



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Računalniška animacija
Course title:	Computer Animation

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Izobraževalno računalništvo 2. stopnja		2.	zimski
Educational computer science 2nd level		2.	Autumn

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			90	5

Nosilec predmeta / Lecturer:

Damjan Strnad

Jeziki /

Predavanja / Lectures: slovenski / Slovene

Languages:

Vaje / Tutorial: slovenski / Slovene

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

Ni pogojev.

Prerequisites:

None.

Vsebina:

- Uvod v računalniško animacijo: zgodovina in animacijske tehnike, produkcija animacije.
- Predstavitev položaja in orientacije v prostoru.
- Interpolacija položaja in orientacije, določanje poti in hitrosti gibanja.
- Kinematične verige: hierarhično modeliranje, kinematika z delovanjem naprej, inverzna kinematika.
- Zajemanje gibanja.
- Fizikalno gibanje objektov: premočrtno gibanje v gravitacijskem polju brez dušenja in z dušenjem, gibanje po spiralni krivulji, trenje, nihanja.
- Zaznavanje trka: trk z okoljem, trk dveh gibajočih objektov.
- Posebni modeli animacije: sistemi delcev,

Content (Syllabus outline):

- Introduction to computer animation: history and animation techniques, animation production.
- Representing position and orientation in space.
- Interpolation of position and orientation, determining the path and speed of motion.
- Kinematic linkages: hierarchical modeling, forward kinematics, inverse kinematics.
- Motion capture.
- Physically-based object motion: projectile motion in gravity field without resistance and with resistance, spiral motion, friction, oscillatory motion.
- Collision detection: environmental collision, interobject collision.
- Special animation models: particle systems, fluid and gas animation, animation of human figures,



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animacija tekočin in plinov, animacija človeških figur, obrazna animacija, animacija tekstilij, animacija naravnih objektov.

- Vedenjska animacija.

facial animation, cloth animation, animation of natural objects.

- Behavioural animation.

Temeljni literatura in viri / Readings:

- D. S. Ebert, F. K. Musgrave, D. Peachey, K. Perlin, S. Worley: *Texturing and Modeling*. Third Edition, AP Professional, San Diego, 2003.
- D. Hearn, M. P. Baker, W. Carithers: *Computer graphics with OpenGL*, 4th Edition, Prentice Hall, Upper Saddle River, 2010.
- R. Parent: *Computer Animation. Algorithms and Techniques*, Third Edition Elsevier, Amsterdam, 2012.

Cilji in kompetence:

Cilj predmeta je seznaniti študente s tehnikami računalniške animacije, zato da bodo znali uporabiti primerno metodo interpolacije položaja in orientacije objektov ter upoštevati fizikalne in vedenjske zakonitosti gibanja pri izdelavi realističnih animacij.

Objectives and competences:

The objective of this course is to acquaint the students with computer animation techniques, so that they can use the suitable method for interpolating object position and orientation, as well as consider physical and behavioral laws when producing realistic animations.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- opisati položaj, orientacijo in gibanje objektov v prostoru,
- razumeti in ločiti osnovne tehnike računalniške animacije,
- predstaviti in uporabiti modele računalniške animacije za doseganje posebnih učinkov,
- pojasniti fizikalne in vedenjske lastnosti, ki vplivajo na gibanje objektov oz. ljudi, ter jih upoštevati pri izdelavi animacije.

Prenosljive/ključne spretnosti in drugi atributi:

- *Spretnosti komuniciranja:* ustni zagovor laboratorijskih vaj, pisno izražanje pri pisnem izpitu.
- *Uporaba informacijske tehnologije:* pisanje računalniških programov, uporaba programskih orodij za animacijske aplikacije.
- *Spretnosti računanja:* reševanje računskih problemov pri domačih nalogah.
- *Reševanje problemov:* izvedba preprostih animacijskih aplikacij.

