EGR 261
Signals and Systems
File: N261PS3A

Due date: _____
(See Due Dates Table)

PSPICE Assignment #3:
Fourier Series

Reference: (also see the instructor's web page)
Handout: ***Sample PSPICE Report***
Example: ***Fourier Analysis of a Pulse Waveform using PSPICE***

Assignment: v(t)

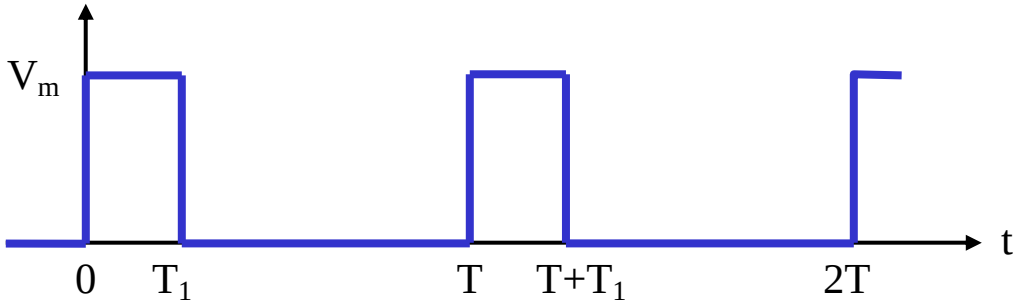
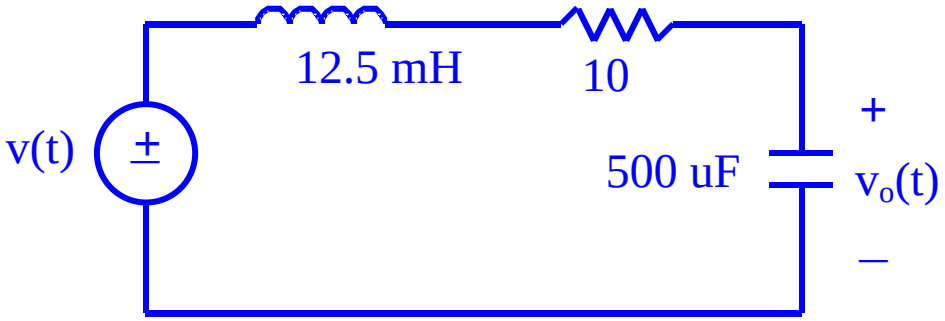


Figure 1: Periodic Pulse Waveform

1 Determine by hand the Fourier series (general form) for v(t) above using the following values:
- T = 20 ms
- T_1 = the average value of the digits of your EmplID in ms. For example, if your EmplID is 3339202, then use T_1 = (3+3+3+9+2+0+2)/7 = 3.1 ms
- V_m = the last two non-zero digits of your EmplID in volts. For example, if your EmplID is 3339202, then use V_m = 22 V.

2. Write out the DC through 5th harmonic terms (with the coefficients in decimal form) for the Fourier series in both **standard form** and in the **alternate trigonometric form**.
3. Graph v(t) using your results in part B (either form) using Excel, MatLab, or MathCAD. Clearly present all tables, equations, and graphs. Discuss how closely the graph represents the original function. If Excel is used, include sample Excel formulas so that it is clear what calculations were used.
4. If v(t) is the input to Circuit 1, calculate $v_o(t)$ by hand (using superposition) if v(t) is represented by the DC through 5th harmonic terms as determined in part B (alternate trigonometric form).
5. Use PSPICE to analyze Circuit 1. Note that you will get much better results if you use TF and TR values of 1fs for VPULSE, rather than 1ns as shown in the example on my web page.
   - Perform a transient analysis over 3 cycles of the input.
   - Graph the input and the output.
   - Perform a Fourier analysis of the input and the output (include up to the 5th harmonic).
   - Use tables to compare the magnitude of Fourier series coefficients for both the input and the output to the values determined by hand in steps 2 and 4.
6. Find the transfer function, $H(s) = V_o(s)/V(s)$, for Circuit 1 and sketch the Bode LM plot (with frequency in Hz). Also sketch the amplitude spectrum for v(t) and $V_o(t)$ including up to the 5th harmonic. Discuss how the amplitude of the harmonics of $V_o(t)$ were affected by the low-pass filter circuit.



Circuit 1: Low-Pass Filter