EE 422G (Sections 01 02)
Signals & Systems Laboratory, Spring 2009

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Texts:

1. EE 422G Lab Notes
2. *Signals and Systems*, 3rd ed., CT Chen, Oxford Press, ISBN-13: 9780195156614 (same texts as used in EE421G)

Expected Student Learning Outcomes

Students successfully completing this course must be able to:

1. Characterize random signals with correlation and probability density functions
2. Analyze discrete-time signals with the (discrete) Fast Fourier transform.
3. Design FIR and IIR filters based on signal and noise specifications.
4. Characterize system dynamics using impulse responses, transfer functions, and state-variable representations.
5. Simulate signals and systems using modern computer software packages
6. Design experiments to estimate signal and system model parameters from input and/or output data.

Course Summary

Lectures present new material on state variables and applications of random variables, as well as review topics from EE421G. Laboratory exercises provide opportunities for student to apply and implement concepts used in signals and systems to solve problems using modern engineering methods. Topics include noise models, filter design, modulation techniques, sampling, discrete Fourier Transforms, State Variable Models, and feedback design with an emphasis on using computer software for analysis and simulation.

Prerequisites

EE 421G and MA320. Students taking EE 422G must be able to: apply convolution and Fourier methods to determine the output of linear time-invariant systems, Analyze continuous-time and discrete-time systems with appropriate transforms. Characterize input-output relationships of linear time-invariant discrete-time systems using impulse response and transfer function representations, model random variation with distribution functions. Also it is helpful to have a background in matrix algebra and experience with programming languages such as Matlab and C++.

Class Email List:

To receive relevant communications and homework assignments for this class you must register for the list at the following web site: http://lists.engr.uky.edu/mailman/listinfo/ee422

Grading Undergraduate:

Pre-lab assignments (8)	32%
Lab Team Plan (1)	4%
Lab Reports (8)	56%
Demonstration (2)	8%

Grading Graduate:

Pre-lab assignments (8)	32%
Lab Team Plan (1)	4%
Lab Reports (8)	56%
Lab Exercise Design	8%

Undergraduate Students: Grades will be assigned using a10-point scale (A: 90+% of total points assigned, B: 80+%, C: 70+%, D: 60+%, E: Less than 60%.

Graduate Students: Grades will be assigned using a10-point scale (A: 90+% of total points assigned, B: 80+%, C: 70+%, E: Less than 70%.

Laboratory Reports: Each laboratory assignment is made up of two parts; the pre-lab (analysis and programming) and corresponding lab exercise (implement, measure, and interpret). The lab report will be due at the beginning of the next laboratory section meeting. Late assignments will be accepted with a 0.25 point per day penalty. You may work in groups up to 3 students in the laboratory; where the group turns in a single pre-lab assignment and a single lab report. The report is graded on organization, completeness, clarity, and accuracy. All lab reports must be prepared in a word processor and printed out. Programs written for the lab must be commented and placed in an appendix of the lab report. In the case of LabVIEW and Simulink programs, a screen shot of the block diagram (with descriptive labels) must be taken and included as figures in the lab report.

Pre-Lab Assignments: Pre-lab assignments typically involve an analysis/synthesis of the system used in the experiment, or the development of a program template to be used in the lab assignment. The responses to the pre-lab questions must be handed in at the end of the lab period where the lab assignment was performed. You can hold on to the pre-lab assignment during the lab to use as a reference. There will **NOT BE** enough time to do the pre-lab and the lab exercise in the 3 hour allotted period. **If you do not finish the experiment in the 3 hour time period, you will NOT be allowed extra time.** The pre-lab assignments can be handwritten, but must be legible and organized. The pre-lab is graded on completeness, clarity, and accuracy.

Lab Report Format: Lab reports must be prepared with a word processor and organized according to the following format:

- **Title Page**: This includes your name, lab partner's name, title of lab experiment, date of experiment, and date of completing the final write up.
- **Objectives**: Restate (copy) objectives from the lab assignment.
- **Solution/Procedure Description:** For each lab you need to implement a design that was either presented in the lab assignment or the result of a pre-lab exercise. The reader should be able to repeat your results based on the description provided (without reference to the original lab assignment document). Solutions or implementation strategies for each lab assignment will have multiple procedures and you need to describe each one. If a program was written to implement a solution, do not copy and past the program in the text. Describe what the program does (functional description) and include the actual code in an appendix. A flowchart may help clearly explain the program. The "*how*" questions for obtaining the results are answered in this section. When grading this section the reader will ask the question, "Can I repeat these measurements from the information given?" If it is not clear (as a result of missing, poorly organized, or ambiguous information), then points will be lost (3 points).
- **Presentation of Results:** For each solution/procedure efficient methods and statistics must be used for presenting the results. This typically includes performance metrics presented in tables and/or waveforms in figures. All axes must be labeled as well as columns and rows of tables. All figures and tables should be numbered and referred to in the text. Do not include a table or figure without introducing and explaining it within the text. The actual data generated/recorded must be presented in this section along with any analysis (formula or code description) used to estimated parameters or functions of the original data. The "*what*" questions concerning the results are answered in this section (2 points).
- **Discussion of Results:** This section primarily makes reference to the results to explain them relative to the underlying theories presented in the systems and systems course and/or limitations of the experiment/simulation. It typically includes a comparison of results between the implementation and the pre-lab predictions. There are discussion questions in the lab assignment to help direct your writing. Make sure you address these questions in your report, in addition to whatever other issues you as an engineer consider significant or important. It should NOT simply be a questions-answer format but a narrative that addresses these questions in coherent stream of ideas. The "*why*" questions concerning the results are answered in this section. (1 point)
- **Conclusions:** Summarize your results relative to the lab objectives. Assess how well the lab met the objectives. If applicable, suggest ways to improve the experiment, or how you may do things differently if experiment was repeated. (1 point)