

---

```

% NUMERICAL COMPUTATION OF FOURIER SERIES COEFFICIENTS
% Sinusoidal wave and Line spectrum of coefficients
% approximate the integral as a summation

% x = abs(cos(pi*t));      % PERIODIC SIGNAL

T = 1;                      % PERIOD
wo = 2*pi/T;

M = 200;                    % DISCRETIZATION OF THE TIME AXIS
deltT = T/M;
t = [0:deltT:T-deltT];     % TIME AXIS
x = abs(cos(pi*t));        % COMPUTE SAMPLES OF x(t) ON GRID

N = 20;                     % COMPUTE FS COEFFICIENTS C(0)...C(N)
J = sqrt(-1);
c = zeros(1,N+1);          % COMPUTE C(k) WITH A SUM
c(1) = 1/T * deltT * sum(x);
for k = 1:N
    c(k+1) = 1/T * deltT * sum(x .* exp(-J*k*wo*[0:M-1]*deltT));
    % note: because Matlab indexing begins with 1 instead of 0,
    % it is necessary to add 1 to the index. c(k+1) means 'c(k)!'
end

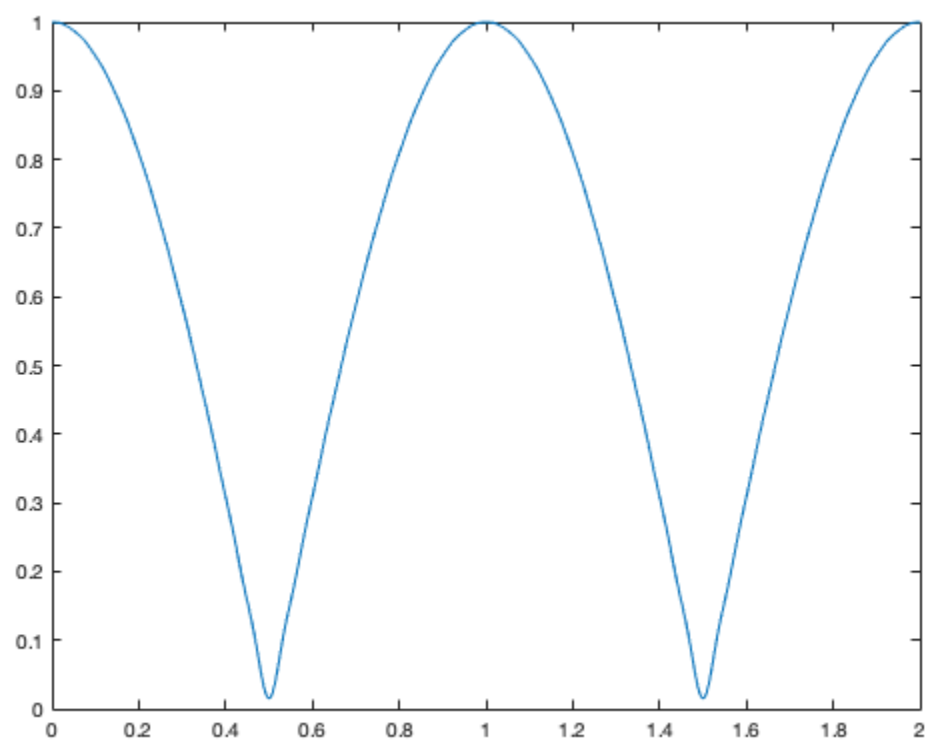
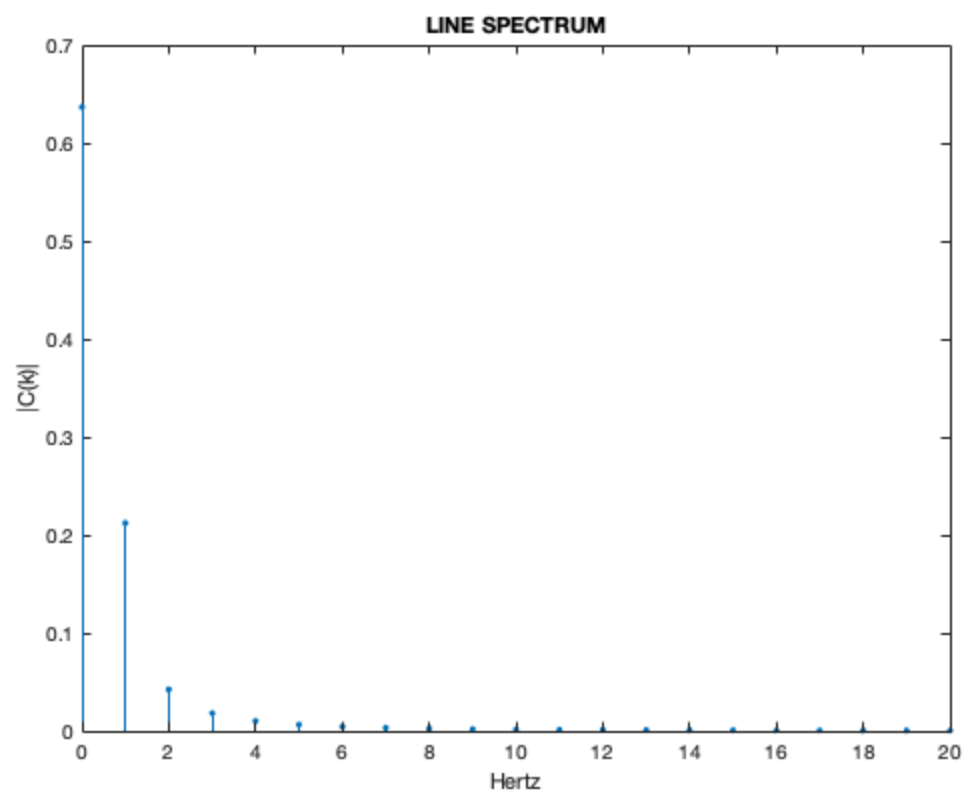
% NOTE: C(-k) = conj(C(k)) because x(t) is a REAL signal.
% Therefore only compute c(k) for k >= 0.

figure(1)                   % PLOT THE LINE SPECTRUM
stem([0:N]/T,abs(c),'.')   % (THE LINE SPECTRUM IS A PLOT OF C(K))
xlabel('Hertz')
ylabel('|C(k)|')
title('LINE SPECTRUM')

t = [0:500]/500*2*T;       % PLOT TWO PERIODS OF THE SIGNAL
y = c(1) * ones(size(t));  % SYNTHESIZED FROM THE NUMERICALLY
for k = 1:N                 % OBTAINED FS COEFFICIENTS
    y = y + c(k+1)*exp(J*k*wo*t) + conj(c(k+1))*exp(-J*k*wo*t);
end
figure(2)
plot(t,real(y));

```

---



---

*Published with MATLAB® R2018a*