

Subject card

Subject name and code	Elements of Fractal Theory in the Sense of Hutchinson–Barnsley, PG_00179418						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	Master's studies		Subject group				
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		6.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Division of Algebra -> Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Filip Strobін				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		10.0		80.0	150
Subject objectives	The aim of the course is to acquaint the student with the basics of the Hutchinson-Barnsley theory of fractals, together with some applications in modeling real-life objects.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MMiADMU2_U07] is able to define his interests and develop them; in particular, is able to establish contact with specialists in their field, e.g. understand their lectures intended for young mathematicians	is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians	[SU8] observation of student's independent or team work
	[MMiADMU2_U01] can construct mathematical reasoning: prove theorems and disprove hypotheses by constructions and selecting counterexamples	verifies selected properties of iterated function systems and their attractors, is able to construct basic fractals and proves selected facts about iterated function systems and their attractors	[SU4] test/exam - oral or written
	[MMiADMU2_U04] can, at an advanced level and including modern mathematics, apply and present in speech and in writing the methods of at least one selected branch of mathematics	verifies selected properties of iterated function systems and their attractors, is able to construct basic fractals and proves selected facts about iterated function systems and their attractors	[SU4] test/exam - oral or written
	[MMiADMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	understands the importance of thoughtful and logical reasoning in mathematics and is able to recognize their role in solving of problems	[SW4] test/exam - oral or written
	[MMiADMU2_K06] is ready to form an opinion on basic mathematical issues	is able to formulate opinions on basic mathematical issues related to the Hutchinson-Barnsley theory of fractals	[SK8] observation of student's independent or team work
	[MMiADMU2_K05] is ready to independently search for information in literature, also in foreign languages	is able to independently search for information in available sources, including those in foreign languages	[SK8] observation of student's independent or team work
	[MMiADMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in the actions of himself and others; is ready to act ethically	understands and appreciates the importance of intellectual honesty in one's own and others' actions; acts ethically	[SK8] observation of student's independent or team work
	[MMiADMU2_K02] is ready to precisely formulate questions to deepen his own understanding of a given topic or to find missing elements of reasoning	is able to formulate precise questions that serve to deepen one's understanding of a given topic or to find missing elements of reasoning	[SK8] observation of student's independent or team work
	[MMiADMU2_K01] is ready to recognize the limitations of his own knowledge and is ready to continue his education	knows the limitations of his own knowledge and understands the need for further education	[SK8] observation of student's independent or team work
	[MMiADMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	can model selected objects using the Hutchinson-Barnsley theory of fractals	[SU4] test/exam - oral or written
	[MMiADMU2_U03] can understand mathematical texts from selected areas of mathematics	understands mathematical texts of various nature related to the Hutchinson-Barnsley theory of fractals	[SU8] observation of student's independent or team work
	[MMiADMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	has in-depth theoretical knowledge of the Hutchinson-Barnsley theory of fractals and understands its foundations and relationships	[SW4] test/exam - oral or written

Subject contents	1. Hausdorff metric in Euclidean space		
	2. construction of basic fractals in Euclidean spaces		
	3. Hutchinson-Barnsley theorem on the generation of fractals by iterated function systems (IFSs)		
	4. code space for IFSs; the relationship of the structure of a fractal generated by a mapping system to the code space		
	5. deterministic algorithm and the "chaos game" algorithm		
	6. fractal interpolation.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	observation of the student's attitude	100.0%	0.0%
	test	51.0%	60.0%
	exam	51.0%	40.0%
Recommended reading	Basic literature	M. Barnsley, Fractals Everywhere, Dover Publications	
		K. Falconer, Fractal Geometry, John Wiley & Sons	
		H. Kunze, D. La Torre, F. Mendivil, E. Vrscay, Fractal-Based Methods in Analysis, Springer	
	Supplementary literature	J. Kudrewicz, Fraktale i Chaos, Wydawnictwo WNT	
		G. A. Edgar, Measure, Topology and fractal geometry, Springer	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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