

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Nelinearna dinamika v tehniki
Course title:	Nonlinear dynamics in engineering

Študijski program Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Inženiring in avtomobilska industrija		prvi	prvi
		first	first

Vrsta predmeta / Course type Modul I-1

Univerzitetna koda predmeta / University course code: DR_31003

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
60	-	30	-	-	180	10

Nosilec predmeta / Lecturer: doc. dr. Anatolij Nikonov

Jeziki / Languages:	Predavanja / Lectures:	Slovenski / slovenian
	Vaje / Tutorial:	Slovenski / slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

<ul style="list-style-type: none"> - vpis v prvi letnik tretje stopnje študija, - študent(ka) mora obvladati znanja iz predmeta Izbrana poglavja iz matematike, in Izbrana poglavja iz mehanike na drugi stopnji študija.

Prerequisites:

<ul style="list-style-type: none"> - inscription in the first year of the 3rd level of study, - mastering of knowledges obtained within the courses Selected topics in mathematics and Selected topics in mechanics at the 2nd level of study.
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Vsebina:

<ul style="list-style-type: none"> - Razširjeni Hamiltonov princip. Linearna in nelinearna dinamika rotorjev. Linearna in nelinearna dinamika konstrukcij. Dinamika udarnih sistemov. Stabilnost konstrukcij. Problemi nelinearne dinamike v elektromehanskih sistemih. Elektromehanski sistemi z neidealnimi izvori

Content (Syllabus outline):

<ul style="list-style-type: none"> - Extended Hamilton's principle. Linear and nonlinear dynamics of rotors. Linear and nonlinear structural dynamics. The dynamics of shock systems. Stability of structures. The problems of nonlinear dynamics of electromechanical systems. Electromechanical systems with non-ideal

energije. Upravljanje dinamičnih sistemov s spremenljivo strukturo. Upravljanje termoakustičnih nihanj v procesih izgorevanja.	power sources. Management of dynamic systems with variable structure. Management termoakustičnih fluctuations in combustion processes.
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Temeljni literatura in viri / Readings:

<ul style="list-style-type: none"> - Yamamoto T., Ishida Y. Linear and nonlinear rotordynamics: A modern treatment with applications. Wiley Interscience, 2001. - A. H. Nayfeh, B. Balachandran. Applied Nonlinear Dynamics. John Wiley, New York, 1995. - J. Guckenheimer and P. Holmes. Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields. Springer, 1983.
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Priporočljiva literatura / Recommended Textbooks

<ul style="list-style-type: none"> - S.H. Strogatz. Nonlinear Dynamics and Chaos with Applications to Physics, Biology, Chemistry and Engineering, Perseus Books Publishing, 2000. - D. Kaplan and L. Glass. Understanding nonlinear dynamics, Springer-Verlag, New York, 1995.

Cilji in kompetence:

Cilji

Predmet je namenjen pridobitvi poglobljenih znanj in specializaciji študentov za posamezna raziskovalna področja doktorskega študija, ki zajemajo dinamiko rotorjev, konstrukcij, udarnih sistemov, dinamično stabilnost, elektromehanske sisteme z omejenimi izvori energije, mehanske sisteme s spremenljivo strukturo ter termoakustične procese s posebnim ozirom na avtomobilsko industrijo.

Kompetence

Učna enota prispeva k razvoju naslednjih splošnih in specifičnih kompetenc:

- sposobnost raziskovanja problemov dinamike rotorjev in njihove analize,
- sposobnost raziskovanja problemov dinamike udarnih sistemov,
- sposobnost raziskovanja problemov dinamike elektromehanskih sistemov s posebnim ozirom na omejene izvore energije,
- sposobnost izvedbe upravljanje dinamičnih sistemov s spremenljivo strukturo,
- sposobnost raziskovanja in izvedbe upravljanja termoakustičnih procesov.

Objectives and competences:

Objectives

The course is designed to gain in-depth knowledge and specialization of students in specific research areas of the doctoral study, covering the dynamics of rotor structures, the impact of systems, dynamic stability, electromechanical systems with limited power sources, mechanical systems with variable structure and thermoacoustic processes with particular reference to the automotive industry.

Competences

Learning unit contributes to the development of generic and specific competences:

- the ability to research problems of the dynamics of the rotors and their analysis,
- the ability to research problems of the dynamics of shock systems,
- the ability to research problems of the dynamics of electromechanical systems with special emphasis on limited sources of energy,
- the ability to manage the performance of dynamic systems with variable structure,
- the ability to research and performance management of thermoacoustical processes.

