Course: Introduction to advanced numerical methods in engineering

Teaching hours: 15 h

Prerequisites: The course is primarily open to all PhD students at Gdansk University of Technology.

This course is compulsory for PhD students assigned to Control, Electronic and Electrical Engineering tracks at Doctoral School at Gdańsk University of Technology

Course outline

Content
The aim of this interdisciplinary course is to provide the knowledge associated with the advanced numerical analysis, which can be used to solve a broad range of scientific and engineering computational problems. It is expected that the course attendant will clearly understand the concepts and the roles of the numerical techniques, such as a singular value decomposition, finite element method, stochastic methods, euler method, finite difference method in time domain, method of moments, mode matching method, methods based on homotopy. The techniques discussed in the course are widely illustrated by applications from the field of electronics, data science, computational mechanics, etc.

General topics coverage:
1. Singular Value Decomposition
2. Finite Element Method
3. Stochastic methods
4. Euler method
5. Finite difference method in time domain
6. An introduction to the method of moments
7. An introduction to the mode matching method
8. Selected methods based on homotopy

Teaching mode

There will be 15 hours of lectures to be completed during the first semesters of PhD programme. The course is entirely delivered in English.

Examination

A wide range of formative feedback from your tutor, questions and practical individual and group exercises will be used by tutors to aid learning as will exercises to encourage the researchers' abilities in critical and reflective learning. The exact nature of these assessment devices will be at the discretion of the tutor. The PhD students will be required to demonstrate their skills, knowledge and understanding of the numerical methods during an oral/written examination.

Fundamental readings:

1. Trefethen, Lloyd N., and David Bau III. Numerical linear algebra. Vol. 50. Siam, 1997.
2. Sadiku, Matthew NO. Numerical techniques in electromagnetics with MATLAB. CRC press, 2018.