Predmet:	Izbrana poglavja iz numerične matematike
Course title:	Topics in numerical mathematics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Doktorski študijski program Matematika in fizika	Matematika	1 ali 2	prvi ali drugi
Doctoral study programme Mathematics and Physics	Mathematics	1 or 2	first or second

Vrsta predmeta / Course type	izbirni / elective

Univerzitetna koda predmeta / University course code:	M3117

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30					150	6

Nosilec predmeta / Lecturer:	prof. dr. Gašper Jaklič, prof. dr. Marjeta Krajnc, prof. dr. Bor Plestenjak, prof. dr. Emil Žagar

Jeziki / **Languages:**	**Predavanja /** **Lectures:**	slovenski / Slovene, angleški / English
	Vaje / Tutorial:	slovenski / Slovene, angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.

Vsebina:	**Content (Syllabus outline):**

Izbrane bodo nekatere standardne teme iz podiplomske numerične matematike. Možna poglavja so: geometrijska interpolacija in aproksimacija s parametričnimi polinomskimi krivuljami in ploskvami, polinomska interpolacija v več spremenljivkah, parametrične krivulje in ploskve, ki se uporabljajo v CAGD (računalniško podprtem geometrijskem načrtovanju), valčki in uporaba v teoriji signalov in analizi slik, subdivizijske sheme za krivulje in ploskve, numerične metode za računanje matričnih funkcij, iterativne metode podprostorov in predpogojevanje, nelinearni problemi lastnih vrednosti, večparametrični problemi lastnih vrednosti, inverzni problemi lastnih vrednosti, metode zveznega nadaljevanja, večmrežne metode, teorija zlepkov, redukcija modela, slabo pogojeni problemi in regularizacija. Izbira je odvisna od interesov in raziskovalne usmeritve študentov.

The content consists of a selection of standard topics in postgraduate numerical mathematics. Possible themes include geometric interpolation and approximation by parametric polynomial curves and surfaces, multivariable polynomial interpolation, parametric curves and surfaces in CAGD (computer aided geometric design), wavelets in signal processing and image analysis, subdivision schemes for curves and surfaces, numerical methods for functions of matrices, iterative subspace methods and preconditioning, nonlinear eigenvalue problems, multiparameter eigenvalue problems, inverse eigenvalue problems,continuation methods, multigrid methods, spline theory, model reduction, ill-conditioned problems and regularization.The choice depends on students' research interests.

Temeljni literatura in viri / Readings:

N. J. Higham: Functions of matrices, Theory and Computation, SIAM, Philadelphia, 2008.

P. C. Hansen: Rank-Deficient and Discrete Ill-Posed Problems, SIAM, Philadelphia, 1998.

N.J. Higham: Accuracy and Stability of Numerical Algorithms, SIAM, Philadelphia, 2002.

J.P. Boyd: Chebyshev and Fourier Spectral Methods, Dover publications, Mineola, 2000.

F.W. Faierman: Linear Control Theory. The State Space Approach, John Wiley & Sons, Chichester, 1998.

W.L. Briggs, V.E. Henson, S.F. McCormick: A Multigrid tutorial, Second Edition, SIAM, Philadelphia, 2000

M.T. Chu, G.H. Golub: Inverse eigenvalue problems: theory, algorithms and applications, Numerical

mathematics and Scientific Computation, Oxford University Press, New York, 2005

R. Barrett, M. W. Berry, T. F. Chan, J. Demmel, J. Donato, J. Dongarra, V. Eijkhout, R. Pozo, C. Romine, H. van der Vorst: Templates for the Solution of Linear Systems: Building Blocks for Iterative Methods, SIAM, Philadelphia, 1994.

Z. Bai, J. Demmel, J. Dongarra, A. Ruhe, H. van der Vorst: Templates for the Solution of Algebraic Eigenvalue Problems: A Practical Guide, SIAM, Philadelphia, 2000.

G. Farin, J. Hoschek in M.-S. Kim: Handbook of Computer Aided Geometric Design, Elsevier, 2002.

R. T. Farouki: Pythagorean-hodograph curves: algebra and geometry inseparable, Vol. 1 of Geometry and Computing, Springer, Berlin, 2008.

