CIE 337: Final Project

Part I (8 points)

Consider the system shown in Fig. 1

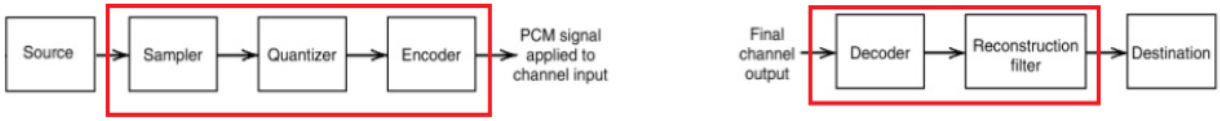

Fig. 1

It is required to build a Matlab Simulator for the system block and to study different systems employing various samplers, quantizers and encoders.

Description

1) Each of the system blocks (Sampler, Quantizer, Encoder, Decoder, Reconstruction Filter) should be implemented as a separate function.
2) Your 'Sampler' function should allow the use of an arbitrary source signal, $m(t)$, and a user-input sampling frequency f_s
3) Your 'Quantizer' function should have the option that the user chooses between
   - Uniform mid-rise quantizer, where the user specifies the number of levels, L and the peak quantization level, m_p
   - Non-Uniform μ-Law quantizer, where the user specifies μ, L and m_p
4) Your 'Encoder' function should allow the user to choose between
   - Unipolar NRZ signaling
   - Polar NRZ signaling
   - Manchester signaling
5) Your 'Decoder' and 'Reconstruction Filter' functions should follow the parameters inserted to the 'Encoder'/'Quantizer' and 'Sampler' functions, respectively.

Testing your System Simulator

Test your overall system for the input signal $m(t)$ and the following cases

$$m(t) = 5\cos(2\pi f_m t), \qquad \text{where } f_m = 10$$

	Case 1	Case 2	Case 3	Case 4
Sampler	$f_s = 40$	$f_s = 20$	$f_s = 20$	$f_s = 15$
Quantizer	$\mu = 0, L = 8, m_p = 5$	$\mu = 0, L = 32, m_p = 5$	$\mu = 100, L = 32, m_p = 5$	$\mu = 0, L = 16, m_p = 5$
Encoder	Unipolar NRZ	Polar NRZ	Manchester	Unipolar NRZ

Deliverables - Part I: Deliver the following in printed format

1) Source codes (.m files) of each of the 5 functions
2) Source code of main script used for the 4 test cases. This main script should allow a user to enter the following:
   - Arbitrary signal $m(t)$
   - Arbitrary sampling frequency f_s
   - Arbitrary quantizer parameters μ, L and m_p
   - Arbitrary encoder signaling type

   It should be also used to output the following 5 figures
   - Plot the source input signal and the sampled signal on one figure
   - Plot the sampled signal and the quantized signal on one figure
   - Plot the output waveform from the encoder
   - Plot the source input signal and the destination output signal on one figure
   - Plot the frequency domain representation of the source input signal, the sampled signal and the destination output signal on 3 different subplots of one figure
3) For each of the 4 cases, submit the 5 figures generated as mentioned above
4) For each of the 4 cases, make a brief comment on your findings

Electronic Deliverables - Part I

Deliver, electronically, the following in a .zip file

1) Source codes (.m files) of each of the 5 functions
2) Source code of main script (as well as any additional functions needed to properly run your codes). **This will be used to test your system with arbitrary parameters and for arbitrary input signals**
3) A .pdf file of the whole report

Part II (12 points)

An important component of this course is the detailed study and the implementation of analog/digital communication system. A strong project will demonstrate understanding of communication basics and concepts. The deadline for forming project teams and selecting project topic is July 20, 2024 at 11:59 PM Egypt time. You are free to choose any modulation scheme (AM, FM, PM, PAM, PWM, PPM, PCM) and implement it through hardware circuits and MATLAB simulations. Each teamwork should include the following:

- You are required to analyze the selected communication system in the presence and absence of noise.

- You are required to conduct MATLAB simulations for the selected communication system under various conditions and for different parameter regimes.

- You are required to implement the selected communication system using hardware circuits.

- You need to provide the citation of all referenced work, figures, books..... etc

Deliverables- Part II

Deliver, electronically, the following in a .zip file
1) Source code of main script (as well as any additional functions needed to properly run your codes).
2) A .pdf file of the whole report. There is a limit of 12 single-sided pages for your report.

Project Regulation and Grading

- Students are required to work in teams of **1 to 2 students.**

- Grading will be done on the basis of:

- Technical content of the report.

- Project final presentation, including presentation graphics and appeal, accuracy and comprehensibility of presentation content, audience capturing, and audience participation and reply to questions

- Insight: how detailed and perceptive is your analysis?

- How effectively you use the literature? Can I identity the sources of your information well enough to reproduce your results?

- Clarity and writing. The report should be written in such a way that a technically competent person could reproduce your results if he/she wanted to

- Define all acronyms and describe any assumptions that you make. You should be able to pick up this paper a year from now and be able to read it.

- Your course project will be 15 % of your total grade. Marks will be assigned on

    1. Planning (10%)
    2. Final report (40%)
    3. Final presentation (50%)