DOCTORAL (PHD) STUDIES
COURSE DESCRIPTION

Course title	Field of science	Faculty	Institute
Numerical Methods for Differential Equations	Mathematics (N 001)	Faculty of Mathematics and Informatics	Institute of Applied Mathematics
Study method	Number of credits	Study method	Number of credits
Lectures	0	Consultations	1
Individual work	4	Seminars	0

Course summary
Numerical methods for both of ordinary (ODEs) and partial differential equations (PDEs) are one of the most important parts of modern Numerical Analysis. The most important topics in this subject are the stability of numerical methods, cost-effective methods for multidimensional problems and solution of nonlinear differential equations. The main method of this course is the finite difference method. Numerical solution of initial and boundary value problems for ODEs. Finite difference method for parabolic and hyperbolic PDEs and techniques for their analysis. Numerical methods for multidimensional parabolic problems. Finite difference and finite elements methods for elliptic equations. Algorithms to solve large, sparse algebraic systems. Spectral methods. Numerical methods for nonlinear differential equations. Geometric numerical integration.
Main literature
1. R. Čiegis. *Diferencialinių lygčių skaitiniai sprendimo metodai*. Technika, Vilnius, 2003.
2. A. Iserles, *A First Course in the Numerical Analysis of Differential Equations*, Cambridge University Press, 1996.
3. K. W. Morton, D. F. Mayers, *Numerical Solution of Partial Differential Equations: An Introduction.* Cambridge University Press, 2005
4. A.A. Samarskii, *The Theory of Difference Schemes*, English transl.: pp. Marcel Dekker, Inc., New York, Basel, 2001.
5. U.M.Ascher. *Numerical Methods for Evolutionary Differential Equations*. SIAM, Philadelphia, 2008.
6. S. Larsson, V. Thomee. *Partial differential equations with numerical methods*. Springer-Verlag, Berlin, Heidelberg, 2003.

Consulting teacher	Scientific degree	Pedagogical name	Main publications in the field of science of the last 5 year period
Olga Štikonienė	Dr.	Prof.	1. E. Canon, F. Chardard, G. Panasenko, O. Štikonienė. Numerical solution of the viscous flows in a network of thin tubes: equations on the graph. J. Comput. Phys., 435(110262):1–31, 2021 https://doi.org/10.1016/j.jcp.2021.110262. [CA WoS Q1, IF=3.553(2020)] 2. M. Sapagovas, O. Štikonienė, K. Jakubelienė, R. Čiupaila. Finite difference method for boundary value problem for nonlinear elliptic equation with nonlocal conditions, Boundary Value Problems, Article Number: 94, 1-16, 2019. https://boundaryvalueproblems.springeropen.com/articles/10.1186/s13661-019-1202-4. [CA WoS: Q1, IF–1,794] 3. M. Sapagovas, O. Štikonienė, R. Čiupaila and Ž. Jokšienė. Convergence of iterative methods for elliptic equations with integral boundary conditions. Electron. J. Differential Equations, 2016(118), 1–14, 2016. http://ejde.math.txstate.edu . [WoS: Q1, IF–0,954].

			4. M. Sapagovas, V. Griškonienė, O. Štikonienė. Application of m-matrices theory to numerical investigation of a nonlinear elliptic equation with an integral condition. Nonlinear Anal. Model. Control, 22(4):489–504, 2017 https://doi.org/10.15388/NA.2017.4.5. [CA WoS Q3(ApplMath), IF=0.896].

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Board Chairman – assoc. prof. dr. Kristina Lapin