



VU Faculty of Mathematics and Informatics



Institute of Data Science and Digital Technologies – Annual Report 2018



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<http://www.mii.lt>

Director – Prof. Dr. Habil. *Gintautas Dzemyda*

STAFF

62 research fellows (incl. 58 holding research degree),

20 teachers (all of them holding research degree),

42 doctoral students.

GROUPS OF THE INSTITUTE

[Blockchain Technologies Group](#)

[Cognitive Computing Group](#)

[Cyber-Social Systems Engineering Group](#)

[Education Systems Group](#)

[Global Optimization Group](#)

[Image and Signal Analysis Group](#)

[Intelligent Technologies Research Group](#)

[Statistics and Probability Group](#)

RESEARCH AREA

Integrated Development of Mathematics, Informatics and Information Technologies for the Knowledge Society Advanced Products and Services

DOCTORAL DISSERTATIONS MAINTAINED IN 2018

Kotryna Paulauskienė – in Informatics (09 P) defended on 24th of September

Scientific Supervisor: Prof. Dr. Olga Kurasova,

„[Massive Data Visualization Based on Dimensionality Reduction and Projection Error Evaluation](#)“ [in Lithuanian] ([abstract](#)).

Albertas Gimbutas – in Informatics (09 P) defended on 21th of September

Scientific Supervisor: Prof. Dr. Habil. Antanas Žilinskas,

„[Nonconvex Optimization Algorithm with a New Bi-criteria Selection of Potential Simplices Using an Estimate of Lipschitz Constant](#)“ ([abstract](#) [in Lithuanian])

Vladimiras Dolgopolovas – in Informatics Engineering (07 T) defended on 2th of July

Scientific Supervisor: Prof. Dr. Valentina Dagienė,

„[Software Learning Objects for Scientific Computing Education: Teaching Scientific Inquiry with Recurrence Based Stochastic Models](#)“ ([abstract](#) [in Lithuanian])

Vytautas Jakštys – in Informatics Engineering (07 T) defended on 11th of June,
Scientific Supervisor: Dr. Virginijus Marcinkevičius,

„[Application of Contour Detection Methods to Lateral Chromatic Aberration Reduction in Eye Fundus Images and Road Surface Defect Detection](#)“ [in Lithuanian] ([abstract](#)).

Jevgenij Tichonov – in Informatics Engineering (07 T) defended on 11th of June
Scientific Supervisor: Prof. Dr. Olga Kurasova,

„[Classification-Based Compression Solutions of Digital Images](#)“ [in Lithuanian] ([abstract](#)).

Mykolas Jurgis Bilinskas – in Informatics (09 P) defended on 9th of February,
Scientific Supervisor: Prof. Dr. Habil. Gintautas Dzemyda,

„[Development and Application of a Mathematical Model to Parametrization and Registration of Breast Area Computed Tomography](#)“ [in Lithuanian] ([abstract](#)).

MAIN CONFERENCES ORGANIZED IN 2018

- Workshop: STEM PD Net and IncluSMe, June 25–27, 2018, Vilnius, Lithuania
- 13th biennial International Baltic Conference on Databases and Information Systems ([Baltic DB&IS 2018](#)), July 1–4, 2018, Trakai, Lithuania
- International Conference "[Constructionism 2018](#)", August 21–25, Vilnius, Lithuania
- 10th International Workshop "[Data Analysis Methods for Software Systems](#)", November 29 – December 1, 2018, Druskininkai, Lithuania
- 9th International Doctoral Consortium "[Informatics Engineering Education Research](#)", December 5–9, 2018, Druskininkai, Lithuania

BLOCKCHAIN TECHNOLOGIES GROUP

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Head – Dr. Remigijus Paulavičius

STAFF

Senior researchers: dr. Remigijus Paulavičius, dr. Ernestas Filatovas, dr. Viktor Medvedev

Junior researchers: Linas Stripinis

Doctoral students: Vaidas Jusevičius, Ieva Meržvinskaitė, Linas Stripinis, Andrius Adamonis, Saulius Grigaitis, Jaroslava Arsenjeva

RESEARCH INTERESTS

- Blockchain technologies
- Global optimization
- Multi-Objective optimization
- High-Performance Computing
- Artificial Intelligence
- Image Processing
- Big Data

RESEARCH PROJECTS CARRIED OUT IN 2018

National Research Projects

Research Council of Lithuania. *Development and applications of bilevel optimization algorithms* (No. P-MIP-17-60). Dr. R. Paulavičius, 2017-2020.

