GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Bifurcation theory in differential equations, PG_00021514		
Field of study	Mathematics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Optional 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	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Nonlinear Analysis and Statistics -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Robert Krawczyk	
	Teachers	dr inż. Robert Krawczyk	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60

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	60	5.0	35.0	100

Subject objectives

The aim of the lecture is to introduce basic ideas and concepts of bifurcation theory in differential equations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U04	A student uses his knowledge from topology to study dynamical systems.	[SU2] Assessment of ability to analyse information
K7_W06	Student understans questions concerning new problems in bifurcation theory.	[SW1] Assessment of factual knowledge
K7_U06	Using simple examples student is able to explain the phenomenon of bifurcation.	[SU1] Assessment of task fulfilment
K7_W02	Student is able to describe stability property of a solution of differental equation by constructing appropriate dynamical system.	[SW1] Assessment of factual knowledge
K7_K02	student is able to decribe basic notions and methods of bifurcation theory by the use of elementary examples from mechanics, physics and biology.	[SK4] Assessment of communication skills, including language correctness

Subject contents

Scalar autonomous equations. Elementary bifurcations.Computing bifurcation diagrams. Planar autonomous systems. Product systems. Properties of solutions of linear systems. Qualitative equivalence and bifurcations in linear systems. Liapunov functions. Poincare-Andronov-Hopf bifurcation.Structurally stable vector fields. Conservative and gradient systems.

Prerequisites and co-requisites

Ordinary differential equations. Matematical analysis. Topology.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
a completion of exercises	50.0%	50.0%
Colloquium	50.0%	50.0%

Recommended reading	Basic literature	J. Hale and H. Kocak, Dynamics and Bifurcations, Springer-Verlag, 1991, L. Perko, Differential Equations and Dynamical Systems, Springer-Verlag, 2001.
	Supplementary literature	E. Zehnder, Lectures on Dynamical Systems, EMS Textbooks in Mathematics, 2010.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Sketch the phase portraits on the circle and analyze the stability of equilibria of the followinf differential equation: x' = 1-2sin(x); Draw the orbits and the direction of the flow of the following system: $x'=y(x^2-y^2)$, $y'=-x(x^2-y^2)$;	
Work placement	Not applicable	