This is the third time I have taught this class.

Class
- 2003 was the first time I've taught it
- Never took a class like this as a student

Lecture notes (third draft)
Homework assignments (from text & me)
Web site: http://ece.pdx.edu/~ssp
Office hours: Mondays & Wednesdays 4–5 pm (after class)

May be difficult to print on older printers or with older versions of Adobe Acrobat
Should work with “Print as Image” option of Acrobat 7.x
My Background

- Ph.D. 1999
- Teaching in PSU ECE dept. 6 years
- Second time teaching this course
- Presently, this is my favorite topic
- Research area: Biomedical signal processing
- See http://bsp.pdx.edu

Course Outcomes

- Understanding of autoregressive, moving average, autoregressive moving average, and general linear models and how they are related.
- Ability to characterize an estimator.
- Ability to apply nonparametric techniques to estimate autocorrelation, cross-correlation, and partial correlation.
- Ability to apply nonparametric techniques for spectral estimation including power spectral density, cross-power spectral density, coherence, and transfer function.
- Ability to conduct and present a peer-reviewed research project orally and in written form.

Course Web Site: http://ece.pdx.edu/~ssp

- Syllabus
- Outline
- Lecture notes - very helpful
- Lectures (most useful for review)
- Homework assignments
- Textbook errata
- Project
  - Report requirements
  - Presentation tips
  - PowerPoint template
  - Examples from last year
- Grades
- Other resources

Classroom

- DLC 304: seats 32 students, room from which I will teach
- Windows Media Archive?
Prerequisites

- Should have had a class on linear systems and signal analysis
  - DT Fourier series
  - DT Fourier transform
  - z transform
- Random variables and processes
  - Signals and noise is a co-requisite
  - Could probably survive without it, but would be very helpful
  - Should have had at least one class on probability and random variables
- MATLAB familiarity

MATLAB

- You will be required to complete homework assignments that use MATLAB
- I will include MATLAB code segments in my notes
- Will not teach you MATLAB - you are expected to already know it or learn it on your own
- There are many good introductory books
  - Web: [http://www.ma.man.ac.uk/~higham/mg/](http://www.ma.man.ac.uk/~higham/mg/)
- Additional links are provided on the web site

Lecture Notes

- Will be posted on the class web site
- Will update them this term
- Watch for updated notes as late as 30 minutes before lecture, 1:30 pm
- Workspace provided for examples worked during lecture

6-digit Codes

- I use 6-digit codes to post your grades online and for anonymous identification on exams
- Email code to me this week
- Can be any non-whitespace character that you can send via a plain-text email
- Remember it for the exam
Assessment

- 15% Reading quizzes (≈ 17)
  - 5–10 min quizzes on required reading
  - Beginning of each lecture
  - One page each
  - Goal is to test whether you read, not comprehension
- 20% Homework
  - 4–5 assignments
  - Will consist of implementing methods & algorithms discussed in class
  - MATLAB required
  - Generally will have 1 week to complete

Assessment Continued (1)

- 20% Midterm
  - In class (1 sheet of notes probable)
  - Conceptual
  - Late in the term
- 10% Final quiz
  - In class
  - 30–60 minutes
  - All conceptual

Assessment Continued (2)

- 35% Project
  - 5% first draft of report (based on completeness)
  - 5% blinded peer review
  - 5% oral presentation
  - 20% final report (based on quality)
  - Key requirement: Must use or expand methods discussed in class
  - Report details on next slide

Final Report Format

- Must be in IEEE peer-review format (4 page maximum)
- Must be written in L\LaTeX or MS Word
- Must submit electronic copy
- Detailed formatting information is posted on the web site
- Scope should be similar to an IEEE conference paper
- Focus: analysis of signals to answer a question
Final Report Assessment

• Will give a score final report for each of the following categories

  • **Format**
    – Does the report adhere to the IEEE format?
    – Does it adhere to requirements listed on the web site?

