BIRZEIT UNIVERSITY

Faculty of Engineering and Technology
Department of Electrical and Computer Engineering
Summer Semester 2021/2022

Communication Systems ENEE 3309
Course Project; Due Date January 22, 2023

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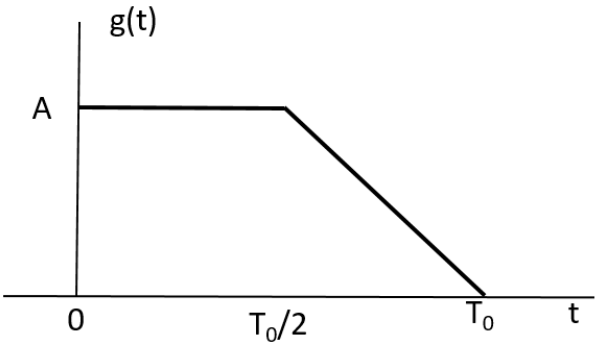
Consider the periodic signal g(t), for which one period is shown in the figure below



One Period of the periodic signal g(t)

where A=1 and $T_0 = 0.1\ sec$. This signal can be expanded in a trigonometric Fourier series as:

$$g(t) = a_0 + \sum_{n=1}^{\infty} (a_n \cos n\omega_0 t + b_n \sin n\omega_0 t)$$

Now, consider the approximate signal:

$$g_a(t) = a_0 + \sum_{n=1}^{K} (a_n \cos n\omega_0 t + b_n \sin n\omega_0 t)$$

1. **Find $a_0, a_1, a_2, a_3, b_1, b_2, and\ b_3$ (you can use matlab or any other code to find numerical values of the coefficients)**
2. **Use matlab to plot $g(t)$ and $g_a(t)$ for K = 3, on the same figure for one cycle of $g(t)$.**
3. **The mean square error between $g(t)$ and $g_a(t)$ is defined as**

$$MSE = \frac{1}{T_0}\left(\int_0^{T_0} \left(g(t) - g_a(t)\right)^2 dt\right)$$

   Find the mean square error for K=1, 2, and 3. Summarize your results in a table.
4. **If $g_a(t)$ (when K = 3) is multiplied by the carrier $c(t) = 10\ \cos 2\pi(200)t$ followed by an ideal bandpass filter to generate the single sideband signal $s(t)$, find s(t) and its spectrum.**