

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Avtomatizacija in robotika
Course title:	Automation and robotics

Študijski program Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Inženiring vozila Engineering and vehicles		tretji third	

Vrsta predmeta / Course type modulni

Univerzitetna koda predmeta / University course code: VS_11036

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	KT po ECTS
60		15	30	-	105	7

Nosilec predmeta / Lecturer: doc. dr. Gregor Dolanc

Jeziki / Languages:	Predavanja / Lectures:	slovenski/ Slovenian
	Vaje / Tutorial:	slovenski/Slovenian

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

<ul style="list-style-type: none"> - Vpis v 3. letnik študija 	<p>Prerequisites:</p> <ul style="list-style-type: none"> - enrolled in third study year
--	---

Content (Syllabus outline):

Vsebina:

<ul style="list-style-type: none"> - Osnovni koncepti sistemov in avtomatskega vodenja (definicije, sistemi, procesi, vhodi, izhodi, dinamika, krmiljenje, povratna zanka) - Pregled signalov, merilnih in izvršnih členov (vrste in oblike signalov, merilni sistemi, izvršni sistemi) - Osnovne lastnosti dinamičnih sistemov in simulacije (modeli, simulacije) - Osnove logičnega in sekvenčnega vodenja - Načrtovanje vodenja dinamičnih sistemov (PLK regulatorji, zvezni regulatorji, PID regulatorji in nastavljanje parametrov regulatorjev) - Primeri procesov in vodenja - Osnove robotike 	<ul style="list-style-type: none"> - Basic concepts of systems and automatic control (definitions, systems, processes, inputs, outputs, dynamics, control, feedback loop) - Overview of signals, sensors and actuators (types and classification of signals, sensors systems, actuators systems) - Basic properties of dynamic systems and simulation (models, simulation) - Basics of logic and sequential control - Control design of dynamic systems (PLC controllers, continuous controllers, PID controllers and controller tuning) - Examples of processes and control - Basics of robotics
--	--

Temeljni literatura in viri / Readings:

Obvezna literatura (ena od spodnjih dveh opcij)

- J. Kocijan in S. Strmčnik: Osnove avtomatskega vodenja, Založba Univerze v Novi Gorici, 2016.
- G. Mušič: Avtomatika, Založba FE in FRI, 2014 (<http://msc.fe.uni-lj.si/Books.asp?book=1>)

Priporočena literatura

- S. Strmčnik: Celostni pristop k računalniškemu vodenju procesov, Fakulteta za elektrotehniko v Ljubljani, 1998.
- R.C.Dorf, R.H. Bishop: Modern Control Systems, Prentice Hall New Yersey
- Katsuhiko Ogata : System Dynamic, Pearson Prentice Hall New Yersey ISBN: 0-13124714-X.
- T. Bajd, M. Mihelj, M. Munih: Introduction to robotics, Springer, 2013
- E-gradiva predmeta | E-Course material

Cilji in kompetence:

Objectives and competences:

<p>Cilji</p> <ul style="list-style-type: none">- Predstaviti koncepte in osnovne gradnike avtomatizacije in njihovo razvrstitev.- Prikazati uporabo sodobne avtomatizacije v različnih vejah industrije. Osnove industrijske robotizacije. <p>Kompetence</p> <ul style="list-style-type: none">- sposobnost analize problema avtomatizacije,- sposobnost obvladavanja standardnih razvojnih metod, postopkov in procesov,- sposobnost uporabe pridobljenega teoretičnega znanja v praksi,- avtonomnost v strokovnem delu s področja tehnologij vodenja sistemov,- sposobnost razumevanja in uporabe teorij s področja sistemov in vodenja,- sposobnost matematičnega razumevanja tehničnih problemov in uporaba matematike pri reševanju le-teh,- sposobnost stalne uporabe informacijske in komunikacijske tehnologije na svojem strokovnem področju.	<p>Objectives</p> <ul style="list-style-type: none">- Presenting the concepts and basic building blocks of automatic control systems and their classification.- Presentation of modern control solutions in various branches of industry. Basics of industrial robotics. <p>Competences</p> <ul style="list-style-type: none">- the ability to analyse the problem of automatic control,- ability to master standard development methods, procedures and processes,- the ability to apply theoretical knowledge in practice,- autonomy in the field of system control technology,- ability to understand and use modern theories in the field of systems and close-loop control,- mathematical ability to understand technical problems and use mathematics in solving them,- the ability to continuously use information and communication technologies in their field of competence.
---	---

