Study programme(s): Applied Mathematics – Data Science

Level: master studies

Course title: Introduction to Digital Signal Processing

Lecturer: Dušan Jakovetić

Status: elective

ECTS: 6

Requirements: Basics of linear algebra, Signals and systems

Learning objectives

- Understanding of fundamental concepts in digital signal processing and their application in big data analytics

Learning outcomes

- Acquired knowledge of basic concepts in digital signal processing, digital signal transforms and their application in big data analytics
- Ability to communicate/collaborate with electrical engineers on practical and research problems
- Ability to design discrete-time signal processing systems using appropriate software tools
- Ability to solve real-world problems using the acquired knowledge

Syllabus

Theoretical instruction Discrete time signals: Nyquist-Shannon sampling theorem, Discrete time Fourier transform, Discrete Fourier transform, Fast Fourier transform; Discrete time systems: Linearity and time invariance, Causality, Stability, Input-output representation, Analysis and characterization in frequency domain. Discrete Fourier transform. Fast Fourier transform. Practical aspects of interfacing analog and digital signal processing. Digital filters: Properties and design of FIR and IIR filters, practical implementation. Multirate signal processing. Adaptive filters. Advanced topics in digital signal processing related to big data analytics: Sparse DFT, DSP on graphs.

Practical instruction

Application examples in all domains where digital signal processing is applied.

Literature

Selected parts of the following books:

5. John G. Proakis and Dimitris K. Manolakis: Digital Signal Processing, Principles, Algorithms and Applications, Prentice Hall, 2006.
6. Paolo Prandoni and Martin Vetterli: Signal Processing for Communications, EPFL Press, 2008.
7. Emmanuel Ifeachor and Barrie Jervis: Digital Signal Processing – A Practical Approach, Prentice Hall, 2001.

Weekly teaching load				Other: 0
Lectures: 2	Exercises: 3	Other forms of teaching: 1	Student research: 0	

Teaching methodology

Lectures; revisions of the material; active students' participation in problem solving; knowledge tests – colloquia; homeworks.

Grading (maximum number of points 100)

Pre-exam obligations	**points**	**Final exam**	**points**
Colloquia + homeworks	20 (Colloquia) + 10 (Homeworks)	written exam	70