

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)						
Predmet:		Mehanika 2				
Course title:		Mechanics 2				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year		Semester Semester
Univerzitetni študijski program Matematika		ni smeri		3		drugi
First cycle academic study programme Mathematics		none		3		second
Vrsta predmeta / Course type				izbirni / elective		
Univerzitetna koda predmeta / University course code:				M0232		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			90	5
Nosilec predmeta / Lecturer:		prof. dr. Igor Dobovšek, doc. dr. George Mejak				
Jeziki / Languages:		Predavanja / Lectures:		slovenski / Slovene		
		Vaje / Tutorial:		slovenski / Slovene		
Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:				Prerequisites:		
Vpis v letnik študija.				Enrolment in the programme.		
Opravljena predmeta Analiza 2a in Analiza 2b.				Completed courses Analysis 2a and Analysis 2b.		
Vsebina:				Content (Syllabus outline):		

<p>Dinamični sistemi. Osnovne definicije. Fazni prostor. Orbite. Linearizacija in kritične točke avtonomnih sistemov. Gradientni sistemi.</p> <p>Stabilnost. Osnovne definicije. Stabilnost lineariziranih sistemov. Sistemi s periodičnimi koeficienti.</p> <p>Teorija bifurkacij. Osnovni pojmi teorije bifurkacij. Razdelitev bifurkacij ravninskih vektorski polj. Enostavne bifurkacije. Hopfova bifurkacija.</p> <p>Metode povprečenja. Geometrijski opis metode povprečenja. Metoda energijskega ravnotežja. Metoda počasi spreminjajoče se amplitude. Periodične rešitve in metoda harmoničnega ravnovesja.</p> <p>Perturbacijske metode. Direktne metode. Lindstedtova metoda. Metoda singularnih perturbacij. Koordinatne transformacije in renormalizacija. Metoda več časovnih skal.</p> <p>Uporabe v nelinearni mehaniki. Bifurkacije v mehaniki trdnih teles. Eulerjev uklon. Primeri generičnih tipov hidrodinamične nestabilnosti.</p>	<p>Dynamical systems. Basic definitions. Phase space. Orbits. Linearization and critical points of autonomous systems. Stability. Basic definitions. Stability of linear systems. Systems with periodic coefficients.</p> <p>Bifurcation theory. Basic definitions. Classification of bifurcations of 2D vector fields. Simple bifurcations. Hopf bifurcation.</p> <p>Averaging methods. Geometrical description. Method of energy equilibrium. Method of slow amplitude variation. Periodic solutions and method of harmonic equilibrium.</p> <p>Perturbation methods. Direct methods. Lindstedt's method. Method of singular perturbations. Coordinate transformations and renormalization. Multiple time scales. Examples in nonlinear mechanics. Bifurcations in solid mechanics. Euler buckling. Hydrodynamical stability.</p>
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Temeljni literatura in viri / Readings:

<p>F. Verhulst: Nonlinear Differential Equations and Dynamical Systems, Universitext, Springer.</p> <p>R. H. Rand, D. Armbruster: Perturbation Methods, Bifurcation Theory and Computer Algebra, Applied Mathematical Sciences 65, Springer.</p> <p>R. Seydel: Practical Bifurcation and Stability Analysis, Interdisciplinary Applied Mathematics, Springer.</p> <p>C. L. Dym: Stability Theory and its Applications to Structural Mechanics, Dover.</p>

Cilji in kompetence:

Objectives and competences:

Predstavitev osnovnih pojmov in vsebin kvalitativne analize nelinearnih sistemov s poudarkom na uporabi v mehaniki.

Introduction to qualitative analysis of nonlinear systems with applications in mechanics.

Predvideni študijski rezultati:

Znanje in razumevanje: Poznavanje in razumevanje osnovnih pojmov in principov kvalitativne analize nelinearnih sistemov.

Uporaba: Uporaba pridobljenega matematičnega znanja omogoča reševanje konkretnih primerov iz prakse.

Refleksija: Na podlagi uporabe konkretnih primerov iz mehanike se omogoči razumevanje abstraktne matematične teorije.

Prenosljive spretnosti – niso vezane le na en predmet: Zmožnost identifikacije, formulacije in reševanja nelinearnih problemov na področju uporabne matematike in tehnike.

Intended learning outcomes:

Knowledge and understanding: Familiarity and understanding of basic principles of qualitative analysis of nonlinear systems.

Application: Application of the acquired knowledge enable solution of real world problems.

Reflection: Abstract mathematical theory is reflected in solving concrete problems of mechanics.

Transferable skills: Ability to identify, formulate and solve nonlinear problems of mechanics and technology.

Metode poučevanja in učenja:

Predavanja, vaje, konzultacije

Learning and teaching methods:

Lectures, exercises, consultations

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

50%

Type (examination, oral, coursework, project):

50%

2 kolokvija namesto izpita iz vaj, izpit iz vaj,

2 midterm exams instead of written

izpit iz teorije		exam, written exam
ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)		oral exam grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

MEJAK, George. Elasto-plastic torsion of composite bars with imperfect bonding. V: BATHE, Klaus-Jürgen (ur.). Computational fluid and solid mechanics : proceedings, Second MIT Conference on Computational Fluid and Solid Mechanics, June 17-20, 2003. Oxford: Elsevier Science, 2003, str. 436-438. [COBISS.SI-ID 12503641]

MEJAK, George. Finite element solution of a model free surface problem by the optimal shape design approach. International journal for numerical methods in engineering, ISSN 0029-5981. [Print ed.], 1997, vol. 40, str. 1525-1550. [COBISS.SI-ID 9983833]

MEJAK, George. Vogalna singularnost torzije kompozitne palice = The corner singularity of composite bars in torsion. Strojniški vestnik, ISSN 0039-2480, 2002, letn. 48, št. 11, str. 571-579. [COBISS.SI-ID 5643291]

DOBOVŠEK, Igor, MORAN, B. Material instabilities in rate dependent solids. European journal of mechanics. A, Solids, ISSN 0997-7538. [Print ed.], 1996, vol. 15, no. 2, str. 267-294. [COBISS.SI-ID 3048214]

DOBOVŠEK, Igor. On formal structure of constitutive equations for materials exhibiting shape memory effects. Materials science forum, ISSN 0255-5476, 2000, vols. 327/328, str. 359-362. [COBISS.SI-ID 5937174]

DOBOVŠEK, Igor. Modeling of amorphous solids by polyclustering technique. Journal de physique, IV, ISSN 1155-4339, 2001, vol. 11, str. Pr4/389-Pr4/396. [COBISS.SI-ID 11487065]