System Identification

Dates and time  
14-9; 21-9; 28-9; 5-10; 12-10; 19-10; 26-10; 02-11 2020  
from 13.45-16.00

## Course location

Online course

## ECTS

6 ECTS if the homework is completed successfully.   
1, 5 ECTS for auditing the course

Lecturers  
Prof.dr.ir. P.M.J. Van den Hof, Eindhoven University of TechnologyProf.dr.ir. J. Schoukens**,** VUB, Brussels, Belgium and Eindhoven University of TechnologyDr. G. Bottegal, ASML, Eindhoven

Objective   
System Identification is involved with data-driven modeling of dynamical systems. The objective of this course is to present the important system identification techniques with a special attention to prediction error methods. Time- and frequency-domain methods will be covered, as well as parametric and non-parametric approaches, with particular attention for recently developed techniques in the domain of machine learning. While the focus will be on linear time-invariant systems, extensions will be made to nonlinear systems also. We will consider both the cases of open-loop and closed-loop data as well as further extensions towards dynamic networks.Contents  
1. Introduction; concepts; discrete-time signal and system analysis; estimation   
2.Parametric (prediction error) identification methods - model sets, identification criterion, statistical properties  
3.Parametric (prediction error) identification methods - model validation, approximate modelling, Maximum likelihood and CRLB  
4. Regularization and non-parametric kernel-based identification; machine learning   
5. Frequency-domain identification, parametric and non-parametric   
6. Nonlinear models  
7. Closed-loop identification  
8. Identification in dynamic networks

## Prerequisites Calculus and linear algebra. Some knowledge of statistics and linear systems theory and/or time series analysis is helpful, but not required. The lecture notes contain useful summaries of the important notions used during the course.

## Course materials

Lecture notes will be distributed during the course.

## Homework assignments

The assessment of this course will be in the form of three homework assignments.