

| UČNI NAČRT PREDMETA / COURSE SYLLABUS  |                           |   |                              |                                    |   |             |
|--|---------------------------|---|------------------------------|------------------------------------|---|-------------|
| <b>Predmet:</b>  |                           | Računalniško podprto (geometrijsko) oblikovanje                   |                              |                                    |   |             |
| <b>Course title:</b>   |                           | Computer aided (geometric) design                                 |                              |                                    |   |             |
| <b>Študijski program in stopnja</b><br>Study programme and level             |                           | <b>Študijska smer</b><br>Study field                              |                              | <b>Letnik</b><br>Academic year     | <b>Semester</b><br>Semester             |             |
| Magistrski študijski program<br>Finančna matematika                          |                           | ni smeri  |                              | 1 ali 2                            | prvi ali drugi                          |             |
| Master's study programme<br>Financial Mathematics                            |                           | none  |                              | 1 or 2                             | first or second                         |             |
| <b>Vrsta predmeta / Course type</b>  |                           |   |                              | izbirni                            |   |             |
| <b>Univerzitetna koda predmeta / University course code:</b>                 |                           |   |                              | M2409                              |   |             |
| <b>Predavanja</b><br>Lectures  | <b>Seminar</b><br>Seminar | <b>Vaje</b><br>Tutorial   | <b>Klinične vaje</b><br>work | <b>Druge oblike študija</b>        | <b>Samost. delo</b><br>Individ.<br>work | <b>ECTS</b> |
| 30   | 15                        | 30  |                              |                                    | 105                                     | 6           |
| <b>Nosilec predmeta / Lecturer:</b>  |                           | prof. dr. Gašper Jaklič, prof. dr. Emil Žagar                     |                              |                                    |   |             |
| <b>Jeziki / Languages:</b>   |                           | <b>Predavanja / Lectures:</b> slovenski/Slovene, angleški/English |                              |                                    |   |             |
|  |                           | <b>Vaje / Tutorial:</b> slovenski/Slovene, angleški/English       |                              |                                    |   |             |
| <b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b> |                           |   |                              | <b>Prerequisites:</b>              |   |             |
|  |                           |   |                              |                                    |   |             |
| <b>Vsebina:</b>  |                           |   |                              | <b>Content (Syllabus outline):</b> |   |             |
|  |                           |   |                              |                                    |   |             |

|  |   |
|--|---|
| <p>Uvod: de Casteljaouov algoritem, Bernsteinova oblika Bezierove krivulje, Bezierove krivulje (splošno), zleпки v Bezierovi obliki, racionalne Bezierove krivulje</p> <p>Geometrijska zveznost: geometrijska zveznost krivulj in ploskev, geometrijsko zvezni zleпки</p> <p>Bezierove ploskve: tenzorski produkti, trikotne krpe, racionalne Bezierove ploskve</p> <p>Stožnice: racionalne kvadratne Bezierove krivulje, eksaktna reprezentacija stožnic</p> <p>Krivulje B-zlepkov: lastnosti, algoritmi za delo z B-zleпки</p> | <p>Introduction: de Casteljau algorithm, Bernstein form of Bezier curve, Bezier curves (general), Bezier splines, rational Bezier curves</p> <p>Geometric continuity: geometric continuity of curves and surfaces, geometrically continuous splines</p> <p>Bezier surfaces: tensor products, triangular patches, rational Bezier surfaces</p> <p>Conics: rational quadratic Bezier curves, exact representation of conics</p> <p>B-spline curves: properties, algorithms for manipulating B-spline curves</p> |
|--|---|

#### **Temeljni literatura in viri / Readings:**

G. Farin: Curves and Surfaces for Computer Aided Geometric Design : A Practical Guide, 4th edition, Academic Press, San Diego, 1997.

C. de Boor: A Practical Guide to Splines, Springer, New York, 2001.

R. H. Bartels, J. C. Beatty, B. A. Barsky: An Introduction to Splines for Use in Computer Graphics and Geometric Modeling: Morgan Kaufmann, Palo Alto, 1996.

