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%=====Homework 2========== %involved m-files: discft.m (analytical solution of fourier transform of % funk % funk.m (function of the exercise) % g.m (function of the exercise) % solveone.m /solvetwo.m (solution for F(s) for two % different driving forces % % WARNING: time needed on my computer to compute all the code = about 1 minute close all;clear all; tic; %======1 Fft of square waves== %initialization fp=100; sample=1/fp; Lperf=200*pi; xxana=(-fp/2:1/Lperf:fp/2)'; xana=(-Lperf/2:(sample):Lperf/2)'; f=funk(xana); if 1 fp1=5; sample1=1/fp1; L(1)=1*pi; x1=(-L(1)/2:sample1:L(1)/2)'; xx1=(-fp1/2:1/L(1):fp1/2)'; n1=length(x1); f1=funk(x1); fp2=10; sample2=1/fp2; L(2)=5*pi; x2=(-L(2)/2:sample2:L(2)/2)'; xx2=(-fp2/2:1/L(2):fp2/2)'; n2=length(x2); f2=funk(x2); fp3=20; sample3=1/fp3; L(3)=10*pi; x3=(-L(3)/2:sample3:L(3)/2)'; xx3=(-fp3/2:1/L(3):fp3/2)'; n3=length(x3); f3=funk(x3); fp4=50; sample4=1/fp4; L(4)=20*pi; x4=(-L(4)/2:sample4:L(4)/2)'; xx4=(-fp4/2:1/L(4):fp4/2)'; n4=length(x4); f4=funk(x4); %===============1.1 - Fourier Transform %Fourier transform calculation with matlab ff1=fft(f1); fs1=fftshift(ff1); ff2=fft(f2); fs2=fftshift(ff2); ff3=fft(f3); fs3=fftshift(ff3); ff4=fft(f4); fs4=fftshift(ff4); %analytic function :real and imaginary part rea=real(discft(xxana)); ima=imag(discft(xxana)); end if 1 %comparison between analytic and matlab fourier transforms figure subplot(2,2,1),plot(xxana,rea,'b.-',xx1,real(fs1)*sample1,'r-') title('sampling freq=0.32'); axis([-1.5 1.5 -2 5]);
subplot(2,2,2),plot(xxana,rea,'b.-',xx2,real(fs2)*sample2,'r-') axis([-1 1 -5 5]); title('sampling freq=0.064'); subplot(2,2,3),plot(xxana,rea,'b.-',xx3,real(fs3)*sample3,'r-') title('sampling freq=0.032'); axis([-1.5 1.5 -4 6]); subplot(2,2,4),plot(xxana,rea,'b.-',xx4,real(fs4)*sample4,'r-') title('sampling freq=0.016'); axis([-1 1 -5 5]); xlabel('frequency .'); ylabel('real part of F(s) .'); figure subplot(2,2,1),plot(xxana,ima,'b.-',xx1,imag(fs1)*sample1,'r-') title('sampling freq=0.32'); axis([-1.5 1.5 -1 1]); subplot(2,2,2),plot(xxana,ima,'b.-',xx2,imag(fs2)*sample2,'r-') title('sampling freq=0.064'); axis([-2 2 -1 1]); subplot(2,2,3),plot(xxana,ima,'b.-',xx3,imag(fs3)*sample3,'r-') title('sampling freq=0.032'); axis([-2 2 -1 1]);
subplot(2,2,4),plot(xxana,ima,'b.-',xx4,imag(fs4)*sample4,'r-') title('sampling freq=0.016'); axis([-2 2 -1 1]); xlabel('frequency .'); ylabel('imaginary part of F(s) .'); end if 1 %==============1.2 - Inverse Fourier Transform %inverse fourier transform ivfs1=ifftshift(fs1); ivf1=ifft(ivfs1); ivfs2=ifftshift(fs2); ivf2=ifft(ivfs2); ivfs3=ifftshift(fs3); ivf3=ifft(ivfs3); ivfs4=ifftshift(fs4); ivf4=ifft(ivfs4); %plotting : comparison % figure % subplot(2,2,1),plot(x1,ivf1,'b',xana,f,'r--') % subplot(2,2,2),plot(x2,ivf2,'b',xana,f,'r--') % subplot(2,2,3),plot(x3,ivf3,'b',xana,f,'r--') % subplot(2,2,4),plot(x4,ivf4,'b',xana,f,'r--') %it's the same ! Hurray !! figure subplot(2,1,1),plot(x1,ivf1,'b',x2,ivf2,'g',x3,ivf3,'m',x4,ivf4,'k',xana,f,'r--') axis([-3 3 -1 3]); subplot(2,1,2),plot(x1,ivf1,'b',x2,ivf2,'g',x3,ivf3,'m',x4,ivf4,'k',xana,f,'r--') axis([0.4 0.7 0.9 2.1]); end if 1 %============1.3 - Convolution fp=30; sample=1/fp; Lperf=30; t=0; %sample=0.01; for i=-25:sample:25 t=t+1; direct(t)=quadgk(@(z)(funk(z).*g(i-z)),-Inf,Inf); end x=(-25:sample:25)'; f=funk(x)'; gn=g(x); horse=fft(f).*fft(gn); convthm=fftshift(ifft(horse)); figure plot(x,direct,'b',x,convthm*sample,'r') end if 1 %============2.1) Forced harmonic oscillator %initializing parameters fp=100; sample=1/fp; L=100; L1=1000; x=(-L/2:sample:L/2)'; xx=(-fp/2:1/L:fp/2)'; x1=(-L1/2:sample:L1/2)'; xx1=(-fp/2:1/L1:fp/2)'; %comparing various solutions gamma=1; omega=[0.1 1 2 5 10]; for i=1:5 sol11(:,i)=solveone(x,xx,omega(i),gamma); sol21(:,i)=solvetwo(x,xx,omega(i),gamma); end gamma=0.01; omega=[0.1 1 2 5 10]; for i=1:5 sol12(:,i)=solveone(x1,xx1,omega(i),gamma); sol22(:,i)=solvetwo(x1,xx1,omega(i),gamma); end % uncomment to test with various omega and gamma % soltest=solveone(x,xx,0.1,0); time=x+L/2; time1=x1+L1/2; figure for i=1:5 subplot(5,1,i),plot(time,sol11(:,i)); end figure for i=1:5 subplot(5,1,i),plot(time1,sol12(:,i)); end %facultative point !! figure for i=1:5 subplot(5,1,i),plot(time,sol21(:,i)); end figure for i=1:5 subplot(5,1,i),plot(time1,sol22(:,i)); end end taratapouetpouet=toc
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