Predvideni študijski rezultati:

Intended learning outcomes:

<p>Študent/študentka po zaključku predmeta:</p> <ul style="list-style-type: none">- Poznava osnovne gradnike zaprtizančnih sistemov, njihove medsebojne odvisnosti in dinamike vključno z načrtovanjem regulatorjev.- prikaže sposobnost načrtovanja zaprtizančnega vodenja.	<p>After the completion of the course the student will be able to:</p> <ul style="list-style-type: none">- Know the basic building blocks in the closed-loop systems, their dynamics, interdependence and the closed-loop system design.- Show competence in the field of closed-loop design via coursework.
--	---

Metode poučevanja in učenja:**Learning and teaching methods:**

<ul style="list-style-type: none"> • predavanja, • avditorne in laboratorijske vaje z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, reševanje nalog) ob pomoči sodobnih pedagoških pripomočkov, • Praktičen zgled avtomatizacije. <p>Predmet je oblikovan na kombinirani način študija, ki vključuje aktivnosti preko elektronskega (on-line) okolja: te aktivnosti so sestavljene iz samostojnih in skupinskih aktivnosti z uporabo učnega okolja Moodle in drugih elektronskih vsebin. Praviloma vključujejo diskusije v forumih, spletne strani, ogled posnetih predavanj in vaj, preverjanje znanja, odgovori na vprašanja, iskanje po spletu (bazah) itd.</p>	<ul style="list-style-type: none"> • Lectures • excercises with active participation of students (explanation, discussion, questions, problem solving), with the help of modern teaching aids • Practical example of the automation system. <p>The course is designed as blended learning that includes online activities: Online activities consist of independent and group activities using the LMS Moodle and other electronic or online content. Activities usually include discussions in forums, websites, viewing of recorded lectures and tutorials, assessments, answering questions, searching the web (databases), etc.</p>
--	--

Načini ocenjevanja:**Delež /Weight (%)****Assessmen**

<p>Pogoj za pristop k pisnemu izpitu je opravljena in pozitivno ocenjena seminarska naloga.</p> <ul style="list-style-type: none"> – Seminarska naloga – Pisni izpit <p>Ocenjevalna lestvica je skladna z ECTS in Pravilnikom o preverjanju in ocenjevanju znanja FINI NM.</p>	<p>30%</p> <p>70%</p>	<p>Completed and positively graded seminar report (a prerequisite for the written exam).</p> <ul style="list-style-type: none"> – Seminar report – Written examination <p>Evaluation scale in accordance with ECTS and the Rules on the Evaluation and Assessment of Knowledge FINI NM.</p>
--	-----------------------	---

Reference nosilca / Lecturer's references:

<p>Izbrane publikacije / Selected publications:</p> <ul style="list-style-type: none"> • G. Dolanc, B. Pregelj, J. Petrovčič, R. C. Samsun, Control of an afterburner in a diesel fuel cell power unit under variable load, J. Power Sources, 338 (2017), pp. 117-128. • G. Dolanc, B. Pregelj, J. Petrovčič, J. Pasel, G. Kolb, Control of autothermal reforming reactor of diesel fuel, J. Power Sources, 313 (2016), pp. 223–232. • G. Dolanc, D. Belavič, M. Hrovat, S. Hočevar, A. Pohar, J. Petrovčič, B. Musizza, A miniature fuel reformer system for portable power sources, J. Power Sources, 271 (2014), pp. 392–400. • G. Dolanc, S. Strmčnik, Identification and control of nonlinear systems using a piecewise-linear Hammerstein model. V: STRMČNIK, Stanko (ur.), JURIČIĆ, Đani (ur.). Case studies in control : putting theory to work, (Advances in industrial control, ISSN 1430-9491). London [etc.]: Springer, 2013, str. 37-75. • G. Dolanc, Tension control in a steel slitting line. V: STRMČNIK, Stanko (ur.), JURIČIĆ, Đani (ur.). Case studies in control : putting theory to work, (Advances in industrial control, ISSN 1430-9491). London [etc.]: Springer, 2013, str. 185-220. • G. Dolanc, S. Strmčnik, Design of a nonlinear controller based on a piecewise-linear Hammerstein model, Syst. control. lett., 57 (2008), pp. 332-339. • G. Dolanc, S. Strmčnik, Identification of nonlinear system using a piecewise-linear Hammerstein model, Syst. control. lett., 54 (2005), pp. 145-158. • G. Dolanc, S. Strmčnik, J. Petrovčič, Nox selective catalytic reduction control based on simple models, J. process control., 11 (2001), pp. 35-51.

- S. Gerškšič, G. Dolanc, D. Vrančič, J. Kocijan, S. Strmčnik, S. Blažič, I. Škrjanc, Z. Marinšek, M. Božiček, A. Stathaki, R. B. KING, M. Hadjski, K. Boshnakov, A PLC-based system for advanced control. V: STRMČNIK, Stanko (ur.), JURIČIČ, Đani (ur.). *Case studies in control : putting theory to work*, (Advances in industrial control, ISSN 1430-9491). London [etc.]: Springer, 2013, str. 327-361.

Izbrani industrijski projekti:

- Optimizacija procesa sušenja v opekarnah (1996-1997), naročnik Goriške Opekarne
- Sistemi za vodenje procesa sintranja, Institut Jožef Stefan (1997-2001)
- Sistem za opazovanje in merjenje mehanizmov trenja (1999-2000), naročnik UL Fakulteta za strojništvo
- Sistem za vodenje linije za razrez pločevine (2001), naročnik Acroni Jesenice
- Sistemi za vodenje merilnih prog elementov daljinskega ogrevanja (2003-2008), naročnik Danfoss
- Sistemi za vodenje naprav za obdelavo kovin s pomočjo plazme (2003-2010), naročnik Plasmait GmbH
- Sistemi za končno kontrolo sesalnih enot (2004-2016), naročnik Domel
- Sistem za avtomatsko pristajanje letal na osnovi obdelave slik (2007-2009), naročnik Dassault Aviation, FP7
- Diagnostika farmacevtskih naprav za oblaganje delcev (2010), naročnik Brinox
- Miniaturni procesor goriva za 100 W gorivno celico (2011-2013), financer ESA (Evropska vesoljska agencija)
- Dizelski agregat z gorivnimi celicami za tovorna vozila (2011-2015), naročnik Volvo, FP7

Selected industrial projects:

- Optimization of drying process in brick and tile industry (1996-1997), customer Goriške opekarne
- Systems for control of sintering process, Jožef Stefan Institute (1997-2001)
- System for the observation of friction mechanisms (1999-2000), customer UL, Faculty of Mechanical Engineering
- Control system for steel slitting line (2001), customer Acroni Jesenice
- Control systems for district heating test rigs (2003-2008), customer Danfoss
- Control systems for plasma wire treatment machines (2003-2010), customer Plasmait GmbH
- End quality control systems for vacuum cleaner motor production (2004-2016), customer Domel
- System for automatic landing of aircrafts based on image processing (2007-2009), customer Dassault Aviation, FP7
- Supervision of pharmaceutical reactors for coating (2010), customer Brinox
- Miniature fuel processor for a 100 W fuel cell (2011-2013), finance ESA (European Space Agency)
- Diesel fuel cell power supply for trucks (2011-2015), customer Volvo, FP7