M.-J. Lai, L. L. Schumaker, Spline functions on triangulations, Cambridge University Press, 2007

#### **Cilji in kompetence:**

Študent spozna osnove računalniškega oblikovanja. Uporaba Bezierovih krivulj in ploskev, racionalnih Bezierovih krivulj in geometrijsko zveznih zlepkov.

V okviru seminarskih/projektnih aktivnosti študentje z individualnim delom in predstavitvijo ter delom v skupinah pridobijo izobraževalno komunikacijske in socialne kompetence za prenos znanj in za vodenje (strokovnega skupinskega dela).

#### **Objectives and competences:**

An introduction to computer aided geometric design, use of Bezier curves and surfaces, rational Bezier curves and geometrically smooth splines.

With individual presentations and team work interactions within seminar/project activities students acquire communication and social competences for successful team work and knowledge transfer.

#### **Predvideni študijski rezultati:**

#### **Intended learning outcomes:**

**Znanje in razumevanje:**

Razumevanje osnovnih pojmov krivulj in ploskev. Osnovno znanje programiranja v Matlabu ali Mathematici. Sposobnost implementacije postopkov na računalniku.

**Uporaba:**

Uporaba postopkov interpolacije in aproksimacije s polinomi in zlepki pri računalniškem oblikovanju.

**Refleksija:**

Razumevanje teorije na podlagi uporabe.

Prenosljive spretnosti – niso vezane le na en predmet: Spretnost uporabe teorije v praksi. Sposobnost povezovanja znanj iz numerične matematike, analize in računalništva. Kritično presojanje razlik med teorijo in prakso.

**Knowledge and understanding:**

Knowledge of basic facts on curves and surfaces. Basic programming skill in Matlab or Mathematica. Skill to implement algorithms in programming language.

**Application:**

Application of interpolation and approximation with polynomials and splines in CAGD.

**Reflection:**

Understanding theory based on application.

**Transferable skills:**

Skill of using theory in practical use. Skill of interconnecting knowledge from numerical mathematics, analysis and computer science. Critical judgement of differences between theory and practical applications.

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

| <b>Načini ocenjevanja:</b>                                | <b>Delež (v %) /<br/>Weight (in %)</b> | <b>Assessment:</b>                             |
|---|--|--|
| Način (pisni izpit, ustno izpraševanje, naloge, projekt): | 50%<br>50%                             | Type (examination, oral, coursework, project): |

|   |  |  |
|---|--|--|
| projekt   |  | project  |
| ustni izpit   |  | oral exam  |
| Ocene: 1-5 (negativno), 6-10 (pozitivno)<br>(po Statutu UL) |  | Grading: 1-5 (fail), 6-10 (pass) (according<br>to the Statute of UL) |

**Reference nosilca / Lecturer's references:**

JAKLIČ, Gašper, KOZAK, Jernej, KRAJNC, Marjetka, VITRIH, Vito, ŽAGAR, Emil. High order parametric polynomial approximation of conic sections. *Constructive approximation*, ISSN 0176-4276, 2013, vol. 38, iss. 1, str. 1-18. [COBISS.SI-ID 16716121]

JAKLIČ, Gašper, KOZAK, Jernej, KRAJNC, Marjetka, VITRIH, Vito, ŽAGAR, Emil. Hermite geometric interpolation by rational Bézier spatial curves. *SIAM journal on numerical analysis*, ISSN 0036-1429, 2012, vol. 50, no. 5, str. 2695-2715. [COBISS.SI-ID 16449369]

JAKLIČ, Gašper, ŽAGAR, Emil. Planar cubic  $G^1$  interpolatory splines with small strain energy. *Journal of Computational and Applied Mathematics*, ISSN 0377-0427. [Print ed.], 2011, vol. 235, iss. 8, str. 2758-2765. [COBISS.SI-ID 15770969]