  • **Grammar**
    – Is the report written in past tense (it should be)?
    – Does the report use the terms "I" or "you" inappropriately?
    – Were there many grammar or spelling errors?

  • **Organization**
    – Is the report well organized?
    – Are the section headings appropriate and clear?

  • **Clarity:**
    – Was the report clearly written?
    – Could I understand what was done and why after reading it?

  • **Results:**
    – Were the results sufficient?
    – Were they clearly stated?
    – Was a table or plot used to display the results appropriately?

  • **Discussion:** Are the results discussed? Were there any surprises and, if so, were ideas about the reasons for the surprises given? What was the significance of the results?

  • **Citations:** Were appropriate citations made to previous work?

Final Report Assessment Continued

• **Scope:** Was the project of sufficient scope for the class? Did the project use appropriate methods taught in this class?

• **Abstract:** Does the abstract give an accurate and concise summary of the report?

• **Context:** Was the context of the problem sufficiently explained?

• **Significance:** Is the significance of the project explained?

• **Objectives:** Are the project objectives clearly specified in the introduction?

• **Methodology:** Were the methods and algorithms used appropriate for the data and project objectives?

General Comments

• Most lectures will use the full period

• I expect much of your learning to occur out of lecture working on homework and the exams

• Homework assignments will be heavy on MATLAB simulation

• Will focus on
  – Theory (key concepts)
  – Methods (estimation)
  – Nonparametric analysis

• Will not emphasize
  – Proofs
  – Computational issues
  – Filter structures
  – Communications and other applications
  – Wavelets or time-frequency analysis
Coarse [sic.] Outline

- Introduction
  - Chapter 1
  - Overview of problems and topics
- Review of DSP
  - Chapter 2
  - Four lectures
  - Should be (but may not be) review
  - All theory
- Random Variables, Vectors, & Signals
  - Chapter 3
  - Four lectures
  - Should be review, but probably is not for many of you
  - All theory

Coarse [sic.] Outline Continued

- Nonparametric Signal Models
  - Chapter 4 (sections 1–2 only)
  - Two lectures
  - All theory and concepts
- Nonparametric Power Spectrum Estimation
  - Chapter 5
  - Six lectures
  - Heavy on methods (estimation)
  - Most useful methods of the class

Coarse [sic.] Outline Continued

- Will not cover every topic in every chapter
- Will try to use the same notation
- Intend to follow textbook closely
- Exam problems will focus on what is discussed in lecture & homework assignments
- Some chance we will not be able to keep to this schedule

Textbook

- Relatively new
- Many advanced topics
- Elegant notation and explanations
- Fairly concise
- Heavy on terminology
- Errors?
  - See errata on web site
Style of Course

- Lectures will be closed-loop: will call on you by name to answer questions
- Reading quizzes designed to help you keep caught-up
- May often go off-the-slides during lectures

Logistics: Text & Workbook Errata

- Each error worth 25% of a homework
- Find four errors = can skip an assignment
- Cannot receive more than full credit for homework
- Typos and grammar count
- Must be first to email me
- May take me a few days to confirm
- Known errata are posted on the web site
- Expect errors in the HW solutions

Homework 1

- Will assign Wednesday
- For now,
  - Skim/read Chapter 1
  - Read Chapter 2
  - Reading quiz: Sections 2.1 – 2.2.4

General Comments on Class

- Challenging, but interesting and useful topics of signal processing
- Fairly advanced class
  - Graduate level ECE course
- Will try to adjust the pace to the class
  - Feedback, regular attendance, and questions in class are essential to make this work
During winter term a new course will be offered: “Statistical Signal Processing II”

- Will run as an ECE 510 course (counts only as elective, not core)
- Will cover parametric modeling, optimal filters (Weiner & Kalman), least squares, and signal modeling
- Chapters 6–9 (10?) of the textbook
- Will only run, if sufficient enrollment (> 6 students)
- Project course