

Course description

Course abbreviation:	KMA/PVM	Page:	1 / 3
Course name:	Progresive Computational Methods		
Academic Year:	2023/2024	Printed:	01.06.2024 10:52

Department/Unit /	KMA / PVM			Academic Year	2023/2024
Title	Progresive Computational Methods			Type of completion	Exam
Accredited/Credits	Yes, 5 Cred.			Type of completion	Oral
Number of hours	Lecture 2 [Hours/Week] Seminar 2 [Hours/Week]			Course credit prior to	YES
Occ/max	Status A	Status B	Status C	Counted into average	YES
Summer semester	0 / -	0 / -	0 / -	Min. (B+C) students	1
Winter semester	4 / -	0 / -	0 / -	Repeated registration	NO
Timetable	Yes			Semester taught	Winter semester
Language of instruction	Czech			Internship duration	0
Optional course	Yes			Ev. sc. – cred.	S/N
Evaluation scale	1 2 3 4				
No. of hours of on-premise					
Auto acc. of credit	No				
Periodicity	K				
Substituted course	None				
Preclusive courses	N/A				
Prerequisite courses	N/A				
Informally recommended courses	N/A				
Courses depending on this Course	KMA/PNM				

Course objectives:

The course extends the basic courses of numerical methods for solving ordinary and partial differential equations KMA/SNM1 and KMA/SNM2. It focuses on methods for solving problems from different application areas (eg., advection-diffusion equation, fluid dynamics, integrodifferential equations for particle transport). Attention will also be paid to selected problems and current methods of numerical mathematics.

Requirements on student

Recommended prerequisites: KMA/NM, KMA/SNM, KIV/PPR

The students get their credit if they defend their student projects.

The final examination is in the oral form, the quality of the students' projects being taken into account.

Compulsory attendance of seminars.

Content

Problem formulation, parabolic equations. Finite volume method. Aproximation of diffusion and advection. Different types of discretization. Numerical viscosity, upwinding, stability. Stokes and Navier-Stokes equations.

Fields of study

Studentům je k dispozici kurz v Google Classroom se všemi podstatnými informacemi a materiály.

Guarantors and lecturers

- **Guarantors:** Ing. Jiří Egermaier, Ph.D. (100%)
- **Lecturer:** Ing. Jiří Egermaier, Ph.D. (100%)
- **Tutorial lecturer:** Ing. Jiří Egermaier, Ph.D. (100%)

Literature

- **Recommended:** Míka, Stanislav; Příkryl, Petr. *Numerické metody řešení parciálních diferenciálních rovnic*. 1. vyd. Plzeň : ZČU, 1995. ISBN 80-7082-204-X.
- **Recommended:** Míka, Stanislav; Příkryl, Petr; Brandner, Marek. *Speciální numerické metody : numerické metody řešení okrajových úloh pro diferenciální rovnice*. 1. vyd. Plzeň : Vydavatelský servis, 2006. ISBN 80-86843-13-0.
- **Recommended:** Moukalled, F.; Mangani, L.; Darwish, M. *The finite volume method in computational fluid dynamics : an advanced introduction with OpenFOAM? and Matlab?*. 2016. ISBN 978-3-319-16873-9.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Contact hours	40
Presentation preparation (report) (1-10)	10
Preparation for an examination (30-60)	40
Graduate study programme term essay (40-50)	40
Total:	130

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

- Oral exam
- Seminar work

Skills - skills achieved by taking this course are verified by the following means:

- Oral exam
- Seminar work

Competences - competence achieved by taking this course are verified by the following means:

- Oral exam
- Seminar work

prerequisite

Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

- rozumět numerickým metodám pro obyčejné diferenciální rovnice
- orientovat se v základní problematice diferenciálních rovnic

Skills - students are expected to possess the following skills before the course commences to finish it successfully:

- sestavit algoritmus numerické metody

používat základní programovací techniky

volit vhodné postupy pro jednotlivé části řešení úloh nestlačitelného proudění (například pro řešení soustav lineárních algebraických rovnic)

Competences - students are expected to possess the following competences before the course commences to finish it successfully:

N/A

teaching methods

Knowledge - the following training methods are used to achieve the required knowledge:

Lecture supplemented with a discussion

Task-based study method

Self-study of literature

Individual study

Students' portfolio

Skills - the following training methods are used to achieve the required skills:

Lecture with visual aids

Practicum

Competences - the following training methods are used to achieve the required competences:

Lecture with visual aids

Task-based study method

learning outcomes

Knowledge - knowledge resulting from the course:

rozumět metodě konečných objemů i z aplikačního hlediska

rozumět principům numerických metod pro řešení parciálních diferenciálních rovnic

volit vhodné diskretizačních postupy

volit vhodné metody řešení dílčích problémů nestlačitelného proudění

Skills - skills resulting from the course:

využívat základní metody řešení úloh nestlačitelného proudění programu OpenFOAM

aplikovat algoritmy některých numerických metod pro řešení parciálních diferenciálních rovnic

volit vhodné okrajové a počáteční podmínky pro danou úlohu

volit vhodné metody diskretizace, řešení soustav lineárních algebraických rovnic, apod.

Competences - competences resulting from the course:

N/A

Course is included in study programmes:

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Mathematics and its Applications	Postgraduate Master	Full-time	Geometrie a geometrické modelování	1	2018 akr	2023	Geometry and Geometric Modelling	A	2	ZS
Mathematics and its Applications	Postgraduate Master	Full-time	Matematická analýza a numerická matematika	1	2018 akr	2023	Mathematical Analysis and Numerical Mathematics	A	2	ZS
Mathematics and its Applications	Postgraduate Master	Full-time	Matematika a její aplikace	1	2018 akr	2023	Geometry and Geometric Modelling	A	2	ZS
Mathematics and its Applications	Postgraduate Master	Full-time	Matematika a její aplikace	1	2018 akr	2023	Mathematical Analysis and Numerical Mathematics	A	2	ZS