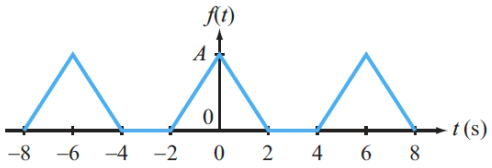
UNIVERSITY of HOUSTON | ECE

ECE 3337: Signals & Systems Analysis, Class Worksheet 19

1. (60 points) Calculate the three Fourier series representations for the following waveform, as requested below.



   a. (20 points) Write down the sine/cosine representation of the Fourier series for the above waveform
   b. (20 points) Write down the amplitude/phase representation for the above waveform
   c. (20 points) Write down the exponential representation for the above waveform
   d. (20 points) Use the MATLAB code given below to generate the sine/cosine representation of the Fourier series for the above waveform (also posted as FourierSeries.m on canvas)

```
%
% ECE 3337 Signals and Systems Analysis
% University of Houston
% Calculate the Fourier series coefficients for a signal x(t)
% x(t) can be typed in as a formula
% This example uses the MATLAB symbolic Toolbox
clear; % always start by clearing the workspace
% Define the symbols
syms t a0 a(k) b(k) x(t) y(t) w0 T0 A;
syms n k N integer;
assume(T0>0);
w0 = 2*pi/T0; % angular frequency
% Textbook square-wave example
x(t) = piecewise(0<=t<T0/4,A,T0/4<t<3*T0/4,-A,3*T0/4<t<=T0,A);
% calculate the Fourier coefficients
a0 = simplify((1/T0)*int(x(t),t,0,T0));a0;
a(k) = simplify((2/T0)*int(x(t)*cos(k*w0*t),t,0,T0));
b(k) = simplify((2/T0)*int(x(t)*sin(k*w0*t),t,0,T0));
% Write out the first N terms of the Fourier series
N = 10; % number of terms of the Fourier series to be written out
y(t) = a0 + symsum(a(k)*cos(k*w0*t),k,1,N) + symsum(b(k)*cos(k*w0*t),k,1,N)
```

2. (30 points) The signal $x(t)$ with A= 10V and T = 1 ms is applied as an input to the following circuit.
   a. (15 points) Derive the Fourier series for the output signal $v_{out}(t)$ taking advantage of table 5-4 of your textbook
   b. (15 points) Calculate the first five terms of $v_{out}(t)$ when $R_1 = R_2 = 2k\Omega, C = 1\mu F$