Description: Bilevel optimization is important from the practical viewpoint, but efficient bilevel optimization methods still exist only in specific cases. As a result, development of general bilevel optimization methods is particularly relevant and timely. Many practical problems in the economy, engineering, and other fields can be described as bilevel optimization models. However, a plethora of these applications still cannot be solved with existing optimization tools. More importantly, only in the last decade, the first methods to solve general bilevel optimization problems were proposed. Unfortunately, the application of these methods has been mainly demonstrated only on small test instances. In this project, we seek an ambitious goal to develop new and improve existing bilevel optimization algorithms, enabling to solve real practical problems. It is equally important to implement efficient and publicly accessible bilevel optimization software, which would allow solving such problems for a broad range of practitioners. This would have a significant and internationally recognizable contribution to the field of bilevel optimization.

Main results:

- New algorithm for global optimization based on a bisection of hyper-rectangles, a novel sampling on diagonals and a set of Lipschitz constants was developed.
- New parallel versions of dominance ranking algorithms for multiobjective optimization were developed.

Main publications:

1. **R. Paulavičius**, L. Chiter, J. Žilinskas (2018) Global optimization based on bisection of rectangles, function values at diagonals, and a set of Lipschitz constants. *Journal of global optimization*. Springer 2018, Vol. 71 (1), 5-20. DOI: 10.1007/s10898-016-0485-6.
2. **L. Stripinis**, **R. Paulavičius**, Žilinskas, Julius (2018). Improved scheme for selection of potentially optimal hyper-rectangles in DIRECT. *Optimization Letters*. Springer, 2018, vol. 12, no 7, p. 1699-1712, DOI: 10.1007/s11590-017-1228-4.
3. J.J. Moreno, G. Ortega, **E. Filatovas**, J.A. Martínez, E.M. Garzón (2018) Improving the performance and energy of Non-Dominated Sorting for evolutionary multiobjective optimization on GPU/CPU platforms. *Journal of Global Optimization*, Springer, Vol. 71 (3), 631-649, DOI: 10.1007/s10898-018-0669-3.

International Research Projects

COST action **High-Performance Modelling and Simulation for Big Data Applications (cHiPSet) IC1406** Member of Managing Committee Dr. Viktor Medvedev 2014-2018, http://www.cost.eu/COST_Actions/ict/IC1406

Description: The Big Data era poses a critically difficult challenge and striking development opportunities in High-Performance Computing (HPC): how to efficiently turn massively large data into valuable information and meaningful knowledge. Computationally effective HPC is required in a rapidly-increasing number of data-intensive domains, such as Life and Physical Sciences, and Socioeconomic Systems. Modelling and Simulation (MS) offer suitable abstractions to manage the complexity of analysing Big Data in various scientific and

engineering domains. Unfortunately, Big Data problems are not always easily amenable to efficient MS over HPC. Also, MS communities may lack the detailed expertise required to exploit the full potential of HPC solutions, and HPC architects may not be fully aware of specific MS requirements. Therefore, there is an urgent need for European co-ordination to facilitate interactions among data-intensive MS and HPC experts, ensuring that the field, which is strategic and of long-standing interest in Europe, develops efficiently – from academic research to industrial practice. This Action will provide the integration to foster a novel, coordinated Big Data endeavour supported by HPC. It will strongly support information exchange, synergy and coordination of activities among leading European research groups and top global partner institutions, and will promote European software industry competitiveness.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

1. Imperial College London (UK)
2. Universidad de Almería (Spain)
3. Università della Calabria (Italy)
4. Systems Research Institute, Polish Academy of Sciences (Poland)

