University of Gdańsk

Subject card

Subject name and code	Elements of fractal theory in the sense of Hutchinson–Barnsley, PG_00178987						
Field of study	Mathematics						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2025/2026			
Education level	Bachelor's studies		Subject group	Optional 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 Strobin				
	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
[MATL3_U08] is able to formulate definitions and theorems in an understandable way, both orally and in writing, and present correct mathematical reasoning regarding the acquired issues	verifies selected properties of iterated mapping systems and their attractors, and proves selected facts about iterated function systems and their attractors	[SU4] test/exam - oral or written
[MATL3_U09] is able to plan how to solve a specific problem and prepare a correct record of this solution, providing strict and precise justification for the correctness of his reasoning	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
[MATL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education	knows the limitations of his own knowledge and understands the need for further education	[SK8] observation of student's independent or team work
[MATL3_W09] knows and understands the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	knows and understands the basic concepts, theorems and methods of the Hutchinson-Barnsley theory of fractals	[SW4] test/exam - oral or written
[MATL3_K06] is ready to formulate opinions 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
[MATL3_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; is willing 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
[MATL3_K02] is ready to precisely formulate questions to deepen his/her 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

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	51.0%	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	not included	
Work placement	Not applicable	

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