COURSE DESCRIPTION CARD - SYLLABUS

Course name
NONLINEAR STRUCTURAL DYNAMICS

Course

Proposed by Discipline
Civil engineering and transport

Year/Semester
II/4, III/6

Type of studies
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
4

Tutorials

Projects/seminars

Number of credit points

1

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Knowledge: knowledge of mathematics covered within engineering courses of studies at the level of the Master of Science degree, basic knowledge of linear vibration theory of single and multiple degrees of freedom systems.

Skills: solving of algebraic equations and algebraic equation systems, solving of differential equations and their systems , integral calculus, mathematical formulation of engineering problems, ability to apply the acquired knowledge and to obtain further information from the literature or other sources.

Social competencies: awareness of the need of permanent updating and improving knowledge and scientific skills.

Course objective

Expanding knowledge in the field of structure dynamics, making it possible to undertake research on engineering problems, the formulation of which using mathematical models in terms of linear dynamics theory presented at the level of master's studies in many technical fields is impossible.

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows and understands:
1) common types of nonlinearity in dynamical systems and basic methods of nonlinear structure vibration analysis. [P8S_WG/SzD_W01]

Skills

A PhD student who graduated from doctoral school can:
1) adopt an appropriate mathematical model for the nonlinear behavior of a dynamic system, [P8S_UW/SzD_U01]
2) perform state space analysis, modal analysis and use some approximate methods for dynamic analysis of simple nonlinear dynamical systems. [P8S_UW/SzD_U01]

Social competences

A PhD student who graduated from doctoral school is ready to:
1) acknowledge the importance of knowledge in solving cognitive and practical problems. [P8S_KK/SzD_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01	Final test of the module (knowledge assessment)	4 questions to answer; 5 points for each correct answer; to pass the test at least 50% (10 points) is required
U01	Final test of the module (skills assessment)	2 problem to be solved; 10 points for each correct solution; to pass the test at least 50% (10 points) is required
K03	Oral test (discussion with PhD students)	No quantitative measures

Programme content

1. Common types of nonlinearity in dynamical systems (cubic stiffnes, bilinear stiffnes or damping, piecewise linear stiffnes, nonlinear damping, coulomb friction).
2. Concepts and phenomena related to nonlinear structural vibrations.
3. Basic methods of nonlinear structure vibration analysis.
4. Case studies (beam, cable, shell).

Teaching methods

Lecture: multimedia presentation including illustrations and examples.

Bibliography

Basic

1. Wagg D., Neild S., Nonlinear Vibration with Control, 2nd Edition, Springer, Cham, 2015.

2. Worden K., Tomlinson G.R., Nonlinearity in Structural Dynamics: Detection, Identification and Modelling, 1st Edition, CRC Press, 2000.

Additional

1. Thompson J.M.T., Stewart H.B., Nonlinear Dynamics and Chaos, 2nd Edition, Wiley, 2002.

Breakdown of average student's workload

	Hours	ECTS
Total workload	15	1.0
Classes requiring direct contact with the teacher	5	0.5
Student's own work (literature studies, preparation for tutorials, project preparation) [1]	10	0.5

[1] delete or add other activities as appropriate