GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Identification methods in mechatronics, PG_00064796		
Field of study	Mechatronics		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Mazur	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	4.0	16.0	50

Subject objectives

Overview of stages and selected methods of identification, model correlation, modal updating.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	Assesses the usefulness and possibility of using identification methods.	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K7_W02] demonstrates structured and theory supported knowledge encompassing key issues in the field of Mechatronics, enabling modeling and analysis of stationary and non-stationary mechatronic systems, devices, and processes with continuous and discrete operation	Has expanded and deepened knowledge of certain branches of mechatronics including elements of discrete mathematics and applied and optimization methods, including mathematical and numerical methods necessary for identification	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W04] demonstrates knowledge encompassing selected issues in the field of detailed knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Mechatronics	Has a theoretical detailed knowledge of the methods of identification and signal processing.	[SW3] Assessment of knowledge contained in written work and projects
[K7_U02] formulates and tests hypotheses concerning problems od stationary and non-stationary mechatronic systems/processes, as well as simple research problems	Is able to verify the stationarity of the identified system.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	LECTURES. Basic definitions and terms of modal analysis. Signal processing. Modal testing. Indirectmethods of identification in the time domain. Direct methods of identification in the time domain. Methods ofidentification of one-degree-of-freedom systems in the frequency domain. Indirect methods of identificationin the frequency domain. Direct methods of identification in the frequency domain. Coupling techniques inidentification of mechatronic systems. Structural models modification. Operational modal analysis. Deeplearning and optimization. FEM model validation. Hybrid models.PROJECT The students implement a mechatronic project in their own interdisciplinary teams, with thedivision of competences into individual team members. The main goal of the project is to identify the modalparameters (poles and scaled shapes of vibrations) of the real object. An additional goal is to create an FEMmodel of the real object. Then, the correlation of the FEM model and the model obtained through theexperiment is assessed. Additional tasks are the synthesis of responses in the time and frequency domain.
Prerequisites and co-requisites	Knowledge on Control Theory (I-st level).Knowledge on Theory and technique of systems (II-nd level).Knowledge and experience in Informatics (I-st level).Knowledge and experience in Modelling of mechatronic systems (I-st level). Knowledge and experience inMechatronic design (I-st and II-nd level).

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Projekt	50.0%	40.0%
Colloquium	50.0%	60.0%

Recommended reading

Basic literature	1. Uhl T.: Komputerowo wspomagana identyfikacja modeli konstrukcjimechanicznych. Warszawa: WNT 1997.2. Maia N. M. M., Silva J. M. M.: Theoretical and Experimental ModalAnalysis. Taunton, Somerset (England): Research Studies Press 1997.3. Heylen W., Lammens S., Sas P.: Modal Analysis Theory andTesting. Leuven: KU Leuven 2007.
Supplementary literature	1. Wybrane zagadnienia analizy modalnej konstrukcji mechanicznych. (Red. T. Uhl). Kraków: Kated. Robotyki i Mechatroniki AGH 2005, 2006,2008.2. Lisowski W.: Wybrane problemy automatyzacji eksperymentalnejanalizy modalnej. Kraków: AGH Uczelniane WydawnictwaNaukowoDydaktyczne 2006. Rozprawy Monografie 158.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. The ERA method 2. pLSCFd method 3. Residues 4. LSFD method 5. Time windows 6. H1 and H2estimator 7. Spectrum leak 8. OMA 9. FBS 10. CMS 11. MAC 12. CMIF 13. Assumptions of Modal Analysis14. Dynamic stiffness, effective mass 15. Modes scaling 16. Frequency aliasing 17. Correctness ofmeasurements 18. Correctness of identification 19. Stages of identification 20. SVD decomposition 21.Poles Determination from the characteristic polynomial equation 22. Multiple poles 23. Inverse problem - load identification 24. TPA 25. FRF synthesis 26. Complex shapes 27. Peak-Picking - dampingdetermination 28. Self-excited vibrations
Work placement	Not applicable

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