**GE524**

**Data-Based Modelling and Identification**

MWF 10:30-11:50 AM, 260 Everitt Lab

**Instructor:** Prof. Carolyn Beck, 216B Transportation Bldg., [*bec*](mailto:beck3@illinois.edu)[*k3@illinois.edu*](mailto:k3@illinois.edu)

**Text:** *System Identification*, by Torsten S¨oderstr¨om and Petre Stoica available online or as USB memory stick

**TENTATIVE COURSE OUTLINE:**

Reading Topics Lectures

**Part 0:** Course Introduction

Chap. 1 & What is System Identification? Why? How? Week 1

App.s A & B Review of fundamental probability and linear algebra concepts Weeks 1-3

**Part 1:** Overview and Introductory Examples

Chap. 2 LTI Systems; Impulse responses; Transfer functions; Signal Spectra; Weeks 3-4

\*Chap. 3 Non-parametric Methods: Transient Response; Correlation Analysis; Week 4

Frequency Response; Fourier and Spectral Analysis

**Part 2:** Foundations of Parametric Methods

Chap. 4 Linear Regression and Least-Squares Weeks 5-6

**Part 3:** Motivations and Models

Chap. 6 LTI Models: Sets and Families of Models; State-Space Models; Weeks 6-7

Identifiability Issues

**Part 4:** Parameter Estimation Methods

Chap. 7 Least Squares and Optimal Predictors; Computational Approaches Weeks 7-9

Chap. 8 and Instrumental-Variables and Subspace Methods Weeks 9-11 handout Maximum Likelihood and connections to Subspace Methods

**Part 5:** Practical Aspects

Chap. 11 Model Structure Selection and Model Validation Week 12

Chap.s 5 & 12 Experiment Design: Input and Output Signals Week 13

**Part 6:** Advanced Topics

Chap.s 9 & 10 Selection of topics from text and journal articles Weeks 13-15

**Assignments:**

*•* Problems will be assigned on an approximately every-other-week basis. Problem discussion sessions will be held in approximately every-other-Friday to discuss and review the assigned problems as a class.

*•* A series of **3 projects** will be completed. The first 2 will be assigned by the instructor, the third may be determined by the individual student with approval of the instructor.

*•* Students will be required to read one journal article on an advanced system identification topic and give a 30 minute in-class presentation of the material in the article. The instructor will hand out a list of pre-approved journal articles for this assignment.

*•* There will be a 3-hour in-class final at the conclusion of the course.

**Course Grade Composition:**

Item % of grade

Homework Problem Sessions (participation) 5%

Data-Based Projects (3) 15% each Journal Article Presentation 20% Comprehensive Final 30%

**Final Exam Date and Time TBD (Default will be 8:00-11:00 AM, Monday, December 14)**