

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	MODELIRANJE DINAMIČNIH PROCESOV V LOGISTIKI
Course title:	PRINCIPLES OF MODELLING DYNAMICS IN LOGISTICS

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
LOGISTIKA SISTEMOV 2.stopnja		2.	3.
SYSTEM LOGISTICS 2 nd degree		2.	3.

Vrsta predmeta / Course type: IZBIRNI

Univerzitetna koda predmeta / University course code: MAG

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Laboratory work	Druge oblike študija Field work	Samost. delo Individ. work	ECTS
15 e-P 30 a-P		15 e-V 25 a-V			65	5

Nosilec predmeta / Lecturer: TONE LERHER

Jeziki / Predavanja / Lectures: SLOVENSKI / SLOVENE
 Languages: Vaje / Tutorial: SLOVENSKI / SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: Ni posebnih pogojev. Prerequisites: No special requirements.

<p>Vsebina:</p> <p>Opredelitev modeliranja dinamičnih procesov v logistiki. Zvezni in diskretni dinamični sistemi (matematični zapis).</p> <p>Modeliranje sistemov toka materiala s poudarkom na določitvi pretočne zmogljivosti sistema.</p> <p>Modeliranje sistemov mehanike vožnje s poudarkom na odporih pri gibanju in vlečnih silah.</p> <p>Modeliranje varovanja tovora v dinamičnih sistemih.</p> <p>Simulacijsko modeliranje dinamičnih procesov (zvezne/diskretne simulacije, uporaba diskretnih numeričnih simulacij v tehniški logistiki).</p> <p>Optimiranje dinamičnih procesov v logistiki, s poudarkom na zvezni in diskretni optimizaciji.</p> <p>Več-objektna Pareto optimizacija projektnih spremenljivk v namenskih funkcijah.</p>	<p>Content (Syllabus outline):</p> <p>Definition of modelling of dynamic processes in logistics. Continuous and discrete dynamic systems (mathematical definition).</p> <p>Modelling of material flow systems with an emphasis on determining the throughput capacity of the system.</p> <p>Modelling of driving system with an emphasis on movement resistance and traction forces.</p> <p>Modelling of cargo securing in dynamic systems.</p> <p>Simulation modelling of dynamic processes (continuous / discrete simulations, the application of discrete numerical simulations in technical logistics).</p> <p>Optimization of dynamic processes with an emphasis on continuous and discrete optimization.</p> <p>Multi-object Pareto optimization of project variables in objective functions.</p>
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Temeljna literatura in viri / Readings:

1. E-gradivo predmeta.
2. Lerher, T., Potrč, I. (2017) Transportni sistemi v intralogistiki. Univerza v Mariboru, Fakulteta za logistiko.
3. Lerher, T. (2016). Throughput and energy related performance calculations for shuttle based storage and retrieval systems, (Energy science, engineering and technology). New York: Nova Science Publishers, Inc., pp 93.
4. Lerher Tone (2015). Cargo securing in road transport using restraining method with top-over lashing, (Transportation issues, policies and R&D). New York: Nova Science Publishers, cop., pp 76.

5. J. Banks, J. S. Carson, B. L. Nelson, D. M. Nicol. Discrete-Event System Simulation, Pearson Education Limited, 2014.
6. A. M. Law, W. D. Kelton. Simulation modeling and analysis, McGraw-Hill, 2000.
7. D. S. Levi, X. Chen, J. Bramel. The Logic of Logistics: Theory, Algorithms, and Applications for Logistics Management, Springer-Verlag, 2013.
8. D. A. Coley. Introduction To Genetic Algorithms For Scientists And Engineers, World Scientific Publishing Co., 2003.

Cilji in kompetence:

Predmet je namenjen pridobitvi poglobljenih znanj iz modeliranja, simulacij in metod analize dinamičnih procesov v logistiki

Objectives and competences:

The subject is designed to gain the deep knowledge about modelling, simulation and analysis methods of dynamic process in logistics.

Predvideni študijski rezultati:

Študent/študentka:

- razume dinamiko zveznih in diskretnih sistemov in jih je sposoben matematično in numerično modelirati dinamične sisteme,
- osvoji poglobljena znanja na področjih analize in modeliranja, simulacij in analize dinamičnih procesov v logistiki,
- usposobi se za reševanje zgoraj navedenih problemov stroke,
- zna uporabljati računalniška orodja za modeliranje in simulacijo dinamičnih procesov v logistiki.

Intended learning outcomes:

Student:

- master the knowledge of continuous and discrete systems and can perform the mathematical and numerical modeling of dynamical systems,
- to gain the deep knowledge about the analysis, modelling and simulation of dynamic processes in logistics,
- to qualify for solving problems in this field,
- to know how to use computer tools for modelling and simulation of dynamical processes in logistics.

Metode poučevanja in učenja:

Predavanja: pri predavanjih študent spozna teoretične vsebine predmeta. Del predavanj se izvaja na klasični način v predavalnici, del pa v obliki e-predavanj (e-predavanja se lahko izvajajo na videokonferenčni način ali s pomočjo posebej v ta namen didaktično pripravljenih e-gradiv v virtualnem elektronskem učnem okolju).