OTHER SCIENTIFIC ACTIVITIES

dr. R. Paulavičius –

- Affiliate member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), www.hipeac.net
- Member of the American Institute of Chemical Engineers (AIChE), www.aiche.org
- Member of The Mathematical Optimization Society (MOS), <http://www.mathopt.org/>
- Member of Program/Scientific Committees:
 - 1st Workshop on Blockchain and Smart Contract Technologies (BSCT 2018)
- Reviewer of international journals:
 - *Journal of Global Optimization*
 - *Optimization Letters*
 - *Information Technology and Control*
 - *Central European Journal of Computer Science*
 - *Communications in Nonlinear Science and Numerical Simulation*
 - *Informatica*
 - *Baltic Journal of Modern Computing*

o

dr. E. Filatovas –

- Member of International Society on Multiple Criteria Decision Making (MCDM).
- Member of the Lithuanian Computer Society (LIKS).
- Member of Program/Scientific Committees:
 - 1st Workshop on Blockchain and Smart Contract Technologies (BSCT 2018)
- Reviewer of international journals:
 - *Complexity*
 - *Information Technology and Control*
 - *Informatica*
 - *Baltic Journal of Modern Computing*

dr. V. Medvedev -

- Expert of FP7-ICT Committee (2013)

- Member of Lithuanian Computer Society, <http://www.liks.lt/>
- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Member of SERVICE COMPUTATION 2014-2017 Technical Program Committee
- Reviewer of international journals:
 - *Informatica (IOSPress/VU)*;
 - *Mathematical Modelling and Analysis (Taylor & Francis)*;
 - *Journal of Global Optimization (Springer)*;
 - *Pattern Recognition Letters (Elsevier)*;
 - *The Baltic Journal of Road and Bridge Engineering (Technika/VGTU, Lithuania)*;
 - *Baltic Journal of Modern Computing*;
 - *Applied Computing and Informatics (Elsevier)*.

COGNITIVE COMPUTING GROUP

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Head – Prof. Habil. Dr. *Gintautas Dzemyda*

STAFF

Principal researchers: Prof. Habil. Dr. Gintautas Dzemyda, Prof. Dr. Olga Kurasova, Prof. Dr. Kęstutis Dučinskas, Prof. Dr. Audronė Jakaitienė, Dr. Rita Dukynaitė. Dr. Saulė Raižienė, Prof. Habil. Dr. Rimantas Želvys

Affiliated researchers: Prof. Habil. Dr. Algis Garliauskas, Prof. Habil. Dr. Jonas Mockus

Researchers: Dr. Jolita Bernatavičienė, Dr. Rasa Karbauskaitė

Junior Researchers: Dr. Martynas Sabaliauskas, Dovilė Stumbrienė, Jogaila Vaitiekaitis

Specialists and engineering staff: Vytautas Tiešis, Dr. Laura Ringienė, Laimutė Mikalauskienė, Raimundas Savukynas

Doctoral students: Liudas Ališauskas, Andrius Daranda, Povilas Gudžius, Rokas Jurevičius, Marta Karaliutė, Roma Purnaitė, Rimantė Rybnikovė, Giedrius Stabingis, Mantas Stankevičius, Dovilė Stumbrienė, Ričardas Toliušis, Viktoras Bulavas

RESEARCH INTERESTS

- Artificial neural networks;
- Big data;
- Bioinformatics;
- Data mining;
- Deep learning;
- Global optimization methods;
- Multi-objective optimization;
- Image analysis, feature detection, image reconstruction, medical image processing;
- Internet data mining;
- Fractal dimensionality;
- Local optimization methods;
- Machine learning;
- Medical data analysis and decision support;
- Multiple criteria decision support;
- Operations research;
- Optimal control applications;
- Parallel computing;
- Simulation models in epidemiology, education, economics, and energy with uncertainty;
- Statistical simulation;
- Stochastic programming;
- Swarm intelligence;
- Visualization of multidimensional data;

- Web service development.

RESEARCH PROJECTS CARRIED OUT IN 2018

Projects Supported by University Budget

Project title: Optimal decisions in the problems of data mining, visualization, and image processing. Prof. Habil. Dr. Gintautas Dzemyda, Prof. Dr. Olga Kurasova. 2017–2019

Description: The aim of the project is to develop the integrated data mining, visualization, and image processing methods and tools and to apply them to solve the problems in economics, health care, medicine and chemical engineering.

