COURSE SYLLABUS: EE583 - STATISTICAL SIGNAL PROCESSING

Instructor: Dr. Edgar Satorius

1. Introduction

This class meets 6:40 PM - 9:10 PM every Thursday evening beginning January 15, 2015 and ending on April 30, 2015. The final exam for this course is on Thursday May 7, 2015 from 7-9:00 PM. Our class room will be Kaprielian Hall (KAP) 165. The grader will be TBD. IMPORTANT dates are: Midterm exam (March 5) and the Final exam (May 7). These are hard dates so make sure you have no conflicts with these dates.

Please note: During this course we will have no classes on:

Mar. 19 Spring recess

Prerequisites: EE483, EE441, EE503

The sections given below are an outline of the topics I hope to cover in this course. Section 4 is mainly a review of material on discrete random processes. To do well in this course, you should be thoroughly familiar with this material. The course texts ('Digital Processing of Random Signals: Theory and Methods' by Porat; Chapter 2 as well as 'Adaptive Filter Theory' by Haykin; Chps. 2 and 3) have good reviews on discrete random processes. Other related courses include: EE563 (Estimation Theory which covers Kalman filters); EE586L (Advanced DSP Design Lab); EE667 (Array Signal Processing) and EE668 (VLSI Processors).

2. Grading and Computers

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<th>Computer Project(s)</th>
<th>Midterm (open book &amp; notes)</th>
<th>Final (open book &amp; notes)</th>
<th>Homework</th>
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Throughout the semester I will assign 5-6 homework sets plus two or three computer projects. The computer projects will help you learn the course material by conducting practical computer experiments on real world problems. Each project will focus on a reasonably well defined problem so that you can concentrate on learning the techniques -- not coming up with problems. The results of your studies should be well documented in a report with computer printouts/plots (no source listings required) to justify your conclusions. In doing the computer projects, you can use any computer language you wish; however, I encourage you to consider Matlab – especially if you have experience with it. Matlab is a very simple and powerful language that is particularly suitable for programming signal processing algorithms. It also has a very nice graphical display capability and includes a convenient mechanism for incorporating on-line help into the system. If you do use Matlab, make sure you have the Signal Processing toolbox.
If you do well on the homeworks and the projects, then you will be able to perform well in the class. Do the homeworks on your own (although you are free to discuss the problems with other classmates). Likewise with the computer projects: you can discuss them with others, but write them yourself. The midterm and final exams will be open text/notes exams. The midterm will include all material covered up to the midterm and the final will cover the remainder of the course (I will clearly describe what topics will be covered in the midterm and final exams prior to the exams).

Policy on late assignment submittals: I will allow late submittals provided you let me know in advance via e-mail. However, once the solutions are posted (typically about a week after the assignments are due), no submittals will be accepted or graded.

3. Office Hours

My office hours are 5:15-6:30 Thursdays in PHE 414. TV students may call me during this time (213 740 7654), or arrange an appointment for Thursday evenings. I strongly encourage you to make use of this time to discuss problems with the course material or any related aspects of digital signal processing which interest you. If you can't reach me otherwise, my e-mail address is: Edgar.H.Satorius@jpl.nasa.gov.

Questions related to the homework, projects, Matlab, etc. should initially be addressed to the grader. The grader’s e-mail address is: TBD.

COURSE OUTLINE:

4. Discrete random processes (Class 1)
   [Porat, Chapter 2.1-2.11; Haykin (Chp. 1)]


5. Classical Spectral Estimation (Class 2)
   [Porat, Chapters 4.1-4.6; Haykin (Chp. 1.16)]


6. Parametric Models of Random Processes (Classes 2-3)
   [Haykin (Chapters 1.5-1.10)]


7. Autoregressive and ARMA spectral estimation (Classes 3-5)  
[Porat (Chapters 6-7); Haykin (Chapters 1.5-1.10)]

[2] AR correlation function estimation techniques.  

8. Other spectral estimation techniques (Classes 5-6)  
[Porat (Chp. 9); Haykin (Chapters 1.5-1.10)]


9. Digital Wiener filtering (Classes 6-7)  
[Haykin (Chp. 2)]


10. Midterm, Class 8: March 5, 2015

11. Least mean squares adaptive filter (Classes 9-12)  
[Porat (Chp. 7.7); Haykin (Chps. 4-6, 12-14)]


12. Orthogonalized and least squares adaptive filters (Classes 12-13)  
[Porat (Chp. 8); Haykin (Chps. 8-10, 16)]

Godard algorithm.

13. Blind adaptive filtering (Classes 13-15)
   [Haykin (Chp. 17)]


REFERENCES:

14.1. Required

   [1] Class notes: I have prepared a large amount of supplementary class notes
   that are required for the course. These will be available at: blackboard.usc.edu.
   13: 978-0132671453.

14.2. Recommended Reading

   [1] Fundamentals of Statistical Signal Processing: Estimation Theory, Steven M. Kay,
   0132808033.
   Modeling, Adaptive Filtering and Array Processing, D. Manolakis, V. Ingle,
   [7] Adaptive Filtering Primer with MATLAB (Electrical Engineering Primer Series),
   0849370434.

14.3. Background Material

   Hall, 1999 (Chps. 2 -- §2.10, 11 & App. A).
15. Statement for Students with Disabilities
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

16. Statement on Academic Integrity
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

17. Academic Conduct
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in Scampus in Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in Scampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://capsnet.usc.edu/department/department-public-safety/online-forms/contactus.

This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/studentaffairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other
resources.

18. Support Systems
A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.