



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet:	Mehanika loma
Subject Title:	Fracture Mechanics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Tehnika – področje izobraževanja		2	zimski/poletni ali
		3	poletni
Education in Engineering		2	winter/summer or
		3	summer

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
10	5				75	3

Nosilec predmeta / Lecturer:

red. prof. dr. Nenad GUBELJAK

Jeziki /
Languages:

Predavanja / Lecture: Slovenščina / Slovene
Vaje / Tutorial:

Pogoji za opravljanje študijskih obveznosti:

Osnovno znanje računalništva,
fizike, matematike, gradiv

Prerequisites:

Basic knowledge of computer science, physics,
mathematics, materials

Vsebina:

Namen predmeta je predstaviti, opisati in demonstrirati uporabo mehanike loma pri reševanju problema razpok v mehanskih sistemih. Predmet je osredotočen na teoretične in praktične lomne analize mehanskih komponent po naslednjih poglavjih: Pristop ocene polja elastičnih napetosti, Plastifikacija na konici razpoke, Pristop ravnovesja energije, Osnovni aspekti elasto-plastične mehanike loma, Ocenitev porušitve po SINTAP postopku, Porušitev pri mejni obremenitvi, Dinamična rast in ustavitev razpoke, mehanizmi loma v kovinskih materialih, Vpliv mehanskega obnašanja materiala na lomnomehanske značilnosti.

Content (Syllabus outline):

The purpose of course is present, describe and demonstrate the application of nonlinear fracture mechanics in solving crack problems of mechanical systems. The course concentrates, to a theoretical and practical fracture analysis of mechanical components, with follows topics:
The Elastic Stress Field Approach, Crack Tip Plasticity, The Energy Balance Approach, Basic Aspects of Elastic-Plastic Fracture Mechanics, Failure Assessment SINTAP Procedure, Sustained Load Fracture, Dynamic Crack Growth and Arrest, Mechanisms of Fracture in Metallic Materials, The Influence of Material Behaviour on Fracture Mechanics Properties.

Temeljni literatura in viri / Textbooks:

- Janssen M., Zuidema J., Wanhill R.J.H., Fracture Mechanics, DUP Blue Print, Delft NL, 2002
- Gubelj N., Mehanika loma, Univerza v Mariboru, Fakulteta za strojništvo, 2009
- Ferahmand B., Fatigue and Fracture Mechanics of High Risk Parts, International Thomson Publishing, NY, 1997

Cilji:

- Podati ter opisati in predstaviti uporabo mehanike loma pri reševanju problemov porušitve konstrukcij, komponent in havarij,
- razviti sposobnosti študentov za definiranje robnih pogojev za varno uporabo konstrukcij in sklopov s stališča mehanike loma.

Objectives:

- to present and describe and demonstrate the use fracture mechanics in solving fracture problems, failure of structures, components and disasters,
- to develop student's capabilities of independent thinking and determination of boundary conditions for safe use of structures regarding to fracture mechanics.

Predvideni študijski rezultati:

Znanje in razumevanje:

- poznavanje osnovnih metod za reševanje problemov v mehaniki loma;
- razumevanje sovisnosti različnih znanj in postopkov ter pomena uporabe strokovne literature za učinkovito reševanje inženirskih problemov v mehaniki loma

Prenesljive/ključne spretnosti in drugi atributi:

- kombinirana uporaba različnih osnovnih znanj za reševanje problemov v nelinearni mehaniki loma;
- osnovni principi za določitev koncentracije napetosti na statično in dinamično obremenjenih konstrukcijah

Intended learning outcomes:

Knowledge and understanding:

- knowledge of basic numerical methods for solving complex problems in fracture mechanics;
- understanding of relationships between different skills and procedures and importance of professional literature for efficient solutions of engineering problems in fracture mechanics.

Transferable/Key Skills and other attributes:

- combined use of different fundamental skills for solution of problems in nonlinear fracture mechanics,
- general principles of stress concentrations determination for static and dynamic loaded structures.

Metode poučevanja in učenja:

frontalna predavanja,
izdelava seminarske naloge,
diskusije v elektronskem forumu,
e-učenje.

Teaching and learning methods:

frontal lectures,
seminar work,
discussion in electronic forums,
e-learning.

Načini ocenjevanja:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):
diskusije v elektronskem forumu,
seminarska naloga,
pisni izpit,
ustni izpit.

Delež (v %) /
Weight (in %)

Assessment methods:

Type (examination, oral, coursework, project):
discussion in electronic forums,
seminar work,
written examination,
oral examination.

10 %
30 %
40 %
20 %

Reference nosilca / Lecturer's references:

- Gubelj N., Mehanika loma, Univerzitetni učbenik, Univerza v Mariboru, Fakulteta za strojništvo, 2009
- GUBELJAK, Nenad, LIKEB, Andrej, PREDAN, Jožef, MATVIENKO, Yury G. Comparison between fracture behaviour of pipe-line ring specimens and standard specimens. V: 12th International Conference on Fracture and Damage Mechanics (FDM 2013), September 17-19, 2013, Sardinia, Italy.
- GUBELJAK, Nenad, PREDAN, Jožef, SENČIČ, Bojan, CHAPETTI, Mirco Daniel. Effect of residual stresses and inclusion size on fatigue resistance of parabolic steel springs. *Materialprüfung*, ISSN 0025-5300, Apr. 2014, vol. 56, iss. 4, str. 312-317
- GUBELJAK, Nenad, JAGARINEC, Darko, PREDAN, Jožef, LANDES, John. Fracture behaviour of thin sheet stainless steel. V: 11th International Conference on Fracture and Damage Mechanics (FDM 2012), September 18-21, 2012, Xian, China.
- GUBELJAK, Nenad, CHAPETTI, Mirco D., PREDAN, Jožef, LANDES, John D. CTOD-R curve construction from surface displacement measurements. *Engineering fracture mechanics*, ISSN 0013-7944. [Print ed.], 2011, vol.78, issue 11, str. 2286-2297,

