Warsaw University of Technology

COURSE OFFERED IN THE DOCTORAL SCHOOL

Code of the course	4606-ES-0000FHI-0080	Name of the course	Polish	**Zastosowanie metody CFD w przemyśle**	
			English	**Application of CFD method in industry**	
Type of the course	Specialty course				
Course coordinator	Professor Michał Makowski, Ph.D., D.Sc., Eng. (teacher: Piotr Tarnawski, Ph.D., Eng.)				
Implementing unit	Faculty of Automotive and Construction Machinery Engineering	Scientific discipline / disciplines*	Mechanical engineering; Civil Engineering, Geodesy and Transport; Environmental engineering, mining and power engineering		
Level of education	Education of PhD students	Semester	Winter/summer		
Language of the course	English				
Type of assessment:	Credit with a grade	Number of hours in a semester	30	ECTS credits	2
Minimum number of participants	10	Maximum number of participants	20	Available for students (BSc, MSc)	Yes

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	1		1		
	in a semester	15		15		

* does not apply to the Researcher's Workshop

1. Prerequisites

Fundamentals of thermodynamics, fluid mechanics, and heat transfer

2. Course objectives

The aim of the course is to acquire basic knowledge in the field of Computational Fluid Dynamics (CFD) and the ability to use ANSYS Fluent program, including building a computational grid, solver settings, defining boundary conditions, visualization of results, and methods of verification of results.

3. Course content (separate for each type of classes)

Lecture

- Theoretical basics.
- Description of the mathematical apparatus of differential equations.
- Derivation of the continuum equation
- Derivation of the momentum equation
- Derivation of the equation energy.

Laboratory

- Drag simulation of internal flow.
- Simulation of the aerodynamics of various objects.
- Simulation of forced and natural convection.
- Simulation of mixing gases with different chemical species.
- Simulation of filling the combustion chamber.
- Two-phase flow simulation - liquid and gas interaction.

4. Learning outcomes

	Learning outcomes description	Reference to the learning outcomes of the WUT DS	Learning outcomes verification methods*
Knowledge			

K01	Acquiring knowledge about physical phenomena occurring in fluids.	DS_K2	project evaluation
K02	Acquiring knowledge in the field of applying numerical fluid mechanics.		project evaluation
K03	Acquiring knowledge in the area of various computational methods of one problem and comparing the results.		project evaluation
Skills			
S01	Independent realization of two simulation projects.	DS_S2	project evaluation
S02	Ability to use simulation software.		project evaluation
S03	The ability to present the results in the form of a technical report.		project evaluation
Social competences			
SC01	The ability to use modern engineering computer tools and the possibility of using them in various industries. Ability to pass on solutions and benefits to others.	DS_SC4	assessment of activity during classes

*Allowed learning outcomes verification methods: exam; oral exam; written test; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria

Assessment of the realization of two independent simulation projects. Building a geometric model and mesh, performing calculations, presenting the results, drawing conclusions from the simulation results.

6. Literature

[1] ANSYS Fluent User's guide

[2] J. Blazek, Computational Fluid Dynamics: Principles and Applications, ELSEVIER SCIENCE PUB CO 2006

7. PhD student's workload necessary to achieve the learning outcomes**

No.	Description	Number of hours
1	Hours of scheduled instruction given by the academic teacher in the classroom	30
2	Hours of consultations with the academic teacher, exams, tests, etc.	2
3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	13
4	Amount of time devoted to the preparation for exams, test, assessments	15
	Total number of hours	**60**
	ECTS credits	**2**

** 1 ECTS = 25-30 hours of the PhD students work (2 ECTS = 60 hours; 4 ECTS = 110 hours, etc.)