Complex Engineering Activity

Subject: Digital Signal Processing Lab

Semester: Spring 2024

Instructor: Engr. Wania Anoosh

Objective:

The objective of this complex engineering activity is to carry out research, analysis, design, investigation, and implementation of a real-world complex engineering project that has the following attributes:

1. The activity requires abstract thinking, originality in analysis to formulate suitable hardware and software models of the activity.
2. The activity involves creative use of engineering principles and research-based knowledge in novel ways.
3. The activity can extend beyond previous experiences by applying principles based approaches.

Complex Engineering Activity Outcomes (CEAO):

The outcome of this activity is that the students may be able to partially attain some or all of the following graduate attributes:

1. GA1: Engineering Knowledge
2. GA2: Problem Analysis
3. GA3: Design/Development of Solutions
4. GA4: Investigation
5. GA5: Modern Tool Usage
6. GA6: The Engineer and Society
7. GA7: Environment and Sustainability
8. GA8: Professional Ethics
9. GA9: Individual and Teamwork
10. GA10: Communication
11. GA11: Project Management
12. GA12: Lifelong Learning

This activity is mapped on CLO1 and CLO3 and your performance in this project will play an important role in their attainment.

CLO1	Effectively **manipulate** signal processing techniques to visualize response of discrete time systems using MATLAB.	PLO 3	P5
CLO3	**Demonstrate** the ability to interact and communicate effectively both in individual and teamwork capacity.	PLO 9	A3

Problem Statement:

The frequency of generated voltage depends on number of poles in alternator and speed of generator's rotor. Pakistan operates on a 230V supply voltage and 50Hz frequency. All appliances are designed to be safe at 50Hz frequency; once the frequencies extend out of this range even for a few seconds, the effects can be catastrophic. At power system generation level, a sudden frequency shift leads to more drastic and immediate consequences. Motor and transformer currents vary inversely with frequency, so a sudden frequency drop could cause potentially damaging current overloading. Frequency spikes could cause sudden insulation failures, resulting in massive electrical short circuit faults. The resulting damage could potentially cost taxpayers hundreds of millions of dollars, both in the short term, as well as the long term, as equipment fails before its service lifespan is reached.

Therefore, it is crucial to identify the sudden glitch in frequency and implement necessary actions to avoid the harmful effects discussed above.

A .wav file containing noisy sinusoid wave is uploaded on the GCR. There is a glitch in this waveform at a certain time instant. Write a code in MATLAB which performs the following operations:

1. Plot the waveform w.r.t time
2. Finds the frequency/frequencies of this waveform
3. Finds the precise time instant (hrs mins secs) at which the glitch in frequency occurs
4. Removes the glitch from the sinusoidal waveform
5. Removes the noise from the sinusoidal waveform

Deliverables:

The deliverables for this project are:

- MATLAB code file
- A detailed report explaining your code along with the mentioned results. Your report should also include some of the pre-emptive measures that can be taken to cater this issue and protect the systems.
- Submission of above-mentioned deliverables will follow up with project demonstration and viva.

  Note:

  1. This is a group activity; each group includes members working on the same workstation every week.
  2. Functional code files should be on your laptops at the time of demonstration and viva.

Policy on Professional Ethics & Plagiarism

You are free to consult any book and online resources during the design and analysis phase, but you could not copy from them. Your design and implementation must be your original effort and same apply for simulations. Remember that if anyone is found to copy from the Internet or other group members, the group shall face severe penalty. You are not allowed to copy any material or code directly from the web or elsewhere. Note that if you are found to violate this policy or it becomes obvious that the work you have submitted is not your own or has been taken from some other source you shall be facing severe consequences.

The Formula that will be generously applied in all cases is:

Final Score = Raw Score – 2*CF*Total

Where CF is the Copying Factor. This means that even if you are found to copy only in 50% of the activity deliverables, and you end up scoring 100% raw score, but your final score will be 0. Please follow the principle that "Honesty is the Best Policy".