Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Fraktali in dinamični sistemi
Course title:	Fractals and dynamic systems

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Matematika, 2. stopnja		**1. ali 2.**	**1. ali 3.**
Mathematics, 2nd degree		**1. or 2.**	**1. or 3.**

Vrsta predmeta / Course type	

Univerzitetna koda predmeta / University course code:

Predavanja **Lectures**	**Seminar** **Seminar**	**Sem. vaje** **Tutorial**	**Lab. vaje** **Laboratory work**	**Teren. vaje** **Field work**	**Samost. delo** **Individ. work**	**ECTS**
45		**15**	**15**		**135**	**7**

Nosilec predmeta / Lecturer:	Dušan PAGON

Jeziki / **Languages:**	**Predavanja /** **Lectures:**	SLOVENSKO/SLOVENE
	Vaje / Tutorial:	SLOVENSKO/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Linearna algebra, Algebra, Analiza 2	Linear algebra, Algebra, Analysis 2

Vsebina:	**Content (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 literatura in viri / Readings:

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 in kompetence:

Študenti se seznanijo 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 and competences:

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
-

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

Metode poučevanja in učenja:

- Predavanja
- Seminarske vaje
- Individualno delo

Learning and teaching methods:

- Lectures
- Tutorial
- Individual work

Načini ocenjevanja:

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
Seminarska naloga	20%	Seminar work
Pisni izpit– praktični del	40%	Written exam – practical part
Ustni izpit – teoretični del	40%	Oral exam – theoretical part

Reference nosilca / Lecturer's references:		

1. PAGON, Dušan, REPOVŠ, Dušan, ZAICEV, Mikhail. On the codimension growth of simple color Lie superalgebras. *J. Lie theory*, 2012, vol. 22, no. 2, str. 465-479. http://www.heldermann.de/JLT/JLT22/JLT222/jlt22017.htm. [COBISS.SI-ID 16070233]

2. PAGON, Dušan. Simplified square equation in the quaternion algebra. *International journal of pure and applied mathematics*, 2010, vol. 61, no. 2, str. 231-240. [COBISS.SI-ID 17718024]

3. GUTIK, Oleg, PAGON, Dušan, REPOVŠ, Dušan. On chains in H-closed topological pospaces. *Order (Dordr.)*, 2010, vol. 27, no. 1, str. 69-81. http://dx.doi.org/10.1007/s11083-010-9140-x. [COBISS.SI-ID 15502169]

4. GUTIK, Oleg, PAGON, Dušan, REPOVŠ, Dušan. The continuity of the inversion and the structure of maximal subgroups in countably compact topological semigroups. *Acta math. Hung.*, 2009, vol. 124, no. 3, str. 201-214. http://dx.doi.org/10.1007/s10474-009-8144-8, doi: 10.1007/s10474-009-8144-8. [COBISS.SI-ID 15212121]

5. PAGON, Dušan. The dynamics of selfsimilar sets generated by multibranching trees. *International journal of computational and numerical analysis and applications*, 2004, vol. 6, no. 1, str. 65-76. [COBISS.SI-ID 14037081]