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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Naključni procesi in signali | | | | | | | | | | | | | | |
| **Course title:** | | | Stochastic Processes and Signals | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| doktorski študijski program tretje stopnje Elektrotehnika | | | | | Ni smeri | | | | | | | | 1 | |  | | |
| 3rd cycle: doctoral study programme Electrical Engineering | | | | |  | | | | | | | | **1** | |  | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | izbirni/elective | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64837 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **30** | **50** | | |  | | |  | | | |  | | | **45** | |  | **5** |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | prof. dr. France Mihelič | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **Slovenščina / English** | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **Slovenščina / English** | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v doktorski študij. Priporočena osnovna znanja iz teorije signalov in verjetnostnega računa. | | | | | | | | |  | Enrolment in Doctoral study. Recommended basic knowledge of Signal processing and Probability theory. | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Uvod:   * definicija naključnega procesa in signala; uvedba nekaterih matematičnih orodij verjetnostnega računa in statistike.   Obdelava naključnih signalov:   * časovna in vzorčna povprečja, filtriranje naključnih signalov (Winnerjev in Kalmanov filter), ocenjevanje verjetnostnih porazdelitev (postopki »Expectation-Maximization« (EM), »Maximum A Posteriori« (MAP) in »Maximum Likelihood Linear Regression« (MLLR)).   Modeliranje stacionarnih in nestacionarnih naklučnih procesov:   * Gaussov proces, Poissonov proces, Gauss-Markov proces, Opis nestacionarnih procesov s Prikritimi Markovovimi modeli (HMM).   Primeri modeliranja tvorjenja, percepcije in obdelave govornega signala:   * model tvorjenja govora »vir-filter«, perceptivini model in dekonvolucija govornega signala, časovno-frekvenčne parametrične predstavitve govornega signala, detekcija govornega signala, modeliranje govornega signala s HMM. | | | | | | | |  | | Introduction:   * definition of stochastic process and random signal. Introduction of some important issues from mathematical modeling in statistics and probability theory.   Random signals processing:   * time and sample mean, random signals filtering (Wienner and Kalman filter), probability distribution evaluation (Expectation-Maximization (EM), Maximum A Posteriori (MAP) and »Maximum Likelihood Linear Regression« (MLLR) procedures)   Modeling of stationary and non-stationary stochastic processes:   * Gauss process, Poisson process, Gauss-Markov process, non-stationary stochastic processes representation using Hidden Markov Models (HMM)   Examples from speech signals processing, modeling of speech perception and production:  source-filter model for speech production, speech perception model and deconvulution of speech signals, time-frequency representations of speech signals, speech detection, speech signal modeling using HMM | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| Robert MG, Lee DD (2004) An Introduction to Statistical Signal Processing. Cambridge University Press  Shlomo E (2007) Random signals and noise: a mathematical introduction. CRC Press  Rabiner L, Schafer R (2010) Theory and Applications of Digital Speech Processing. Prentince Hall  Pieraccini R (2012) The Voice in the Machine: Building Computers That Understand Speech. MIT Press | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Cilj predmeta je seznaniti študenta z naprednimi metodami obravnave naključnih procesov in obdelave naključnih signalov. Posebej bodo obravnavani primeri iz obdelave govornih signalov. | |  | | The aim of the course is to recognize and understand advanced methods for representations of stochastic processes and random signals processing with special attention to the examples on speech signals processing. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Po zaključku predmeta bo študent zmožen izkazati znanje in razumevanje iz:  - modeliranja stacionarnih in nestacionarnih naključnih procesov  - sodobnih metod obdelave naključnih signalov. | | |  | Learning outcomes and competences will be knowledge and understanding on:   * stochastic processes modeling, * advanced methods for random signals processing. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, individualne konzultacije, projektno delo | | |  | Lectures, individual consultations, project work | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Izdelava projekta  Ustni izpit | **50**  **50** | | | | Project presentation  Oral exam |
| **Reference nosilca / Lecturer's references:** | | | | | |
| Žibert J, Mihelič F (2009) Fusion of acoustic and prosodic features for speaker clustering. Lecture notes in artifical intelligence 5729: 210-217  Dobrišek S, Žibert J, Pavešić N, Mihelič F (2009) An edit-distance model for the approximate matching of timed strings*.* IEEE transactionson pattern analysis and machine intelligence 31:736-741  Gajšek R, Štruc V, Mihelič F, Podlesek A, Komidar L, Sočan G, Bajec B (2009) Multi-modal emotional database : AvID. Informatica 33:101-106  Dobrišek S, Gajšek R, Mihelič F, Pavešić N, Štruc V (2013) Towards efficient multi-modal emotion recognition. International journal of advanced robotic systems 10:1-10  Gajšek R, Mihelič F, Dobrišek S (2013) Speaker state recognition using an HMM-based feature extraction method. Computer speech & language 27:135-150 | | | | | |