Main results:

1. Approximation of the ribs-bounded contour in a tomography scan slice has been developed and applied for feature-based registration of thorax CT scan slices.
2. The novel closed-form expression for the actual risk and the approximation of the expected risk associated with the linear classification of the Gaussian Markov Random Field observations are derived. Accuracy of the derived approximation is tested by using the simulated data.
3. Self-organizing map was applied for data mining in the artificial neural network-based decision support system for development of an energy-efficient built environment.
4. A heuristic approach to select the optimal configuration of the parallel MDS-type algorithm SMACOF on the available platforms in terms of energy efficiency has been proposed and investigated.
5. An automatic blood vessel classification algorithm, which is used for artery and vein width ratio measurements, is developed. Method is compared with other similar algorithms. The advantage of the developed algorithm among others is its ability to automatically adapt to image size, it is not dependent on eye fundus camera type and it reduces the influence of unevenly lighting of the image.

Publications:

1. **Bilinskas, Mykolas Jurgis; Dzemyda, Gintautas;** Trakymas, Mantas. Approximation of the ribs-bounded contour in a tomography scan slice // International journal of information technology & decision making. Singapore : World Scientific Publishing Company. ISSN 0219-6220. eISSN 1793-6845. 2018, Vol. 17, no 1, p. 83-102. DOI: 10.1142/S0219622017500298. [DB: Science Citation Index Expanded (Web of Science); Scopus; Applied Science & Technology Source; Business Source Premier; INSPEC; Zentralblatt MATH (zbMATH)]
2. **Dučinskas, Kęstutis;** Dreižienė, Lina. Risks of classification of the Gaussian Markov random field observations // Journal of classification. New York : Springer. ISSN 0176-4268. eISSN 1432-1343. 2018, vol. 35, iss. 3, p. 422-436. DOI: 10.1007/s00357-018-9269-7. [DB: SpringerLink; Academic Search Complete; Scopus; Science Citation Index Expanded (Web of Science)]
3. **Kaklauskas, Artūras; Dzemyda, Gintautas;** Tupėnaitė, Laura; Voitau, Ihar; **Kurasova, Olga;** Naimavičienė, Jurga; Rassokha, Yauheni; Kanapeckienė, Loreta. Artificial neural network-based decision support system for development of an energy-efficient built environment // Energies. Basel : MDPI. eISSN 1996-1073. 2018, vol. 11, iss. 8, p. 1-20.

DOI: 10.3390/en11081994. [DB: Chemical abstracts; RePec; DOAJ; INSPEC; CAB Abstracts; EI Compendex Plus; Scopus; Current Contents / Engineering, Computing & Technology; Science Citation Index Expanded (Web of Science)]

4. Orts, Francisco; Filatovas, Ernestas; Ortega, Gloria; **Kurasova, Olga**; Garzon, Ester M. Improving the energy efficiency of SMACOF for multidimensional scaling on modern architectures // Journal of supercomputing. Dordrecht : Springer. ISSN 0920-8542. eISSN 1573-0484. 2018, First published online, [13 p.]. DOI: 10.1007/s11227-018-2285-x. [DB: Current Contents; Academic OneFile; Zentralblatt MATH (zbMATH); INSPEC; SpringerLink; Scopus; Science Citation Index Expanded (Web of Science)]
5. **Stabingis, Giedrius; Bernatavičienė, Jolita; Dzemyda, Gintautas**; Paunksnis, Alvydas; Stabingienė, Lijana; Treigys, Povilas; Vaičaitienė, Ramutė. Adaptive eye fundus vessel classification for automatic artery and vein diameter ratio evaluation // Informatica. Vilnius : Vilniaus universitetas Matematikos ir informatikos institutas. ISSN 0868-4952. eISSN 1822-8844. 2018, vol. 29, no 4, p. 757-771. DOI: 10.15388/Informatica.2018.191. [DB: Zentralblatt MATH (zbMATH); MatSciNet; Scopus; Science Citation Index Expanded (Web of Science)].

National Research Projects

Effectiveness and Efficiency Analysis of Education Systems in EU Countries Employing Secondary Big Data (EFFECTAS) (No. DOTSUT-39 (09.3.3-LMT-K-712-01-0018) / LSS-250000-57, Research Council of Lithuania) Dr. A. Jakaitienė. 2018-2022.

Description: The main idea of the project is to assess the factors influencing the effectiveness and efficiency of the EU education systems, to develop effectiveness and efficiency measuring instruments in order to implement sound evidence-based educational policy.

