CTFS Octave Codes (1A)

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Please send corrections (or suggestions) to youngwlim@hotmail.com.

This document was produced by using OpenOffice and Octave.

Based on
M.J. Roberts, Fundamentals of Signals and Systems

Some utility function

```
function y = u(t)
   zro = t == 0; pos = t >0; y = zro/2 + pos;
endfunction

function y = ramp(t)
   y = t.*(t >= 0);
endfunction

function y = rect(t)
   y = u(t+0.5) - u(t-0.5);
endfunction

function y = tri(t)
   y = ramp(t+1) - 2*ramp(t) + ramp(t-1);
endfunction
```

M.J. Roberts, Fundamentals of Signals and Systems

Using the DFT to approximate the CTFS (1)

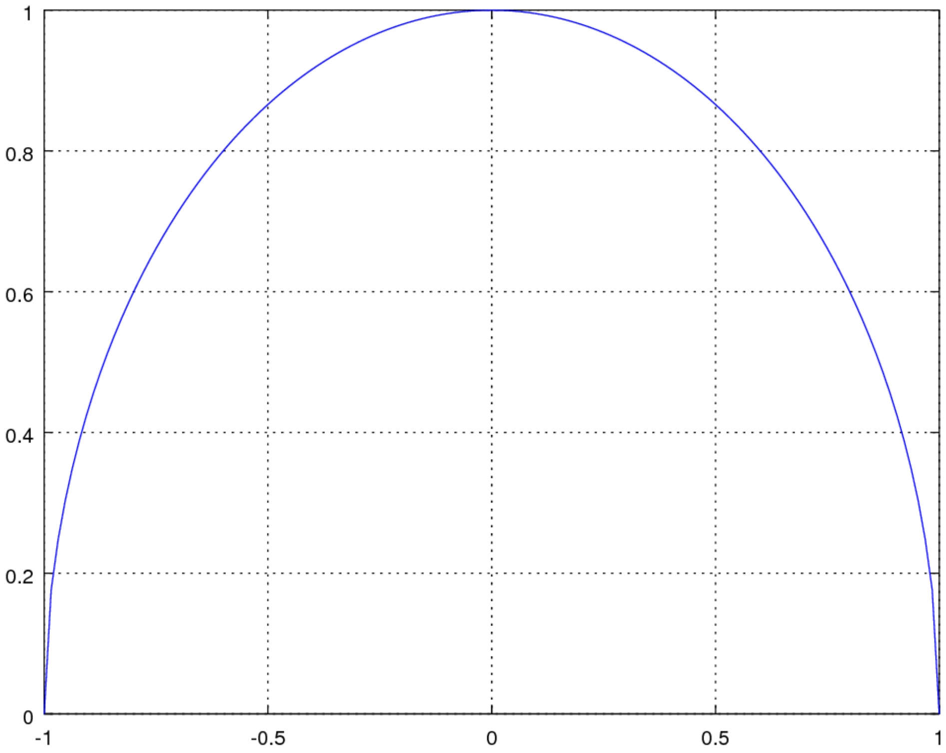
```
NF = 128;           % number of samples
T0 = 2;             % fundamental period
TF = T0;            % representation time
Ts = TF/NF;         % sampling period
Fs = 1/Ts;          % sampling frequency
n = [0:NF-1]';      % time index for sampling
t = n*Ts;           % sample times
```

