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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Modul H: Seminar iz inteligentnega vodenja | | | | | | | | | | | | | |
| **Course title:** | | | Module H: Seminar: Intelligent Control | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Podiplomski magistrski študijski program druge stopnje Elektrotehnika | | | | | Avtomatika in informatika | | | | | | | 2 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | Control systems and computer engineering | | | | | | | 2 | | 1 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | Izbirni-strokovni /elective professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | 64275 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| 15 |  | | | 60 | | |  | | |  | | | 75 | |  | 6 |
|  | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | Gašper Mušič | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | slovenski / Slovenian | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | slovenski / Slovenian | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v letnik predmeta | | | | | | | |  | Enrolment in the year of the course | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v podiplomski magistrski študijski program druge stopnje. | | | | | | | |  | Enrolment in the 2nd cycle masters study programme. | | | | | | | |
| **Vsebina:** | | | | | | | |  | **Content (Syllabus outline):** | | | | | | | |
| Samostojno projektno delo na različnih področjih uporabe inteligentnega vodenja:  - Sodobne metode modeliranja, simulacije in identifikacije za vodenje.  - Vodenje kompleksnih sistemov. Načrtovanje kompleksnih, multivariabilnih sistemov vodenja s klasičnimi metodami hierarhičnega vodenja, metodami internih notranjih modelov, oblikovanja glavnih poti in premikanja polov.  - Adaptivno vodenje. Osnovni principi adaptivnih sistemov, regulatorji za adaptivno vodenje, samonastavljivi regulatorji, razporejanje parametrov in ojačenja, parametrsko adaptivni sistemi in modelno referenčni sistemi.  - Prediktivno vodenje. Pregled najpomembnejših principov in metod prediktivnega vodenja.  - Vodenje na osnovi nelinearnih modelov. Načrtovanje regulatorjev za nelinearne sisteme vodenja. Prediktivno vodenje na osnovi mehkih modelov. Adaptivno vodenje na osnovi mehkih modelov.  - Planiranje in vodenje proizvodnje. Metode umetne inteligence, hevristični postopki, uporaba več-agentnih sistemov v planiranju in razvrščanju. | | | | | | | |  | Autonomous project work in various application domains of intelligent control:  - Modern methods of modelling, simulation and identification for control.  - Control of complex systems. Complex multivariable control design methods, hierarchical approaches, internal model control, individual channel design, and pole placement.  - Adaptive control. Basic principles of adaptive control systems, adaptive controllers, self-tuning controllers, gain scheduling, parameter adaptive control systems and model reference adaptive control systems.  - Predictive control. Major principles and methods of predictive control.  - Nonlinear model based control. Controller design for nonlinear systems control. Fuzzy model based predictive control. Fuzzy adaptive control.  - Production planning and control. Artificial intelligence methods, heuristics and multi-agent systems in planning and scheduling. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. R. Isermann, Adaptive Control Systems, 1991. 2. K. J. Astrom, B. Wittenmark, Adaptive control, Second edition, Addison-Wesley, 1995. 3. E. F. Camacho, C. Bordons, Model predictive control, Second edition, Springer, 2007. 4. J. M. Maciejowski, Predictive control with constraints, Prentice Hall, 2001. 5. M. L. Pinedo, Planning and Scheduling in Manufacturing and Services, Second edition, Springer, 2009. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Seminar združuje znanja strokovnih predmetov celotnega študija in omogoča študentu poglobljeno samostojno projektno delo. | |  | | Seminar comprises professional courses knowledge of the studying programme and directs students toward autonomous project work. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Sposobnost samostojnega pristopa k načrtovanju sistemov in vodenja.  Uporaba znanj s področja strokovnih predmetov za praktično realizacijo inteligentnih sistemov in sistemov za vodenje.  Poznavanje projektnega dela in razumevanje dinamike izvajanja projektov avtomatizacije in vodenja procesov. | | |  | Capacity of autonomous design of systems and control.  Application of professional knowledge in practical implementation of intelligent control systems.  Knowledge of project work and understanding of automation and process control projects’ dynamics. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja in mentorsko vodeno projektno delo. | | |  | Lectures and supervised project work. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: projektno delo, predstavitev rezultatov projekta, projektno poročilo.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Pozitivna ocena projektnega dela je pogoj za pristop k izpitu.  Prispevki k oceni:  projektno delo  predstavitev rezultatov projekta  projektno poročilo | 40 %  30 %  30 % | | | | Type: project work, presentation of project results, project report.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of project work is a prerequisite for the exam.  Contributions to final grade:  project work  presentation of project results  project report |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. GRADIŠAR, Dejan, GLAVAN, Miha, STRMČNIK, Stanko, MUŠIČ, Gašper. ProOpter: an advanced platform for production analysis and optimization. *Computers in industry*, ISSN 0166-3615, jun. 2015, vol. 70, str. 102-115, 2. MUŠIČ, Gašper, NAPALKOVA, Liana, PIERA, Miquel Àngel. Performance evaluation of flexible manufacturing systems by coloured timed Petri nets and timed state space generation. V: CAMPOS, Javier (ur.), SEATZU, Carla (ur.), XIE, Xiaolan (ur.). *Formal methods in manufacturing*, (Industrial information technology series). Boca Raton; London; New York: CRC Press, cop. 2014, str. 381-408. 3. GLAVAN, Miha, GRADIŠAR, Dejan, STRMČNIK, Stanko, MUŠIČ, Gašper. Production modelling for holistic production control. Simulation modelling practice and theory, ISSN 1569-190X, jan. 2013, vol. 30, str. 1-20. 4. KLANČAR, Gregor, BLAŽIČ, Sašo, MATKO, Drago, MUŠIČ, Gašper. Image-based attitude control of a remote sensing satellite. *Journal of intelligent & robotic systems*, ISSN 0921-0296, 2012, vol. 66, no. 3, str. 343-357. 5. MUŠIČ, Gašper, MATKO, Drago. An admissible-behaviour-based analysis of the deadlock in Petri-net controllers. Simulation modelling practice and theory, ISSN 1569-190X, Vol. 16, iss. 8 (Sep. 2008), Elsevier, 2008, str. 1077-1090. | | | | | |