Publications:

Želvys, Rimantas; Dukynaitė, Rita; Vaitekaitis, Jogaila. Švietimo sistemų efektyvumas ir našumas kintančių švietimo paradigmu kontekste = Effectiveness and efficiency of educational systems in a context of shifting educational paradigms // Pedagogika : mokslo darbai. Vilnius : Lietuvos edukologijos universiteto leidykla. ISSN 1392-0340. eISSN 2029-0551. 2018, T. 130, Nr. 2, p. 32-45. DOI: 10.15823/p.2018.20

Jakaitienė, Audronė; Žilinskas, Antanas; Stumbrienė, Dovilė. Analysis of education systems performance in European countries by means of PCA-DEA // Informatics in education. Vilnius : Vilniaus universiteto Matematikos ir informatikos institutas. ISSN 1648-5831. eISSN 2335-8971. 2018, vol. 17, no 2, p. 245-263. DOI: 10.15388/infedu.2018.13

International Research Projects

1. COST action **Big Data Era in Sky and Earth Observation TD1403** Member of Managing Committee Prof. Dr. Olga Kurasova. 2014-2018, http://www.cost.eu/COST_Actions/TDP/Actions/TD1403
2. COST action **High-Performance Modelling and Simulation for Big Data Applications (cHiPSet) IC1406** Member of Managing Committee Dr. Viktor Medvedev 2014-2018, http://www.cost.eu/COST_Actions/ict/IC1406

3. COST action **A new Network of European BioImage Analysts to advance life science imaging (NEUBIAS) CA15124** Member of Managing Committee Dr. Povilas Treigys 2016-2020, http://www.cost.eu/COST_Actions/ca/CA15124
4. COST action **Open Multiscale Systems Medicine CA15120** Member of Managing Committee dr. Jolita Bernatavičienė 2016-2020, http://www.cost.eu/COST_Actions/ca/CA15120

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INOVATION) PARTNERS

1. University of Almeria, Spain
2. University College London, UK
3. Bar-Ilan University, Israel
4. University of Ferrara, Italy
5. Southwestern University of Finance and Economics, China
6. Belarus State University
7. University of Calabria, Italy
8. National Cancer Institute of Lithuania
9. Hospital of Lithuanian University of Health Sciences Kauno klinikos
10. Maribor University, Slovenia

OTHER SCIENTIFIC ACTIVITIES

Prof. Habil. Dr. G. Dzemyda –

- Member of Lithuanian Academy of Science, <http://lma.lt>
- Member of programme committees of the following International conferences:
 - International conference on Psychological Computing Systems (PhyCS 2018),
 - 4th International Conference on Sensor Networks (SENSORNET 2018),
- Chairman of the 9th International Workshop „Data Analysis Methods for Software Systems“, Druskininkai, Lithuania, 2018, <http://www.mii.lt/DatAMSS/>
- Editor-in-Chief of *Baltic Journal of Modern Computing* <http://www.lu.lv/baltic-journal-of-modern-computing/> and the International Journal *Informatica* (IOSPress/VU) <https://www.mii.lt/Informatica/>.
- Editorial board member of 9 international journals: *Financial Innovation; International Journal of Computers; Communications and Control; Applied Computer Systems; Informatics in Education; Journal of Civil Engineering and Management; Nonlinear Analysis: Modelling and Control; Mathematics and Informatics. Journal of the Belarusian State University; Scientific Proceedings of Riga Technical University. Computer Science, Information Technology and Management Science.*
- Member of the Lithuanian Academy of Sciences <http://lma.lt/>
- Member of IFIP Technical Committee 12 Artificial Intelligence, <http://www.ifiptc12.org.uk/ifiptc12/members.php>
- Board member of Transportation Science and Information Technologies in Ministry of Transport and Communications of the Republic of Lithuania
- Board member of Military Science and Technologies in Ministry of National Defence of the Republic of Lithuania
- Member of Lithuanian Computer Society, <http://www.liks.lt/>
- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Member of Lithuanian Operational Research Society, <http://www.mii.lt/LitORS/>