M.J. Roberts, Fundamentals of Signals and Systems

Using the DFT to approximate the CTFS (1)

```
t = -1: Ts :+1;
plot(t, x)
```

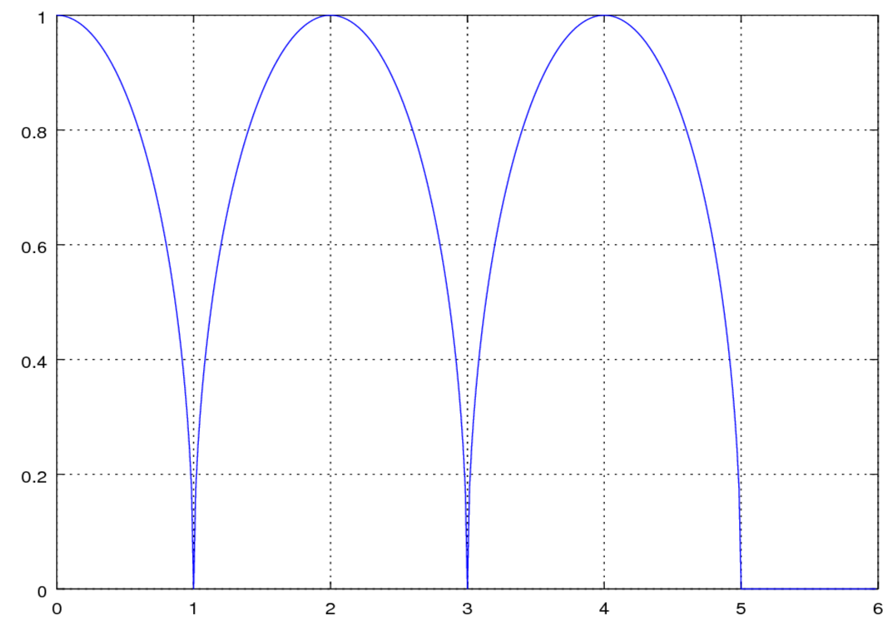
$$f(t) = \sqrt{1-t^2}, \quad (-1 < t < +1)$$



M.J. Roberts, Fundamentals of Signals and Systems

Using the DFT to approximate the CTFS (1)

$$f(t)\ \boldsymbol{rect}(t/2) + f(t-2)\ \boldsymbol{rect}((t-2)/2) + f(t-4)\ \boldsymbol{rect}((t-4)/2)$$




```
NF=128;
T0=2;
TF=T0;
Ts=TF/NF;
Fs=1/Ts;
n = [0:3*NF-1]';
t = n*Ts;
x = sqrt(1-t.^2).*rect(t/2) + ...
     sqrt(1-(t-2).^2).*rect((t-2)/2) + ...
     sqrt(1-(t-4).^2).*rect((t-4)/2) ;
plot(t, x)
```

M.J. Roberts, Fundamentals of Signals and Systems

Using the DFT to approximate the CTFS (2)

```
x = sqrt(1-t.^2).*rect(t/2) + ...
    sqrt(1-(t-2).^2).*rect((t-2)/2) + ...
    sqrt(1-(t-4).^2).*rect((t-4)/2) ;

X = fft(x)/NF;

k = [0:NF/2-1];
```