N. Dyn in D. Levin: Subdivision Schemes in Geometric Modelling, Acta Numer. 11 (2002) 73-144.

Cilji in kompetence:

Namen predmeta je seznaniti študente z nekaterimi pomembnimi temami numerične matematike.

Objectives and competences:

The main goal of the course is to provide students with some important topics in numerical mathematics.

Predvideni študijski rezultati:

Znanje in razumevanje predstavljenih konceptov.

Sposobnost uporabe pridobljenega znanja in spretnosti.

Intended learning outcomes:

Knowledge and comprehension of presented concepts.

Ability to use acquired knowledge and skills.

Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja, konzultacije, reševanje problemov	Lectures, consultations, problem sessions

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pisni izpit (domače naloge), ustni izpit Ocene: 1-5 (negativno), 6-10 (pozitivno)	100%	Writen exam (homeworks), oral exam Grading: 1-5 (fail), 6-10 (pass)

Reference nosilca / Lecturer's references:

Bor Plestenjak:

HOCHSTENBACH, Michiel E., MUHIČ, Andrej, PLESTENJAK, Bor. On linearizations of the quadratic two-parameter eigenvalue problem. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2012, vol. 436, iss. 8, str. 2725-2743. [COBISS.SI-ID 16095065]

MUHIČ, Andrej, PLESTENJAK, Bor. On the quadratic two-parameter eigenvalue problem and its linearization. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2010, vol. 432, iss. 10, str. 2529-2542. [COBISS.SI-ID 15469913]

HOCHSTENBACH, Michiel E., KOŠIR, Tomaž, PLESTENJAK, Bor. A Jacobi-Davidson type method for the two-parameter eigenvalue problem. SIAM journal on matrix analysis and applications, ISSN 0895-4798, 2005, vol. 26, no. 2, str. 477-497. [COBISS.SI-ID 13613401]

Gašper Jaklič:

JAKLIČ, Gašper, ŽAGAR, Emil. Curvature variation minimizing cubic Hermite interpolants. Applied mathematics and computation, ISSN 0096-3003. [Print ed.], 2011, vol. 218, iss. 7, str. 3918-3924. [COBISS.SI-ID 16049241]

JAKLIČ, Gašper, ŽAGAR, Emil. Planar cubic G [sup] 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]

JAKLIČ, Gašper. On the dimension of bivariate spline space S [sub] 3 [sup] 1 ([triangle]). International journal of computer mathematics, ISSN 0020-7160, 2005, vol. 82, no. 11, str. 1355-

1369. [COBISS.SI-ID 13801305]

Marjetka Krajnc:

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]

KRAJNC, Marjetka. Interpolation scheme for planar cubic G [sup] 2 spline curves. Acta applicandae mathematicae, ISSN 0167-8019, 2011, vol. 113, no. 2, str. 129-143. [COBISS.SI-ID 16215385]

KRAJNC, Marjetka. Geometric Hermite interpolation by cubic G[sup]1 splines. Nonlinear Analysis, Theory, Methods and Applications, ISSN 0362-546X. [Print ed.], 2009, vol. 70, iss. 7, str. 2614-2626. [COBISS.SI-ID 15508569]

Emil Žagar:

JAKLIČ, Gašper, KOZAK, Jernej, VITRIH, Vito, ŽAGAR, Emil. Lagrange geometric interpolation by rational spatial cubic Bézier curves. Computer Aided Geometric Design, ISSN 0167-8396, 2012, vol. 29, iss. 3-4, str. 175-188. [COBISS.SI-ID 16207449]

KOZAK, Jernej, ŽAGAR, Emil. On geometric interpolation by polynomial curves. SIAM journal on numerical analysis, ISSN 0036-1429, 2004, vol. 42, no. 3, str. 953-967. [COBISS.SI-ID 13398617]

ŽAGAR, Emil. On G [sup] 2 continuous spline interpolation of curves in R [sup] d. BIT, ISSN 0006-3835, 2002, vol. 42, no. 3, str. 670-688. [COBISS.SI-ID 12027993]