Vaje: pri vajah študent utrdi teoretično znanje in spozna aplikativne možnosti. Del vaj se izvaja na klasični način v predavalnici, del pa v obliki e-vaj (e-vaje se lahko izvajajo na videokonferenčni način ali s pomočjo posebej v ta namen didaktično pripravljenih e-gradiv v virtualnem elektronskem učnem okolju).

Learning and teaching methods:

Lectures: Students understand the theoretical frameworks of the course. Part of the lecture course is in a classroom while the rest is in the form of e-learning (e-lectures may be given via video-conferencing or with the help of specially designed e-material in a virtual electronic learning environment).

Tutorials: Students enhance their theoretical knowledge and are able to apply it. Part of the seminar is in a classroom while the rest is in the form of e-learning (e-tutorials may be given via video-conferencing or with the help of specially designed e-material in a virtual electronic learning environment).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
• Opravljene domače naloge in projektna naloga,	60%	<ul style="list-style-type: none"> • Completed home works and seminar (project) work, • oral exam (theoretical and practical knowledge). Successful completion of e-lectures and e-tutorials is a prerequisite for entering the exam.
• ustni izpit (teoretično in praktično znanje).	40%	
Opravljene obveznosti e-predavanj in e-vaj so pogoj za pristop k izpitu.		

Reference nosilca / Lecturer's references:

1. Borovinšek, Matej., Ekren, Y. B., Burinskiene, A., Aurelija, Lerher, T. (2017). Multi-objective optimisation model of shuttle-based storage and retrieval system. Transport, ISSN 1648-4142. [Print ed.], 2017, Vol. 32, No. 2, 120-137, doi: 10.3846/16484142.2016.1186732.
2. Lerher, T., Borovinšek, M., Ficko, M., Palčič, I. (2017). Parametric study of throughput performance in SBS/RS

- based on simulation. *International journal of simulation modelling*, Vol. 16, No. 1, 96-107, doi: 10.2507/IJSIMM16(1)8.372.
3. Rosi, B., Grasic, L., Dukic, G., Opetuk, T., Lerher, T. (2016). Simulation-based performance analysis of automated single-tray vertical lift module. *International journal of simulation modelling*, Vol. 15, No. 1, 97-108. doi: 10.2507/IJSIMM15(1)8.328.
 4. Lerher, T., Ekren, B. Y., Sari, Z., Rosi, B. (2016). Method for evaluating the throughput performance of shuttle based storage and retrieval systems. *Technical Gazette*, Vol. 23, No. 3, 715-723.
 5. Lerher, T. (2016). Throughput and energy related performance calculations for shuttle based storage and retrieval systems, (Energy science, engineering and technology). New York: Nova Science Publishers, Inc., cop., pp 93.
 6. Dukic, G., Opetuk, T., Lerher, T. (2015). A throughput model for a dual-tray Vertical Lift Module with a human order-picker. *International journal of production economics*, Vol.170, Part C, 874-881. doi:10.1016/j.ijpe.2015.04.009.
 7. Lerher, T., Ekren, B. Y., Sari, Z., Rosi, B. (2015). Simulation Analysis of Shuttle Based Storage and Retrieval Systems. *International Journal of Simulation Modelling*, Vol. 14, No. 1, 48-59. doi: 10.2507/IJSIMM14(1)5.281
 8. Lerher, T. (2015). Travel time model for double-deep shuttle-based storage and retrieval systems. *International Journal of Production Research*, Vol. 54, Issue 9, 2519-2540. doi: 10.1080/00207543.2015.1061717.
 9. Lerher, T. (2013). Modern automation in warehousing by using the shuttle-based technology. V: ARENT, Doug (ur.), FREEBUSH, Monica (ur.). *Automation systems of the 21st century : new technologies, applications and impacts on the environment & industrial processes*, (Engineering tools, techniques and tables). New York: Nova Publishers, Inc., pp 51-86.
 10. Lerher, T., Borovinšek, M., Šraml, M. (2013). A multi objective model for optimization of automated warehouses. V: CHEUNG, Jinghua (ur.), SONG, Huan (ur.). *Logistics : perspectives, approaches and challenges*. New York: Nova Publishers. Inc., pp. 87-110.
 11. Lerher, T., Šraml, M., Borovinšek, M., Potrč, I. (2013). Multi-objective optimization of automated storage and retrieval systems. *Annals of the Faculty of Engineering Hunedoara*, ISSN 1584-2665, 2013, tome 11, fasc. 1, str. 187-194. <http://annals.fih.upt.ro/pdf-full/2013/ANNALS-2013-1-26.pdf>.

Opomba:

Navedene sestavine so obvezna sestavina učnega načrta predmeta kot ga določajo Merila za akreditacijo visokošolskih zavodov in študijskih programov v 7. členu (Ur. l. RS, št. 101/2004).