M.J. Roberts, Fundamentals of Signals and Systems

Normalized ω_s and ω_0

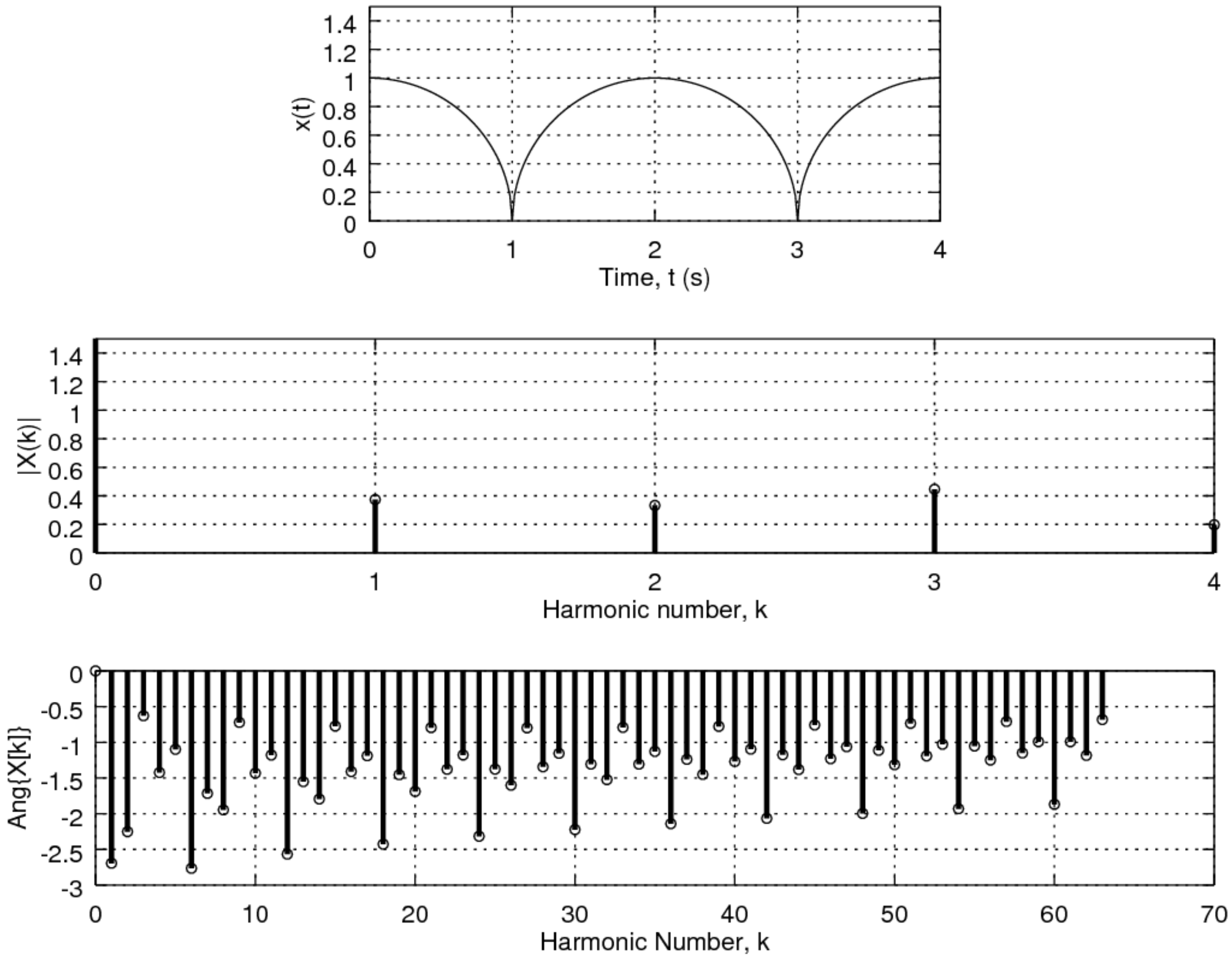
```
subplot(3,1,1);
p = plot(t, x, 'k'); grid on;
axis("equal"); axis([0,4,0,1.5]);
xlabel('Time, t (s)');
ylabel('x(t)');

subplot(3,1,2);
p = stem(k, abs(X(1:NF/2)), 'k');
set(p,'LineWidth',2,'MarkerSize',4); grid on;
axis([0,4,0,1.5]);
xlabel('Harmonic number, k');
ylabel('|X(k)|');

subplot(3,1,3);
p = stem(k, angle(X(1:NF/2)), 'k');
set(p,'LineWidth',2,'MarkerSize',4); grid on;
xlabel('Harmonic Number, k');
ylabel('Ang{X[k]}');
```

M.J. Roberts, Fundamentals of Signals and Systems

Normalized ω_s and ω_0



References

[1] http://en.wikipedia.org/
[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003
[3] M.J. Roberts, Fundamentals of Signals and Systems
[4] S.J. Orfanidis, Introduction to Signal Processing
[5] K. Shin, et al., Fundamentals of Signal Processing for Sound and Vibration Engineerings

[6] A “graphical interpretation” of the DFT and FFT, by Steve Mann