Prof. Habil. Dr. J. Mockus –

- Member of the Lithuanian Academy of Sciences
http://lma.lt/index.php?option=com_k2&view=item&layout=item&id=235&Itemid=243&lang=lt
- Member of American Mathematical Society <http://www.ams.org/cml>
- Member of IFIP Technical Committee WG 7.7 Stochastic Optimization,
<http://www.ifip.org/bulletin/bulltcs/memtc07.htm>

Prof. Dr. O. Kurasova –

- Member of editorial boards of international journals:
 - *Nonlinear Analysis: Modelling and Control*, <http://www.mii.lt/NA/>
 - *Baltic Journal of Modern Computing*, <http://www.lu.lv/baltic-journal-of-modern-computing/editorial-board/>
 - *Computational Science and Techniques*
<http://journals.ku.lt/index.php/CST/about/editorialTeam>
 - Informatics, <http://www.mdpi.com/journal/informatics>
- Member of Lithuanian Computer Society, <https://www.liks.lt/en/>
- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Member of Lithuanian Operational Research Society, <http://www.mii.lt/LitORS/>
- Reviewer of international journals:
 - *Informatica* (IOSPress/VU)
 - *Mathematical Modelling and Analysis* (Taylor & Francis)
 - *Journal of Visualization* (Springer)
 - *Mechanical Systems and Signal Processing* (Elsevier)
 - *Informatics in Education* (VU)
 - *Central European Journal of Computer Science* (Springer),
 - *Neural Processing Letters* (Springer),
 - *Optimization Letters* (Springer),
 - *Information Technology and Control* (KTU),
 - *Neurocomputing* (Elsevier)

Dr. J. Bernatavičienė –

- Managing Co-editor of *Baltic Journal of Modern Computing*,
<http://www.bjmc.lu.lv/editorial-board/>
- Member of Lithuanian Computer Society (Artificial Intelligence Section),
<http://www.liks.lt/>
- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Member of Lithuanian Operational Research Society, <http://www.mii.lt/LitORS/>
- reviewer of international journals:
 - *Informatica* (IOSPress/VU)
 - *Baltic Journal of Modern Computing*

Dr. R. Karbauskaitė –

- Managing editor of *Informatica* (IOSPress/VU) <http://www.mii.lt/informatica/editors.htm>
- Reviewer of international journal *Informatica* (IOSPress/VU)

V. Tiešis – Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>

CYBER-SOCIAL SYSTEMS ENGINEERING GROUP

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Head – Prof. Dr. *Saulius Gudas*

STAFF

Chief research fellows: Prof. Dr. S. Gudas.

Senior research fellows: Prof. Dr. D. Dzemydienė.

Research fellows: Dr. Romas Alonderis, Assoc. Prof. Dr. A. Lupeikienė, Dr. S. Maskeliūnas.

Junior research fellow: Dr. J. Miliauskaitė, Dr. H. Giedra.

Chief Specialists: Prof. Dr. O. Vasilecas.

Assistant research fellow: L. Paliulionienė.

Affiliated professors: Prof. Dr. A. Čaplinskas.

Affiliated researchers: Prof. Habil. Dr. S. Jukna, Assoc. Prof. Habil. Dr. R. Pliuškevičius, Assoc. Prof. Dr. A. Pliuškevičienė.

Doctoral students: A. Šaikūnas, A. Valatavičius, M. Jusis, R. Savukynas, E. Arbataitis, V. Radzevičius, A. Širaliov.

RESEARCH INTERESTS

Software engineering for cyber-physical-social systems:

- Theoretical foundations of information systems;
- Domain causal dependencies modeling for software engineering;
- Model based applications development (MBD) for different types of domains (enterprises, Internet of Things, smart systems, etc.);
- Knowledge-based development of cyber-physical-social systems;
- Process mining.

Mathematical logic:

- Automated deduction;
- Knowledge analysis methods;
- Deductive systems.

RESEARCH PROJECTS CARRIED OUT IN 2018

Projects Supported by University Budget

Research in the area of cyber-social systems engineering. Development of methods and technologies at the intersection of cyber-physical and cyber-social systems.

Prof. Dr. S. Gudas (leader), Dr. R. Alonderis, Prof. Dr. D. Dzemydienė, Assoc. Prof. Dr.

