**Lab 4：The Continuous-Time Fourier Transform**

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| **Introduction**  The lab will compare numeric approximation to the continuous-time Fourier transfer to the exact value of the Fourier transform.  **Lab results & Analysis:**  4.2  Question(a)  屏幕剪辑  Analysis  The CTFT of F(w) is 4/(w^2 + 4)  Question(b)  屏幕剪辑  屏幕剪辑  The result is as shown.  Question(c)  屏幕剪辑  屏幕剪辑  Analysis  The result is as shown. The figure shows the magnitude and phase of Y related to t.  Question(d)  屏幕剪辑  屏幕剪辑  The result is represented as a figure of w and t.  Question(e)  屏幕剪辑  屏幕剪辑  Analysis  The result is represented by the figure of X. The figure shows the magnitude and phase of X related to t.  Question(f)  屏幕剪辑  屏幕剪辑  Analysis  As the figure shows, F represents the analytic expression derived from Question(a) and the approximation matches the derivation well. The approximation is better for frequency components of the signal.    Question(g)  屏幕剪辑  屏幕剪辑  Analysis  As the result shows, the magnitude of X and Y matches well while the phase of them does not. | |
| **Experience**  **12011124 冯柏钧**  C:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(29).png  C:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(34).png C:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(38).png  C:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(40).pngC:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(41).png  C:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(42).png C:\Users\16954\AppData\Local\Packages\Microsoft.Office.Desktop_8wekyb3d8bbwe\AC\INetCache\Content.Word\屏幕截图(44).png | |
| **Score** |  |

Code

4.2

Question(a)

clc

clear

x = sym('r');

y = fourier(exp(-2\*abs(x)))

Question(b)

t = [0:0.01:9.99];

yt = exp(-2\*abs(t-5));

plot(t,yt),xlabel('t'),ylabel('yt')

Question(c)

clc

clear

N = 1000;

tau = 0.01;

t = [0:0.01:9.99];

yt = exp(-2\*abs(t-5));

Y = tau\*fftshift(fft(yt))

subplot(2,1,1)

plot(t,abs(Y)),title('magnitude of Y'),xlabel('t')

subplot(2,1,2)

plot(t,angle(Y)),title('phase of Y'),xlabel('t')

Question(d)

clc

clear

N = 1000;

tau = 0.01;

t = [0:0.01:9.99];

w = -(pi/tau)+(0:N-1)\*(2\*pi/(N\*tau));

plot(w),title('w'),xlabel('t'),ylabel('value')

Question(e)

clc

clear

N = 1000;

tau = 0.01;

t = [0:0.01:9.99];

w = -(pi/tau)+(0:N-1)\*(2\*pi/(N\*tau));

yt = exp(-2\*abs(t-5));

Y = tau\*fftshift(fft(yt));

X = Y.\*exp(5\*i\*w);

subplot(2,1,1)

plot(t,abs(X)),title('magnitude of X'),xlabel('t')

subplot(2,1,2)

plot(t,angle(X)),title('phase of X'),xlabel('t')

Question(f)

clc

clear

N = 1000;

tau = 0.01;

t = [0:0.01:9.99];

w = -(pi/tau)+(0:N-1)\*(2\*pi/(N\*tau));

yt = exp(-2\*abs(t-5));

Y = tau\*fftshift(fft(yt));

X = Y.\*exp(5\*i\*w);

Xm = abs(X);

Xp = angle(X);

F = 4./(w.^2 + 4);

Fm = abs(F);

Fp = angle(F);

subplot(2,1,1)

semilogy(w,Xm,'b'),hold on,title('magnitude of X and accurate value '),xlabel('w'),ylabel('value')

semilogy(w,Fm,'r')

legend('abs(X)','abs(F)')

subplot(2,1,2)

plot(w,Xp,'b'),hold on,title('angle of X and accurate value'),xlabel('w'),ylabel('value')

plot(w,Fp,'r')

legend('angle(X)','angle(F)')

Question(g)

clc

clear

N = 1000;

tau = 0.01;

t = [0:0.01:9.99];

w = -(pi/tau)+(0:N-1)\*(2\*pi/(N\*tau));

yt = exp(-2\*abs(t-5));

Y = tau\*fftshift(fft(yt));

X = Y.\*exp(5\*i\*w);

Xm = abs(X);

Xp = angle(X);

Ym = abs(Y);

Yp = angle(Y);

subplot(2,1,1)

semilogy(w,Xm,'b'),hold on,title('magnitude of X and Y'),xlabel('w'),ylabel('value')

semilogy(w,Ym,'y')

legend('abs(X)','abs(Y)')

subplot(2,1,2)

plot(w,Xp,'b'),hold on,title('angle of X and Y'),xlabel('w'),ylabel('value')

plot(w,Yp,'y')

legend('angle(X)','angle(Y)')