SYSTEM IDENTIFICATION

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Moodle ME-421

Spring 2025

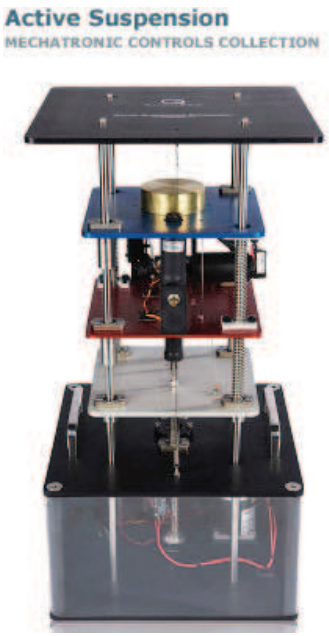
Content

1. **Fitting a Model to the Data**
   - Modeling, Type of models
   - Input signals
   - Linear regression (Least squares algorithm)
2. **Nonparametric Model Identification**
   - Time-domain methods (transient response, deconvolution method, correlation approach)
   - Frequency-domain methods (frequency analysis, Fourier analysis, spectral analysis)
3. **Parametric Model Identification**
   - Basic models (Finite Impulse Response (FIR) model, ARX model, state-space model)
   - Black-box linear models (ARMAX, BJ, OE)
   - Nonlinear model identification
   - Practical aspects (data filtering, order estimation, model validation, closed-loop identification)

Computer Exercises

Objectives:

- Practice the identification algorithms in simulation.
- Become familiar with the Identification Toolbox of Matlab.
- Parametric identification and validation of the model of mechanical systems using real data.



Computer Exercises

CE1: Nonparametric methods

- Impulse response
- Deconvolution algorithm
- Correlation approach
- Fourier analysis (periodic signal)
- Spectral analysis (random signal)

CE-2 : Parametric methods

- FIR model,
- ARX model, IV method
- State-space model
- Order estimation
- ARMAX, BJ, OE models, validation

Project : Identification of a Mechatronic system

Course Schedule

System Identification, Spring 2025		
Tuesday	10:15 – 12:00	12:15– 13:00
Place	MED 2 2423	MED 2 1120
18 February	Introduction	Chapter 1
25 February	Chapter 1	CE-1
04 March	Chapter 1	CE-1
11 March	Chapter 2	CE-1
18 March	Chapter 2	CE-1
25 March	Chapter 2	CE-1
01 April	Chapter 3	CE-1
08 April	Chapter 3	CE-2
15 April	Chapter 3	CE-2
29 April	Chapter 3	CE-2
06 May	Chapter 3	CE-2
13 May	Chapter 3	CE-2
20 May	Chapter 3	CE-2
27 May	Project	Project

Course-notes and Grades

Grades and Evaluation

- Brief reports for CE-1 (18 points) and CE-2 (18 points).
- Identification of a system in the final exam (48 points).
- Theoretical questions in the final exam (36 points).

Grading:

Points	111-120	106-110	$\cdots$	76-80	71-75	66-70	$\cdots$	11-15	0-10
Grade	6.00	5.75	$\cdots$	4.25	4.0	3.75	$\cdots$	1.00	NA

References :

1. L. Ljung : "System identification, Theory for the users"
2. T. Soderstrom, P. Stoica : "System Identification"
3. Course-notes: " System Identification", A. Karimi, Edition 2023 (in English)