Study programme(s): Mathematics

Level: PhD studies

Course title: Scientific Computing (NM-08)

Lecturer: Vladimir Kostić

Status: optional

ECTS: 10

Requirements: Modeling of Dynamical Systems, Numerical methods of linear algebra 1 and 2, Numerical Analysis 1 and 2

Learning objectives

Prepare students for solve in creative and innovative way problems emerged from mathematical modeling of real processes in engineering, industry, economy and inovative technologies of modern society using modern matrix and numerical algorithms, and techniques of simulation and optimization.

Learning outcomes

Students will be trained to model complex systems on a computer in an independent and innovative way using algebraic and differential equations that describe the real dynamic processes, will learn modern matrix and numerical methods for their simulation, and develop the ability to apply appropriate algorithms in order to optimize them.

Syllabus

Theoretical lessons

Theory of dynamical systems and control.
Modelling with systems of algebraic and differential equations.
Scientific Computing - overview of the basic concepts and the field
Advanced techniques of numerical linear algebra algorithms as the base's of Scientific Computing.
Numerical algorithms for solving systems of algebraic and differential equations.
Numerical algorithms for the simulation of dynamical systems.
Numerical algorithms for optimization of dynamical systems.

Practical lessons

Implementation of theoreticly studied algorithms in object-oriented programming language Modelica and MATLAB.

Literature

1. Michael T. Heath: Scientific Computing: An Introductory Survey, McGraw-Hill, New York, Second Edition, (2002)
2. D. Hinrichsen, A. J. Pritchard, Mathematical Systems Theory I – Modeling, State Space Analysis, Stability and Robustness, Texts in Applied Mathematics, Springer (2005)
3. P. Fritzson, Principles of Object-Oriented Modeling and Simulation with Modelica 2.1, Wiley (2003)
4. P. Fritzson, Introduction to Modeling and Simulation of Technical and Physical Systems, Wiley (2011)
5. Leslie Hogben: Handbook of Linear Algebra, CRC Press (2007)

Weekly teaching load				Other: 0
Lectures: 2	Exercises 0	Other forms of teaching: 0	Student research: 6	

Teaching methodology

Lectures with the active participation of students. Independent work on the computer. Testing acquired skills in specific examples from practice. Testing of the obtained knowledge and skills with oral examination and via presentations at the seminars.

Grading method (maximal number of points 100)

Pre-exam obligations	**points**	**Final exam**	**points**
Colloquia	50	written exam	50