**Lab 4：**

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| **Introduction**  Based on the exercises of 4.2 and 4.5 on the Computer Explorations in Signals and Systems Using MATLAB.  We have the following aims:   1. Using MATLAB to sample continuous signal 2. Using MATLAB to analysis the properties of the discrete time signals and systems. 3. To be more familiar with the calculation of matrix and the code logic of MATLAB. 4. Finish exercises and strengthen the knowledge studying in the theory course.   **Lab results & Analysis**：  **4.2**    For x(t) = g(t) + g(-t),    For  N = length(y) = T/tau = 1000  y(t) as fig1 shows  fig1    Y as fig2 shows.  fig2 | |
| w has constructed.  **w = -(pi / tau) + (0:N - 1) \* (2 \* pi / (N \* tau));**      CTFT of x(t) by calculate fft(y)\*exp(-5jw) as fig3.1 shows    Fig3.1  X(jw) as figure3.2 shows    Fig3.2  As figure3.3 shows, in high frequency part, the approximation is not similar.    Fig3.3    As figure 4.1 shows, Y is very close to X, and according to , Y is different with X only on the phase domain, abs(X) is equal abs(Y), and fig4.2 prove that.    Fig4.1    Fig4.2  **4.5** | |
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| **Experience**  For learning DT signal by using MATLAB, we coding and debugging day and night, but the theory under the code is more difficult. To analysis the graph, I learn more visual information, and combined with the formula under the graph, I find different between theory and simulation. | |
| **Score** |  |

**Code:**

**%%%%4.2**

**%%% a)**

**%% g(t) = e^(-2t)u(t)**

**%% x(t) = g(t) + g(-t) = e^(-2t)u(t) + e^(2t)u(-t)**

**%% X(jw) = \frac{1}{2+jw} + \frac{1}{2-jw}**

**%%% b)**

**clear;**

**clc;**

**close all;**

**%% samples of signal y(t) = x(t-5) = yp(t)**

**tau = 0.01;**

**T = 10;**

**t = 0:tau:(T - tau);**

**%% y(t) = x(t-5) = e^(-2t+10)u(t-5) + e^(2t-10)u(-t+5)**

**%% in t = [0:tau:5] y(t) = e^(2t-10)**

**%% in t = [5+tau:tau:T-tau] y(t) = e^(-2t+10)**

**y = [exp(2 \* (0:tau:5) - 10), exp(-2 \* (5 + tau:tau:(T - tau)) + 10)];**

**figure(11)**

**plot(t,y)**

**xlabel("t", "fontsize", 15);**

**ylabel("y(t)", "fontsize", 15);**

**title("signal y(t)", "fontsize", 18)**

**N = length(y);**

**%%% c)**

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

**lb = (1 - N) \* pi / N / tau;**

**ub = (N - 1) \* pi / N / tau;**

**step = 2 \* pi / N / tau;**

**figure(12)**

**plot(lb:step:ub,abs(Y))**

**xlabel("\omega", "fontsize", 15);**

**ylabel("abs(Y)", "fontsize", 15);**

**title("fft of signal y(t)", "fontsize", 18)**

**%%% d)**

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

**%%% e)**

**%% Y = e^(5jw)X**

**%% X = e^(-5jw)Y**

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

**%%% f)**

**figure(1);**

**title("CTFT of signal x(t) by fft", "fontsize", 18);**

**subplot(211),plot(w, abs(X));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("abs(X)", "fontsize", 15);**

**title("CTFT of signal x(t) by theory", "fontsize", 18);**

**subplot(212),plot(w, unwrap(angle(X)));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("phase(X)", "fontsize", 15);**

**X\_ =1./(2+1j.\*w)+1./(2-1j.\*w);**

**figure(2)**

**subplot(211),plot(w, abs(X\_));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("abs(X(j\omega))", "fontsize", 15);**

**title("CTFT of signal x(t) by theory", "fontsize", 18);**

**subplot(212),plot(w, unwrap(angle(X\_)));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("phase(X(j\omega))", "fontsize", 15);**

**figure(3)**

**semilogy(w,abs(X));**

**hold on**

**semilogy(w,abs(X\_));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("log(abs(X(j\omega)))", "fontsize", 15);**

**title("different of CTFT of signal x(t)", "fontsize", 18);**

**legend("X","X(j\omega)");**

**%%% g)**

**figure(4)**

**subplot(211),plot(w,abs(Y));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("abs(Y)", "fontsize", 15);**

**subplot(212),plot(w,unwrap(angle(Y)));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("phase(Y)", "fontsize", 15);**

**figure(5)**

**semilogy(w,abs(Y));**

**hold on**

**semilogy(w,abs(X));**

**xlabel("\omega", "fontsize", 15);**

**ylabel("log(abs(X(j\omega)))", "fontsize", 15);**

**title("different of X and Y", "fontsize", 18);**

**legend("Y","X");**

**%%%%4.5**

**clc;**

**clear;**

**%%% a)**

**b1=[1 -2];**

**a1=[1 1.5 0.5];**

**%%% b)**

**[r1,p1,k1]=residue(b1,a1);**

**%%% d)**

**b2=[3 10 5];**

**a2=[1 7 16 12];**

**%%% e)**

**[r2,p2,k2]=residue(b2,a2)**

**%%% g)**

**b3=-4;**

**a3=[1 0 -4];**

**[r3,p3,k3]=residue(b3,a3)**