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			**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 LV**			**90**	**5**

Nosilec predmeta / Lecturer: Damjan Strnad

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisits:
Osnovno znanje programiranja.	Basics of computer programming.

Vsebina:

- Alias - antialias: povečano vzorčenje, vzorčenje področja, zamik piksla.
- Teksture: preslikava tekstur (preslikava naprej, inverzna preslikava), dvodelna preslikava teksture, preslikava izboklin, preslikava s pomikanjem, prostorske teksture, hiperteksture.
- Fraktali: definicija, metrični prostori, skrčitev, sistem IFS, konstrukcija fraktalov, kondenzacijski fraktali, izrek lepljenke, kaotični dinamični sistemi, fraktalna dimenzija, Juliajeve in Mandelbrotove množice.
- Animacijske tehnike.
- Animacija izoblikovanih podob: kinematika z delovanjem naprej, inverzna kinematika, animacija premikanja nog.
- Animacija obraza.
- Gibanje objektov: osnove premočrtnega gibanja, premočrtno gibanje v gravitacijskem polju brez dušenja in z dušenjem, gibanje po spiralni krivulji,

Content (Syllabus outline):

- Anti-aliasing: super-sampling, area sampling, pixel phasing.
- Textures: texture mapping (forward mapping, inverse mapping), two-part texture mapping, bump mapping, displacement mapping, solid textures, hypertextures.
- Fractals: definition, metric spaces, contraction mapping, IFS system, fractal construction, condensation fractals, collage theorem, chaotic dynamic systems, fractal dimension, Julia and Mandelbrot sets.
- Animation techniques.
- Animating articulated structures: forward kinematics, inverse kinematics, animation of legged figures.
- Facial animation.
- Object motion: fundamentals of linear motion, projectile motion in gravity field without resistance and with resistance, spiral motion, friction,

• trenje, nihanja. • Zaznavanje trka: trk z okoljem, trk dveh gibajočih objektov. • Modeliranje in animacija pregrinjanja objektov s tekstilijami. • Izkrivljanje in preoblikovanje grafičnih objektov. • Animacija delcev. • Vedenjska animacija. • Modeliranje in animacija naravnih objektov (oblakov, dreves).	• oscillatory motion. • Collision detection: environmental collision, interobject collision. • Modelling and animating draping behaviour of woven cloth. • Warping and morphing graphical objects. • Particle set animation. • Behavioural animation. • Modelling and animation of natural objects (clouds, trees).

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 z osnovami računalniške animacije.

Objectives and competences:

The objective of this course is to acquaint students with fundamentals of computer animation.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben
- razumeti temeljne metode antialiasa, tvorbe tekstur, fraktalov in animacijskih tehnik,
- načrtovati preproste grafične aplikacije,
- zgraditi preprosti osvetlitveni model.

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
- understand fundamentals of antialias methods, texture construction, fractals, and animation techniques,
- design simple animation applications,
- construct a simple animation application.

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:

- predavanja,
- seminarske vaje,
- laboratorijske vaje.

Learning and teaching methods:

- lectures,
- tutorial,
- lab work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**

• laboratorijske vaje,	50	• lab work,
• 1. vmesni pisni izpit,	17	• 1st midterm written exam,
• 2. vmesni pisni izpit,	17	• 2nd midterm written exam,
• 3. vmesni pisni izpit.	16	• 3rd midterm written exam.

Opomba:

Če študent ni uspešno opravil vseh treh vmesnih izpitov, jih nadomesti s pisnim izpitom v deležu 50 %.

Note:

If a student has not completed all three 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. [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. [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. [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]
- 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]