Intended learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to

- describe the position, orientation, and motion of objects in space,
- understand and discern basic techniques of computer animation,
- present and use computer animation models for achieving special effects,
- explain physical and behavioral properties that affect the motion of objects and people, and use them in animation production.

Transferable/Key skills and other attributes:

- *Communication skills:* oral lab work defence, manner of expression at written examination.
- *Use of information technology:* writing computer programs, use of software tools for animation applications.
- *Calculation skills:* solving calculating problems in homework assignments.
- *Problem solving:* construction of simple animation applications.

Metode poučevanja in učenja:

Learning and teaching methods:



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<ul style="list-style-type: none">• predavanja,• seminarske vaje,• laboratorijske vaje.	<ul style="list-style-type: none">• lectures,• tutorial,• lab work.
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Delež (v %) /

Načini ocenjevanja:	Weight (in %)	Assessment:
<ul style="list-style-type: none">• laboratorijske vaje,• 1. vmesni pisni izpit,• 2. vmesni pisni izpit.	<p>50</p> <p>25</p> <p>25</p>	<ul style="list-style-type: none">• lab work,• 1st midterm written exam,• 2nd midterm written exam.

Opomba:

Če študent ni uspešno opravil obeh vmesnih izpitov, ju nadomesti s pisnim izpitom v deležu 50 %.

Note:

If a student has not completed both midterm exams, he replaces them with a written exam in the weight of 50 %.

Reference nosilca / Lecturer's references:

- STRNAD, Damjan, GUID, Nikola. A fuzzy-genetic decision support system for project team formation. *Applied soft computing*, ISSN 1568-4946, Sep. 2010, vol. 10, iss. 4, str. 1178-1187, doi: [10.1016/j.asoc.2009.08.032](https://doi.org/10.1016/j.asoc.2009.08.032). [COBISS.SI-ID [14386966](https://www.cobiss.si/id/14386966)]
- STRNAD, Damjan. Parallel terrain visibility calculation on the graphics processing unit. *Concurrency and computation*, ISSN 1532-0634, 2011, vol. 23, iss. 8, str. 2452-2462. <http://onlinelibrary.wiley.com/doi/10.1002/cpe.1808/pdf>, doi: [10.1002/cpe.1808](https://doi.org/10.1002/cpe.1808). [COBISS.SI-ID [15693334](https://www.cobiss.si/id/15693334)]
- KOHEK, Štefan, STRNAD, Damjan. Interactive synthesis of self-organizing tree models on the GPU. *Computing*, ISSN 0010-485X, Feb. 2015, vol. 97, iss. 2, str. 145-169, doi: [10.1007/s00607-014-0424-7](https://doi.org/10.1007/s00607-014-0424-7). [COBISS.SI-ID [18066454](https://www.cobiss.si/id/18066454)]
- STRNAD, Damjan, GUID, Nikola. Parallel alpha-beta algorithm on the GPU. V: 33rd International Conference on Information Technology Interfaces [also] ITI 2011, June 27-30, 2011, Cavtat / Dubrovnik, Croatia. LUŽAR - STIFFLER, Vesna (ur.), JAREC, Iva (ur.), BEKIĆ, Zoran (ur.). *Proceedings of the ITI 2010*, (ITI ... (Tisak), ISSN 1330-1012). Zagreb: University of Zagreb: University Computing Centre, cop. 2010, str. 571-576, ilustr. [COBISS.SI-ID [15189014](https://www.cobiss.si/id/15189014)]
- FISTER, Iztok, STRNAD, Damjan, YANG, Xin-She, FISTER, Iztok. Adaptation and hybridization in nature-inspired algorithms. V: FISTER, Iztok (ur.), FISTER, Iztok (ur.). *Adaptation and Hybridization in Computational Intelligence*, (Adaptation, learning, and optimization, ISSN 1867-4534, Vol. 18). Cham ... [et al.]: Springer, 2015, str. 3-50. <http://link.springer.com/book/10.1007/978-3-319-14400-9>. [COBISS.SI-ID [18405142](https://www.cobiss.si/id/18405142)]