Homework 5

ME 240: Fundamentals of Instrumentation & Measurement
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1. (6 points) A single cycle of a ramp function of voltage v versus time t has the form $v(t) = \alpha t$, from -0.02 to 0.02 s, where $\alpha = 50$ V/s. Using direct integration, evaluate the Fourier coefficients a_0, a_1, a_2, b_1, and b_2. Could you have deduced the values of a_0, a_1, and a_2 without performing the integrations?

2. (6 points) For the ramp function described above, evaluate the coefficients a_0, a_1, a_2, b_1, and b_2 numerically, using Matlab or a spreadsheet or a similar tool. Use 100 equally spaced time intervals. Submit your code or spreadsheet. *Hint: Section A.1 in the Wheeler text may help. Consider using a Riemann sum or the trapezoid rule.*

3. (12 points) A function $f(t)$ can be represented by the Fourier cosine series

$$f(t) = 0.2 + \frac{2}{\pi} \sum_{n=1}^{\infty} \frac{-1^n}{n} \sin 0.2 n \pi \cos 4 n \pi t.$$

Using computational software, compute the sum of the $n \le 3$ terms at intervals of 0.01 s for $0 \le t \le 0.5$ s. Then, compute the sum of the $n \le 20$ terms at the same intervals. Plot both results on the same axes. Comment on your results.