Department of Electrical Engineering
IIT Madras, Chennai 600 036.

EE 5141 Introduction to Wireless and Cellular Communications
Feb – May 2021

Computer Assignment Instructions

- Teams of two students
- Submit the following
  - Required plots
  - Include brief explanation of observations, as appropriate
  - Listing of code written by you

- The submitted file should be in .pdf format

- Mention name and roll number of both team members

- Use following naming convention for file you
  - roll_number_assign# . pdf
    (Use roll number of one of the team members)
  - Example: EE17M001_assign1. pdf

- Assignment submission via Moodle
  - Instructions given by TAs
  - Do not send via email

- Honour Code:
  - Add this line to your assignment and an electronic signature
  - We certify that this assignment submission is our own work and not from obtained from any other source

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Computer Assignment #1 (Due date: February 15, 2021)

1. The Square Root Raised Cosine (SRRC) pulse is commonly used in wireless communications. The expression of the impulse response is given below:

$$h(t)=\begin{cases} 1-\alpha+4\dfrac{\alpha}{\pi}, & t=0 \\ \dfrac{\alpha}{\sqrt{2}}\left[\left(1+\dfrac{2}{\pi}\right)\sin\left(\dfrac{\pi}{4\alpha}\right)+\left(1-\dfrac{2}{\pi}\right)\cos\left(\dfrac{\pi}{4\alpha}\right)\right], & t=\pm\dfrac{T}{4\alpha} \\ \dfrac{\sin\left[\pi(1-\alpha)\dfrac{t}{T}\right]+4\alpha\dfrac{t}{T}\cos\left[\pi(1+\alpha)\dfrac{t}{T}\right]}{\pi\dfrac{t}{T}\left[1-\left(4\alpha\dfrac{t}{T}\right)^2\right]}, & \text{for all other } t \end{cases}$$

   where α is the roll-off factor. Plot the normalized frequency response 20*log $\left|H\left(e^{j\omega}\right)\right|$ vs ω computed via DFT for the following values of roll-off factor $\alpha=0.35, 0.7$ and 1.0. Use 8X oversampling factor in the representation of the SRRC pulse and a truncation length of 10 symbols. Assume that the symbol rate is 25 Ksymbols/sec
   (Note: Do not use MATLAB built-in function for generating the SRC pulse)

2. Verification of ISI-free property of RC pulse
   (a) Generate the SRRC as defined in task 1
   (b) Convolve the SRRC pulse with itself to get an RC pulse (SRRC $\otimes$ SRRC).
   (c) Take a random sequence of 20 bits ($\pm$ 1). Apply RC pulse shaping to this data sequence.
   (d) Select the samples the resultant waveform at symbol-spaced sampling points which correspond to the peak of the RC pulse
   (e) Write down the values of the samples
   (f) Observe that there is no ISI at the ideal sampling points
   (g) For this sequence, generate the eye diagram (to show the optimum sampling point)

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