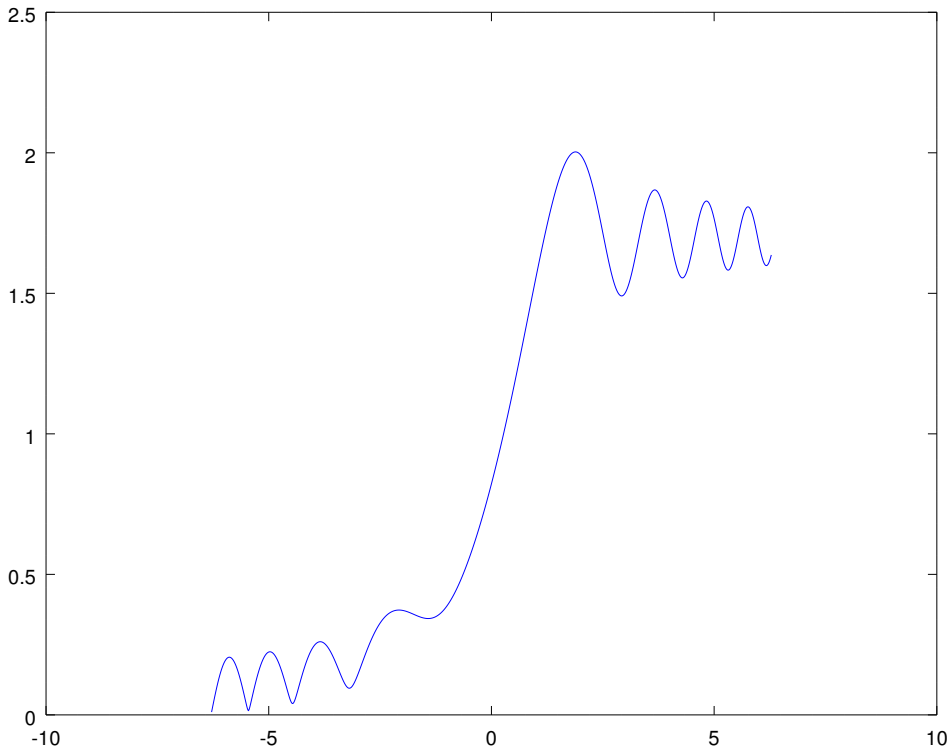


3. Plot the magnitude of the continuous time Fourier transform of x(t) = 1 when -4 <t <4, and x(t)=0 otherwise.

$$\int_{-\infty}^{\infty} e^{-jwt}dt = \int_{-4}^{4} e^{-jwt}dt$$

```
function F = fourier(w)
t = [-4:0.01:4];
F = cumsum(exp(-j * w .* t)) * 0.01;
end

w = linspace(-2*pi, 2*pi, length(t));
y = fourier(w);
plot(w, abs(y));
```


2.5
2
1.5
1
0.5
0
-10
-5
0
5
10