A. Lupeikienė, Dr. S. Maskeliūnas, Dr. J. Miliauskaitė, L. Paliulionienė, Prof. Dr.

O. Vasilecas, Affil. Prof. Dr. A. Čaplinskas, Affil. Researcher Habil. Dr. S. Jukna, Affil.

Researcher Habil. Dr. R. Pliuškevičius, Affil. Researcher Dr. A. Pliuškevičienė, doctoral

students A. Šaikūnas, A. Valatavičius, M. Jusis, R. Savukynas, E. Arbataitis, V. Radzevičius,

A. Širaliov. 2018–2020.

Main results obtained in 2018:

1. A model-based software development method using deep knowledge modeling was proposed. For this, the integration of the traditional MDA / MDD process with causal modeling has been used. The modified MDA scheme includes a new layer of domain knowledge discovery and causal modeling frameworks. The method is adapted to evaluate the interoperability of applications.
2. A requirements specifications (UML Use Case Diagram) generation algorithm was designed, and a prototype using domain causal dependency models was developed.
3. A component architecture for the provision of semi-automatically generated electronic services is designed, based on the principles of BDI intelligent agents.
4. The multilayered architecture of secure identification and interaction of objects in the wireless environment was analyzed, and partial cases of risk analysis and protection measures were identified.
5. A sound and complete sequent calculus for the logic of likelihood was constructed. A proof-search system for the logic of likelihood was developed based on this calculus.
6. Investigating the evolution of the concept of algorithm has resulted in a report containing about 60 pages, which will be used to prepare 2 or 3 publications.

Main publications:

1. **Valatavičius, Andrius; Gudas, Saulius.** Measuring Enterprise Application Software Interoperability Capability // *Baltic DB&IS 2018: Joint proceedings of the conference forum and doctoral consortium co-located with the 13th international Baltic conference on databases and information systems*, Trakai, Lithuania, July 1–4, 2018 / edited by: Audrone Lupeikiene, Raimundas Matulevičius, Olegas Vasilecas. Aachen : CEUR-WS, 2018. ISBN 9783319975702. p. 127-134. (CEUR workshop proceedings, ISSN 1613-0073; vol. 2158). Prieiga per internetą: <http://ceur-ws.org/Vol-2158/paper11.pdf>.
2. Tekutov, Jurij; **Gudas, Saulius**; Denisov, Vitalij. The formation of requirements engineering processes based on a problem domain model // *ICTIC : the 7th international virtual conference on Informatics and management sciences* : April 2-7, 2018, Slovakia. Zilina : EDIS - Publishing Institution of the University of Zilina, 2018. ISBN 9788055414362. ISSN 1339-231X. eISSN 1339-9144. 2018, vol. 7, iss. 1, p. 93-97.
3. **Miliauskas, Arūnas; Dzemydienė, Dalė.** An Approach to Designing Belief-Desire-Intention Based Virtual Agents for Travel Assistance. // *Baltic DB&IS 2018: Joint proceedings of the conference forum and doctoral consortium co-located with the 13th international Baltic conference on databases and information systems*, Trakai, Lithuania, July 1–4, 2018 / edited by: Audrone Lupeikiene, Raimundas Matulevičius, Olegas Vasilecas. Aachen : CEUR-WS, 2018. ISBN 9783319975702. p. 94-103. (CEUR workshop proceedings, ISSN 1613-0073; vol. 2158). Prieiga per internetą: <http://ceur-ws.org/Vol-2158/paper10.pdf>.
4. **Savukynas, Raimundas; Dzemydienė, Dalė.** Security means in multilayered architecture of Internet of Things for secure communication and data transmission // *Baltic DB&IS 2018: Joint proceedings of the conference forum and doctoral consortium co-located with*

the 13th international Baltic conference on databases and information systems, Trakai, Lithuania, July 1–4, 2018 / edited by: Audrone Lupeikiene, Raimundas Matulevičius, Olegas Vasilecas. Aachen : CEUR-WS, 2018. ISBN 9783319975702. p. 127-134. (CEUR workshop proceedings, ISSN 1613-0073; vol. 2158). Prieiga per internetą: <http://ceur-ws.org/Vol-2158/paper13dc1.pdf>.

