Review of Signals and Systems-1

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Important Instructions

- Check 'Nalanda' for useful course material and lab related stuff.
- Bring a dedicated lab note book to do rough work.
- Please maintain decency in lab. Mind works faster and better in peaceful atmosphere.
- You may leave lab after evaluation. Make sure that your evaluation is done before you leave lab.
- You may take a short break for 5-7 minutes after one and half hour.
- Note down all useful commands in your notebook.
- Save all your work (e.g., codes, plots) in Google drive or somewhere else for your reference. Delete your work files from your computer.

Important Instructions (contd.,)

- Try to complete all tasks within 2 hours. After 2 hrs, evaluation starts. Each lab carries three marks (one mark for attendance, and two marks for successful completion of tasks)
- For each subtask, create mfiles (e.g., Gibbs.m) and save them with suitable name.
- Prepare a word document naming your name and ID. In it, save all results including plots.
- In all plots, put x-label, y-label, legend, font 'Arial' (font size = **10**), and, Width '**2**'. By doing this, visibility of figures will improve.

- Makeup policy: There is no makeup for lab. However, if you are absent for the n^{th} lab, you can complete it in the $(n+1)^{th}$ lab. In this scenario, you will be evaluated only for lab tasks. Note that this is allowed with prior permission from the Instructor-in-charge. You may be asked to show a valid proof.

- Two finite energy signals $g_1(t)$ and $g_2(t)$ are defined in the interval $a \leq t \leq b$. Cauchy-Schwarz inequality is given by

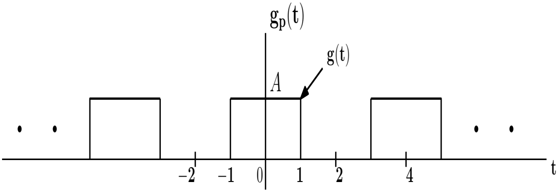
$$\left| \int_a^b g_1(t)\, g_2(t)\, dt \right|^2 \leq \int_a^b |g_1(t)|^2 \; dt \int_a^b |g_2(t)|^2 \; dt.$$

- Using MATLAB help, understand the following commands:
  - a). exp b). integral
- Questions (1 mark): (i). Write a MATLAB program to verify the C-S inequality for the following signals:

$$g_1(t) = \exp(-t)\, u(t), \quad g_2(t) = \exp(-2t)\, u(t),$$

  where $u(t)$ denotes the unit-step.
  ii). Let $g_1(t) = \exp(-t)\, u(t)$ and $\mu = -1$. Write a MATLAB program to verify equality when $g_2(t) = -\mu g_1(t)$.

Task 2: Gibbs Phenomenon



- Consider the rectangular pulse train shown in the Figure.
- Trigonometric Fourier Series (FS) coefficients: $a_0 = \frac{A}{2}$, $a_n = A\,\mathrm{sinc}\left(\frac{n}{2}\right)$, and $b_n = 0$ (Verify).
- Understand following commands
  - a). clc b). close all c). clf d). linspace e). zeros f). ones g). int2str

Task 2: Gibbs Phenomenon

- Consider the FS expansion up to finite N terms

$$g_N(t) = a_0 + \sum_{n=1}^{N} a_n \cos\left(n\omega_0 t\right),$$

where $\omega_0 = \frac{2\pi}{T_0}$.

- Question (1 mark): Let $A = 2$. Write a MATLAB program to plot the generating function $g(t)$ and $g_N(t)$ for $N = [1, 3, 9, 29, 49, 99]$. Use: axis([-2 2 -0.5 2.5]); **You must show all six subplots in one Figure.** Further, for each scenario, display N value as title. Compare $g_N(t)$ and $g(t)$. Comment on $g_N(t)$.