Predvideni študijski rezultati:

<p>Znanje in razumevanje: <i>Študent/študentka:</i></p> <ul style="list-style-type: none"> - obvlada področja nelinearne dinamike rotorjev, konstrukcij in elektromehanskih sistemov - obvlada področja nelinearne dinamike udarnih sistemov - obvlada področja dinamične stabilnosti - obvlada izvedbo upravljanja mehanskih sistemov s spremenljivo strukturo - obvlada upravljanje termoakustičnih procesov

Intended learning outcomes:

<p>Knowledge and understanding: <i>Student:</i></p> <ul style="list-style-type: none"> - mastered the field of nonlinear dynamics of rotors, structural and electromechanical systems - mastered the field of non-linear dynamics of shock systems - mastered the field of dynamic stability - mastered execution of management of mechanical systems with variable structure - mastered management of thermoacoustical processes
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Metode poučevanja in učenja:

<ul style="list-style-type: none"> - <i>predavanja z aktivno udeležbo študentov, ki vsebujejo razprave, diskusije in odgovore na vprašanja,</i> - <i>individualno delo v obliki konzultacij.</i>
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Learning and teaching methods:

<ul style="list-style-type: none"> - lectures with active participation of students, which contain debates, discussions and answering questions, - individual work in the form of consultations

Načini ocenjevanja:

**Delež (v %) /
Weight (in%)**

Assessment:

<ul style="list-style-type: none"> - seminarska naloga (60%) - ustni izpit (40%) - končna ocena izpita je povprečje obeh ocen (seminarske naloge in ustnega dela izpita). 	-	<ul style="list-style-type: none"> - seminar (60%) - oral exam (40%) - the final grade of the exam is the average of both grades (of the seminar and oral exam, respectively).
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Reference nosilca / Lecturer's references:

<ul style="list-style-type: none"> - NIKONOV, Anatolij, BURNIK, Stojan, ROTOVNIK, Bojan, EMRI, Igor. Jolt - new criterium of safety in climbing. V: GOLOBIČ, Iztok (ur.), CIMERMAN, Franc (ur.). Engineering - development and innovations for new employments 2014 : proceedings of the 4th AMES International Conference, Ljubljana, Slovenia, October 23th, 2014. 1st ed. Ljubljana: Association of Mechanical Engineers of Slovenia - AMES, 2015, str. 199-204, ilustr. [COBISS.SI-ID 14122267] - NIKONOV, Anatolij Viktorovič, SAPRUNOV, Ivan, ZUPANČIČ, Barbara, EMRI, Igor. Influence of moisture on functional properties of climbing ropes. International Journal of Impact Engineering, ISSN 0734-743X. [Print ed.], Nov. 2010, vol. 38, iss. 11, str. 900-909, doi:10.1016/j.ijimpeng.2011.06.003. [COBISS.SI-ID 11964699] - NIKONOV, Anatolij Viktorovič, BURNIK, Stojan, EMRI, Igor. Examination of the time-dependent behaviour of climbing ropes under impact loading = Preiskava časovno odvisnega vedenja plezalnih vrvi pri impulznih obremenitvah. Kinesiologia Slovenica, ISSN 1318-2269. [Print ed.], 2010, vol. 16, no. 3, str. 7-13, ilustr., tabeli. [COBISS.SI-ID 4044977] - ZUPANČIČ, Barbara, NIKONOV, Anatolij Viktorovič, FLORJANČIČ, Urška, EMRI, Igor. Časovno odvisno

vedenje pogonskih jermenov pod vplivom periodične mehanske obremenitve : analiza lokacije enojne spektralne črte = Time-dependent behaviour of drive belts under periodic mechanical loading : analysis of the location of a single line spectrum. Strojniški vestnik, ISSN 0039-2480, 2007, letn. 53, št. 10, str. 696-705. [COBISS.SI-ID 10330395]

- EMRI, Igor, KRAMAR, Janez, HRIBAR, Anton, NIKONOV, Anatolij Viktorovič, FLORJANČIČ, Urška. Time-dependent constitutive modeling of drive belts - I. : the effect of geometry and number of loading cycles. Mechanics of time-dependent materials, ISSN 1385-2000, 2006, letn. 10, št. 3, str. 245-262. <http://dx.doi.org/10.1007/s11043-006-9021-2>. [COBISS.SI-ID 9871387]
- NIKONOV, Anatolij Viktorovič, DAVIES, A.R., EMRI, Igor. The determination of creep and relaxation functions from a single experiment. Journal of rheology, ISSN 0148-6055, 2005, letn. 49, št. 6, str. 1193-1211. [COBISS.SI-ID 8872219]
- ZAKHAROV, D.D., NIKONOV, Anatolij Viktorovič. Approximate description of the dynamics of thin isotropic elastic coatings and interlayers by using asymptotics of high order of accuracy. Mechanics of composite materials, ISSN 0191-5665, 2005, letn. 41, št. 6, str. 527-534. <http://dx.doi.org/10.1007/s11029-006-0006-7>. [COBISS.SI-ID 9506843]