Faculty of Eng. & Natural Sci.

EE672-202302

System Identification

Instructor

Name	Email	Office	Phone	Office Hours
Mustafa Ünel	munel@sabanciuniv.edu	FENS-1066	9549	Before and after classes, or by appointment

Course Content

Aims to provide the fundamental theory of identification of dynamical systems, i.e. how to use measured input-output data to build mathematical models, typically in terms of differential or difference equations. It covers the mathematical foundations of system identification, non-parametric techniques, parameterizations, and model structures, parameter estimation, asymptotic statistical theory, user choices, experimental design, and choice of model structure.

Objectives

The objective of the course is to provide graduate students with a strong background in linear and nonlinear system identification to build mathematical models from experimental data.

Recommend or Required Reading

Textbook

System Identification, Theory for the User, 2nd Edition, Lennart Ljung, Prentice Hall, 1999.

Readings

System Identification, Karel J. Keesman, Springer-Verlag London Limited, 2011
Nonlinear System Identification, Oliver Nelles, Springer, 2001.

Assessment Methods and Criteria

	Percentage (%)	Number of assessment methods
Midterm	30	1
Assignment	30	5
Individual Project	35	1
Participation	5	

Course Outline

- Introduction
- Time-Invariant Linear Systems
- Simulation and Prediction
- Models of Linear Time-Invariant Systems
- Models for Time-Varying and Nonlinear Systems
- Nonparametric Time and Frequency Domain Methods
- Parameter Estimation Methods
- Convergence and Consistency
- Computing the Estimate
- Recursive Estimation Methods
- Experiment Design
- Preprocessing Data
- Model Structure Selection and Model Validation

Learning Outcomes

- select inputs and outputs of a system, and characterize disturbances acting on the system.
- design suitable excitation signals,
- use measured input-output data to build mathematical models,
- solve linear regression problems by least squares methods,
- develop nonlinear NARX and Hammerstein-Wiener models
- preprocess data,
- validate obtained models

Course Policies

- This is a physical-only course.
- More than 70% attendance earns participation points.
- Make-up will be given only for official excuses.