



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Dinamika stohastičnih procesov
Course title:	Dynamics of stochastic processes

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		1. ali 2.	1., 2. ali 3.
PHYSICS		1. or 2.	1., 2. or 3.

Vrsta predmeta / Course type

Izbirni za modula Biofizika 3 in Fizika 1, 2, 3

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
10	5				435	15

Nosilec predmeta / Lecturer:

Matjaž Perc

Jeziki /

Languages:

Predavanja /

Lectures:

slovenski/Slovenian

Vaje / Tutorial:

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

Osnove teorije verjetnosti, teorije dinamičnih sistemov, programiranja v poljubnem jeziku in teorije stohastičnih procesov.

Prerequisites:

Basic knowledge of probability theory, dynamical system's theory, programming skills in an arbitrary language, and theory of stochastic processes.

Vsebina:

Dinamika linearnih stohastičnih procesov, dinamika nelinearnih stohastičnih procesov, aditivne vs. multiplikativne stohastične motnje,

Content (Syllabus outline):

Dynamics of linear stochastic processes, dynamics of nonlinear stochastic processes, additive vs. Multiplicative stochastic

stohastična in koherenčna resonanca, notranja stohastika, časovna vs. prostorska in časovno-prostorska dinamika, prostorska koherenčna resonanca, karakterizacija dinamičnih invariant v prisotnosti šuma (napredne metode nelinearne analize časovnih vrst).

disturbances, stochastic and coherence resonance, Internal stochasticity, temporal vs. spatial and spatio-temporal stochastic dynamics, spatial coherence resonance, characterization of dynamical invariants in the presence of noise (advanced methods of nonlinear time series analysis).

Temeljni literatura in viri / Readings:

- 1) C. W. Gardiner, *Handbook of stochastic methods* (Springer, New York, 1995).
- 2) N. G. Van Kampen, *Stochastic processes in physics and chemistry* (Elsevier, Amsterdam, 1992).
- 3) H. Kantz in T. Schreiber, *Nonlinear time series analysis* (Cambridge University Press, Cambridge, 2002).
- 4) H. D. I. Abarbanel, *Analysis of observed chaotic data* (Springer, New York, 1996).
- 5) M. Perc and M. Marhl, Minimal model for spatial coherence resonance, *Phys. Rev. E* 73, 066205 (2006)
- 6) M. Perc, Spatial coherence resonance in excitable media, *Phys. Rev. E* 72, 016207 (2005)

Cilji in kompetence:

Poglobiti znanje o stohastičnih procesih in njihovem vplivu na dinamiko linearnih in nelinearnih dinamičnih sistemov.

Objectives and competences:

Deepen the knowledge about stochastic processes, specifically their impact on the dynamics of linear and nonlinear dynamical systems.

Predvideni študijski rezultati:

Znanje in razumevanje:

Obvladovanje naprednih konceptov in metod, ki služijo za analizo stohastičnih procesov v realnem svetu.

Prenesljive/ključne spretnosti in drugi atributi:

Sposobnost prepoznati in analizirati stohastične procese kjerkoli se pojavijo, in imeti možnost prosperirati v različnih znanstvenih disciplinah kot so ekonomija, kemija, fizika, medicina, biologija itd..

Intended learning outcomes:

Knowledge and understanding:

Mastering advanced concepts and methods, which can be used to analyse stochastic processes in the real world.

Transferable/Key Skills and other attributes:

The ability to recognize and analyse stochastic processes wherever they may occur, and thus have the potential to prosper in diverse scientific disciplines such as: economy, chemistry, physics, medicine, biology etc..

Metode poučevanja in učenja:

Predavanja, seminar, izdelava seminarske naloga.

Learning and teaching methods:

Lectures, seminar work.

Načini ocenjevanja:

Delež (v %) /

Weight (in %) **Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Ustni izpit	60%	Oral exam
Seminarska naloga	40%	Written seminar work

Reference nosilca / Lecturer's references:

1. KOSTIĆ, Srđan, VASOVIĆ, Nebojša, PERC, Matjaž. Temporal distribution of recorded magnitudes in Serbia earthquake catalog. *Applied mathematics and computation*, ISSN 0096-3003. [Print ed.], 2014, vol. 244, str. 917-924, doi: [10.1016/j.amc.2014.07.063](https://doi.org/10.1016/j.amc.2014.07.063). [COBISS.SI-ID [20805896](#)]
2. WANG, Zhen, SZOLNOKI, Attila, PERC, Matjaž. Rewarding evolutionary fitness with links between populations promotes cooperation. *Journal of theoretical biology*, ISSN 0022-5193, 2014, vol. 349, str. 50-56, doi: [10.1016/j.jtbi.2014.01.037](https://doi.org/10.1016/j.jtbi.2014.01.037). [COBISS.SI-ID [20361480](#)]
3. CHEN, Xiaojie, SZOLNOKI, Attila, PERC, Matjaž. Probabilistic sharing solves the problem of costly punishment. *New journal of physics*, ISSN 1367-2630. [Online ed.], 2014, vol. 16, iss. 8, str. 083016-1-083016-14, doi: [10.1088/1367-2630/16/8/083016](https://doi.org/10.1088/1367-2630/16/8/083016). [COBISS.SI-ID [20806152](#)]
4. TRENCHARD, Hugh, RICHARDSON, Ashlin, RATAMERO, Erick, PERC, Matjaž. Collective behavior and the identification of phases in bicycle pelotons. *Physica. A*, ISSN 0378-4371. [Print ed.], 2014, vol. 405, str. 92-103, doi: [10.1016/j.physa.2014.03.002](https://doi.org/10.1016/j.physa.2014.03.002). [COBISS.SI-ID [20443912](#)]
5. SZOLNOKI, Attila, PERC, Matjaž. Evolution of extortion in structured populations. *Physical review. E, Statistical, nonlinear, and soft matter physics*, ISSN 1539-3755, 2014, vol. 89, iss. 2, str. 022804-1-022804-5, doi: [10.1103/PhysRevE.89.022804](https://doi.org/10.1103/PhysRevE.89.022804). [COBISS.SI-ID [20361224](#)]