

Course Syllabus: AT.325.EN System Identification

Instructor: Yuri Shardt (e-mail: yuri.shardt@tu-ilmenau.de; Website: <http://www.tu-ilmenau.de/en/dept-automation>)

Office: Zusebau 3006

Office Hours: I follow the open-door policy. When I am in my office, I will happily answer your questions. If you wish a fixed appointment, please e-mail me to arrange it. I am not available Thursdays and Tuesdays afternoon.

E-Mail Policy: I will respond to all e-mails within 1 workday after arrival. A day runs from 9:00 am to 9:00 pm the next day. Weekends are excluded from the computation. In the subject header of your e-mails, please place the phrase “[AT.325]” and the rest of the header so that I can respond faster to your e-mails, for example “[AT.325]: Question about the seminar”.

Course Website: [https://www.tu-ilmenau.de/en/university/departments/department-of-computer-science-and-automation/profile/institutes-and-groups/institute-for-automation-and-systems-engineering-fak-ia/automation-engineering-group/teaching/at325-system-identification-](https://www.tu-ilmenau.de/en/university/departments/department-of-computer-science-and-automation/profile/institutes-and-groups/institute-for-automation-and-systems-engineering-fak-ia/automation-engineering-group/teaching/at325-system-identification-1)

[1](#)

Lecture: Wednesdays: 11:00 am to 12:30 pm in HU 201

Seminar: Tuesdays: 3:00 to 4:30 pm in K 2002B (every odd week)

Course Overview

In today’s world, where data is relatively easy to get and manipulate, it is essential to understand how to properly use such data to obtain the most value from it. Using data can range from simply displaying it visually to developing models that can be used to predict future behaviour. In order to understand how to use the data, it is necessary to develop a strong understanding of statistics, which underlies almost all data processing methods. Therefore, this course will focus to provide you with the necessary tools to accurately and efficiently use the different data sets. The course has the following 4 main topics:

- 1) Introduction to Statistics and Data Visualisation (1 Week; Chapter 1)**
 - a. Descriptive statistics
 - b. Data visualisation
- 2) Theoretical Background to Statistics (4 Weeks; Chapter 2)**

- a. Statistical axioms and definitions
 - b. Expectation operator
 - c. Statistical probability distributions
 - d. Parameter estimation
 - e. Hypothesis testing
 - f. Confidence intervals
- 3) Regression (4 Weeks; Chapter 3)**
- a. What is regression analysis?
 - b. What is the regression procedure?
 - c. Linear regression
 - d. Nonlinear regression
- 4) Design of Experiments (4 Weeks; Chapter 4)**
- a. What is design of experiments and why do we need it?
 - b. Full factorial design
 - c. Fractional factorial design
 - d. Other designs

Prerequisites

I expect that you have knowledge in the following areas:

- 1) **Math:** Basics in calculus and linear algebra

Grading

Final

100%

For the final, it is acceptable to bring your own copy of the course notes, the textbook, and one dictionary.

Bonus Points

There is a possibility to earn up to 5% extra on the final examination by submitting a correction form for suggestions on how to improve either the German course notes or the English book. Each accepted correction has a value of 0.5%.

The procedure for submitting the correction is as follows. For each correction, submit the correction form that is available online and send it to me at least 5 days before the start of the

final exam. Should two or more people find the same mistake, then I will give the bonus point to the person who first sent it to me. Please check the online *Errata and Corrigenda* for the current list of noted corrections. Once I have accepted the correction, I will send you a certificate that you will attached to your examination when you write it.

Mailing List for the Course

Please register for the course mailing list using the following link: <https://www1.tu-ilmenau.de/fg-at-register/course/> or you can use the QR code below.



Laboratory

For this course, there is an associated laboratory. Information about the laboratory can be found on the course website.

Recommended Book

The course is based on the following book:

- Yuri A.W. Shardt (2022). *Statistics for Chemical and Process Engineers: A Modern Approach*, Springer International Publishing: Cham, Switzerland. (414 pp.) ISBN: 978-3-030-83190-5. doi: [10.1007/978-3-030-83190-5](https://doi.org/10.1007/978-3-030-83190-5).