Course code	
Type and description	Background Course
ECTS credit	2
Course name	Mathematical modeling II
Course name in Polish	Modelowanie matematyczne II
Language of instruction	English
Course level	8 PRK
Course coordinator	Krzysztof Sobczak
Course instructors	Paweł Olejnik, Przemysław Perlikowski, Radosław Mania, Krzysztof Sobczak
Delivery methods and course duration	

	Lecture	Tutorials	Laboratory	Project	Seminar	Other	Total of teaching hours during semester
Contact hours	9	0	0	0	6	0	15
E-learning	No	No	No	No	No	No	
Assessment criteria (weightage)	0,40				0,60	0,00	

Course objective

1. Acquiring knowledge of the mathematical description and analysis of fluid dynamics problems.
2. Acquiring knowledge about modern methods of controlling the dynamics of mechatronic systems.

Learning outcomes

After the course a PhD student we be able to:

1. understand the physical meaning of the equations of fluid dynamics – outcome W1
2. analyse and solve the system of fluid dynamics equations for selected flow problems – outcome W4
3. describe and distinguish modern control methods used in applied mechanical engineering – outcomes W1 and W4
4. implement control methods suitable for selected dynamical problem – outcome U3
5. present the mathematical modelling concerning the problems of PhD dissertation – outcomes W4, U3, K1, K2

Assessment methods

Outcomes W1, W4 – test

outcomes W4, U3, K1, K2 – presentation

The final evaluation is based on:

Test - 40%

Presentation - 60%

Prerequisites	The contents of the master degree course on the fluid dynamics, basic theory of control and mechatronics.
Course content with delivery methods	Lecture 1. Principles and equations of fluid dynamics: conservation (balance) equations of mass, momentum and energy in integral and differential forms. 2. Analysis, simplifications and solutions of the Navier-Stokes equation for selected flow cases. 3. Principles and application of modern control methods used in applied mechanical engineering. Seminary Presentation of the mathematical modelling concerning the problems of PhD dissertation
Basic reference materials	1. Yunus A. Cengel, John M. Cimbala. ”Fluid Mechanics: Fundamentals and Applications”, McGraw-Hill, 2nd edition, 2010. 2. Frank M. White, ”Fluid Mechanics”, McGraw-Hill, 7th edition, 2009. 3. Kok Lay Teo, Bin Li, Changjun Yu and Volker Rehbock: ‘Applied and Computational Optimal Control’ Springer, Berlin 2021. 4. J. Awrejcewicz, D. Lewandowski and Paweł Olejnik: 'Dynamics of Mechatronics Systems: Modeling, Simulation, Control, Optimization and Experimental Investigations' World Scientific Publishing, Singapore 2017.
Other reference materials	1. Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Alric P. Rothmayer, ”Fundamentals of fluid mechanics”, John Wiley & Sons, 7th edition, 2013. 2. Paweł Olejnik, D. Lewandowski and J. Awrejcewicz: 'Modeling and Optimization of Discrete Mechatronic Systems' The Lodz University of Technology Press, Lodz 2015. 3. Paweł Olejnik: 'Numerical Methods of Solution, Analysis and Control of Discontinuous Dynamical Systems', Scientific Books of Lodz University of Technology, No. 1151, Lodz 2013.
Average student workload outside classroom	35 h
Comments	
Last update	