

4IZ636 KOMPLEXNÍ SYSTÉMY

Course code	4IZ636
Course title in language of instruction	Komplexní systémy
Course title in Czech	Komplexní systémy
Course title in English	Complex Systems
Mode of completion and number of credits	Exam ECTS (3 credits), Exam (2 credits) One ECTS credit corresponds to 26 hours of workload for an average student.
Type of course	Daily attendance: 2/0 (hours of lectures per week / hours of seminars per week)
Language of instruction	Czech
Level of course and year of study	master: 5; master continuing: 2
Semester	Sklad FIS – FIS
Name of lecturer	doc. PhDr. Petr Jirků, CSc. (supervisor)
Prerequisites	none

Aims of the course

The aim of this lecture is to make students familiar with basic concepts, methods and modeling tools enabling the description of complex dynamic systems. Emphasis is laid on the methodological interpretation of systems as agents or societies of agents adapting on changing environment.

Learning outcomes and competences

Upon successful completion of this course, students will be able to distinguish the differences between classical analytical models. Student will be able to design models of complex systems, especially systems of social and economical interactions.

Course contents

1. Complex systems. What is complexity. Intuitive and formal definitions of complexity. Structure and dynamics of complex systems. Attractor types.
2. Self-organization. Self-organization and emergence. Self-organized criticality.
3. Graphs and networks. Characteristics of network topology. Complex networks: Random networks, Small-world networks, Scale-free networks.
4. Cellular automata (CA) and Boolean Networks. Classes of CA. Self-reproduction. Computational universality of CA.
5. Multi-agent models. Autonomy and situatedness of agents.
6. Multi-agent economical models in comparison with classical analytical models. Applicability of multi-agent models.
7. Methodology of modeling of complex dynamics systems. Tools for modeling of complex systems (Netlogo, Repast, MjCell, Ddlab) and experiments with the models.

Teaching methods and student workload

Type of teaching method	Hours of workload
	daily attendance
Participation in lectures	26
Preparation of term paper	23
Preparation for final test	26
Other workload	3
Total	78

Assessment methods

Requirement type	Weight
	daily attendance
Term paper	40 %
Final test	50 %
Review	10 %
Total	100 %
Special requirements and details: none	

Recommended reading

Type*	Author	Title	Published in	Publisher	Year	ISBN
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|---|--|--|--|--|--|--|
| A | | 80-200-0472-6. Umělá inteligence III. Mařík, V., ed. 2001. | | | | |
| A | | 80-204-0910-6. Řád z chaosu. Prigogine, I. 2001 | | | | |
| A | | 80-204-0989-0. Mezi chaosem a řádem. Highfield, R. Coveney, P. 2003. | | | | |
| A | | 80-7185-636-3. Čtvrtý zákon. Kauffman, S. 2004. | | | | |

* R – required reading, A – additional reading