COURSE DESCRIPTION CARD - SYLLABUS

Course name

TAYLOR-COUETTA FLOWS IN SCIENCE AND TECHNOLOGY

Course

Proposed by Discipline

Mechanical Engineering

Year/Semester

II/4, III/6

Type of studies

Doctoral School

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture	Tutorials	Projects/seminars
4		

Number of credit points

1

Lecturers

Responsible for the course/lecturer:

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Faculty of Mechanical Enginneering

Poznan University of Technology

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Responsible for the course/lecturer:

Prerequisites

Knowledge: student knows the basic issues of physics (in particular of mechanics), mathematics and numerical methods.

Skills: student can acquire knowledge/information from the literature (English-language literature), from internet/data bases, can integrate and interpret information and is able to draw conclusions from the obtained data.

Social competencies: student understands the need for continuous learning, is aware of the role of science in the development of technology and civilization, has the ability to work in a team.

Course objective

To acquaint student with widely conducted research in the world on the fluid flows occurring between two concentric rotating cylinders (Taylor-Couette flows) and with the impact of these studies and their results on the interpretation of phenomena occurring in the astrophysics, geophysics and in rotating machines (among others). To familiarize student with research methods (experimental and numerical) applied in such studies and with the possibilities of visualizing the observed phenomena.

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows and understands:

1) global achievements, covering theoretical foundations as well as general and selected specific issues that are relevant to scientific disciplines studied at the doctoral school, to the extend that enables revision of existing paradigms, [P8S_WG/SzD_W01]

2) key development trends of disciplines of science in which education at the doctoral school takes place. [P8S_WG/SzD_W02]

Skills

A PhD student who graduated from doctoral school can:

1) use knowledge from different branches of science to creatively identify, formulate and innovatively solve complex problems or to perform research tasks such as: define the aim and subject of scientific research, from a research hypothesis; develop research methods, techniques and tools and use them creatively, draw conclusions on the basis of research results , [P8S_UW/SzD_U01]

2) critically analyze and asses scientific research results, work of experts and other creative activities together with their contribution into knowledge development . [P8S_UW/SzD_U02]

Social competences

A PhD student who graduated from doctoral school is ready to:

1) critically asses achievements within a given scientific discipline , [P8S_KK/SzD_K01]

2) fulfilling the social obligations of researches and creators . [P8S_KO/SzD_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01, W02	The student's short scientific study (written) on the topic related to the content of the lecture and his/her activity during lectures will be assessed	The choice of material, its completeness and the quality of preparation
U01, U02	The student's short scientific study (written) on the topic related to the content of the lecture and his/her activity during lectures will be assessed	The choice of material, its completeness and the quality of preparation
K01, K04	The student's short scientific study (written) on the topic related to the content of the lecture and his/her activity during lectures will be assessed	The choice of material, its completeness and the quality of preparation

Programme content

1. The basic information of the Taylor-Couette flows: the physical and geometrical control parameters, the mathematical description of the flow dynamics, the basic flow features.
2. The experimental (PIV, LDV) and numerical (DNS, LES) methods used in the studies.
3. The laminar-turbulent transition - experimental and numerical studies (visualization), supercritical and subcritical transition, fully turbulent flows.
4. The Taylor-Couette flow in the quasi-Keplerian regime (accretion disks), in the geophysical problems (also the spherical Couette flow) and in the rotating machinery.

Teaching methods

Lecture: multimedia presentation including illustrations and examples.

Bibliography

Basic

1. H. Wang, Experimental and numerical study of Taylor-Couette flow, PhD thesis, Iowa State University, 2015.

2. S. Grossmann, D. Loshe, C. Sun, High-Reynolds number Taylor-Couette turbulence, Ann. Rev. Fluid Mech., 48: 53-80, 2016.

3. B. Cushman-Roisin, J.M. Beckers, Introduction to Geophysical Fluid Dynamics, Physical and Numerical Aspects, International Geophysical Series, vol. 101, 2012.

Additional

1. E. Tuliszka-Sznitko, Selected problems on rotating fluids (in polish), Wydawnictwo Politechniki Poznańskiej, 2011.

2.C. Egbers, G. Pfister (Eds.), Physics of rotating fluids, Proceedings of the 11th Int. Couette-Taylor Workshop, 1999, Bremen, Springer.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,0
Classes requiring direct contact with the teacher	4	0,2
Student's own work (literature studies, preparation for tutorials, project preparation, consultations with the teacher) [1]	21	0,8

[1] delete or add other activities as appropriate