



Univerza v Mariboru
University of Maribor

Fakulteta za naravoslovje in
matematiko / Faculty of Natural
Sciences and Mathematics



OPIS PREDMETA / SUBJECT SPECIFICATION

Predmet:	Fraktali in dinamični sistemi
Subject Title:	Fractals and dynamic systems

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Matematika / Mathematics	Finančna matematika / Financial mathematics	1. ali 2.	1., 2. ali 3.

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. Vaje Lab. Work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
60		15	15		120	7

Nosilec predmeta / Lecturer:

Dušan Pagon

Jeziki / Predavanja / Lecture: slovenski / Slovenian

Languages: Vaje / Tutorial: slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje
študijskih obveznosti:

Prerequisites:

Linearna algebra, Algebra, Analiza 2

Linear algebra, Algebra, Analysis 2

Vsebina:

Contents (Syllabus outline):

- Metričen prostor, različne vrste podprostorov, prostor fraktalov.
- Afine transformacije, skrčitve, sistemi iterirajočih funkcij.
- Osnove dinamičnih sistemov, dinamika fraktalnih množic.
- Teoretično in eksperimentalno določanje dimenzije fraktala, Hausdorff-Bezikovičeva dimenzija.
- Juliajeve množice, primeri njihove uporabe.

- A metric space, different types of subspaces, the space of fractals.
- Affine transformations, contraction mappings, systems of iterating functions.
- Introduction to dynamical systems, dynamics on fractal sets.
- The theoretical and experimental determination of the fractal dimension, Hausdorff-Besicovitch dimension.
- Julia sets, examples of their application.

Temeljni študijski viri / Textbooks:

Barnsley, M. F.: Fractals Everywhere. Academic Press, Boston (1988); Second edition (1993)
Barnsley, M. F.: Superfractals. Cambridge University Press, Cambridge (2006)
Devaney, Robert: An Introduction To Chaotic Dynamical Systems, 2nd ed., Westview Press (2003)
Devaney, R. L.: Chaos, Fractals and Dynamics - Computer Experiments in Dynamics, Addison-Wesley (1990)
Edgar, G: Classics on Fractals. Westview Press, Boulder (1992)
Falconer, K. J.: The Geometry of Fractal Sets. Cambridge University Press, Cambridge (1985)
Lapidus, M. L., Frankenjuijsen, M. v.: Fractal Geometry, Complex Dimensions and Zeta Functions. Springer, New York (2006)
Edgar, Gerald: Measure, Topology, and Fractal Geometry, 2nd ed., Springer, New York (2008)

Cilji:

- Študenti se seznajajo s strukturo podprostora fraktalov v metričnem prostoru in z osnovnimi načini generiranja fraktalov (družine iterirajočih preslikav). Spoznajo tudi različne pristope k določanju dimenzije fraktala ter dinamiko fraktalnih množic.

Objectives:

- Students get familiar with the structure of the subset of fractals in a metric space and with the main ways of generating fractals (iterated functions systems). They also study different approaches to the fractal dimension and the dynamics of fractal sets.

Predvideni študijski rezultati:**Znanje in razumevanje:**

- aktivno obvladanje strukture metričnega prostora in prepoznavanje fraktalnih podmnožic
- teoretično in eksperimentalno določanje dimenzije fraktalov
- analiza dinamičnih sistemov in njihova uporaba

Prenesljive/ključne spretnosti in drugi atributi:

- sposobnost generiranja fraktalov
- izračun dimenzije fraktalne množice
- modeliranje z dinamičnimi sistemi

Metode poučevanja in učenja:

- Predavanja
- Laboratorijske vaje
- Individualno delo

Intended learning outcomes:**Knowledge and Understanding:**

- active knowledge of metric space structure and the ability to recognize its fractal subsets
- theoretical and experimental ways for finding the dimension of a fractal
- the analysis of dynamical systems and their application

Transferable/Key Skills and other attributes:

- the ability to generate fractals
- the calculation of fractal dimension
- modeling with dynamical systems

Learning and teaching methods:

- Lectures
- Laboratory excersises
- Individual work

Načini ocenjevanja:Delež (v %) /
Weight (in %)**Assessment:**

- pisni in ustni izpit

60 / 40

- written and oral exam

Materialni pogoji za izvedbo predmeta :

- Predavalnica
- Laboratorij

Material conditions for subject realization

- Lecture hall
- Laboratory

Obveznosti študentov:*(pisni, ustni izpit, naloge, projekti)*

- pisni in ustni izpit, seminarska naloga

Students' commitments:*(written, oral examination, coursework, projects):*

- written and oral exam, coursework