5. **Alonderis, Romas; Sakalauskaitė, Jūratė.** A labelled sequent calculus for half-order modal logic // *Journal of Applied Logics - IfCoLog journal of logics and their applications*. Milton : Lightning Source, 2018. ISBN 9781848902749. ISSN 2055-3706. eISSN 2055-3714. 2018, Vol. 5, No. 1, p. 121-163. Prieiga per internetą: <http://www.collegepublications.co.uk/journals/ifcolog/?00021>.
6. **Alonderis, Romas; Giedra, Haroldas.** A Proof-Search System for the Logic of Likelihood // *Logic Journal of the IGPL*, 2018.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Riga Technical University (Latvia)

University of Tartu (Estonia)

Warsaw University of Technology (Poland)

University of Geneva (Switzerland)

University of Frankfurt (Germany)

OTHER SCIENTIFIC ACTIVITIES

Prof. Dr. S. Gudas

- editorial board member of the journal *Transformations in Business and Economy*, <http://www.transformations.khf.vu.lt/about/board>;
- reviewer of the *Baltic Journal of Modern Computing*, <http://www.bjmc.lu.lv/>;
- reviewer of the journal *Informatica*, <https://www.mii.lt/informatica/>;
- program committee member of the 14th International Conference „Beyond Databases, Architectures and Structures“ (BDAS 2018) during IFIP World Computer Congress (IFIP WCC), Poznan, Poland, September 18-20, 2018, <http://bdas.polsl.pl/default.asp?service=opis&tekst=4>;
- program committee member of the 15th International Conference „Beyond Databases, Architectures and Structures“ (BDAS 2019) during IFIP World Computer Congress (IFIP WCC), Ustron, Poland, May 28-31, 2019, <http://bdas.polsl.pl/default.asp?service=opis&tekst=4>;
- program committee member of the 24th International Conference on Information and Software Technologies (ICIST 2018), <https://icist.ktu.edu/#Programme-Committee-members>;

Prof. Dr. A. Čaplinskas

- editorial board member of the journal *Informatica*, <http://www.mii.lt/informatica/editors.htm>;

- editorial board member of the *Baltic Journal of Modern Computing*, <http://www.bjmc.lu.lv/editorial-board/>;
- editorial board member of the *Scientific Journal of Riga Technical University: Applied Computer Systems*, <https://ortus.rtu.lv/science/en/series/16>;
- steering and program committee member of the 22nd East European Conference on Advances in Databases and Information Systems (ADBIS 2018), Budapest, Hungary, September 2-5, 2018, <http://www.adbis2018.org/committees/>;
- steering and program committee member of the 13th International Baltic Conference on Databases and Information Systems (BalticDB&IS 2018), Trakai, Lithuania, July 1-4, 2018, <https://www.mii.lt/balticDBIS2018/index.php?q=conference-organisation>;
- program committee member of the 3rd Workshop on Managed Complexity (ManComp 2018), Stockholm, Sweden, September 24, 2018, <https://wwwswt.informatik.uni-rostock.de/ManComp2018/comm>;
- program committee member of the 8th International Conference on Business Intelligence and Technology (BUSTECH 2018), Barcelona, Spain, February 18-22, 2018, <https://www.iaia.org/conferences2018/ComBUSTECH18.html>;
- program committee member of the 10th International Conference on Advanced Cognitive Technologies and Applications (COGNITIVE 2018), Barcelona, Spain, February 18-22, 2018, <https://www.iaia.org/conferences2018/ComCOGNITIVE18.html>;
- program committee member of the 30th International Conference on Advanced Information Systems Engineering (CAiSE 2018), Tallinn, Estonia, June 11-15, 2018, <https://caise2018.ut.ee/program-committee/>;
- program committee member of the 10th International Workshop on Data Analysis Methods for Software Systems (DAMSS 2018), Druskininkai, Lithuania, November 29 - December 1, 2018, <https://www.mii.lt/damss/index.php?page=organizers&lang=en>;
- program committee member of the 17th International Conference on Perspectives in Business Informatics Research (BIR 2018), Stockholm, Sweden, September 24-26, 2018, <http://bir2018.dsv.su.se/organization>;
- program committee member of the Joint 38th IEEE Software Engineering Workshop (SEW-38) and 5th International Workshop on Cyber-Physical Systems (IWCPs-5) of the Federated Conference on Computer Science and Information Systems (FedCSIS 2018), Poznań, Poland, September 9-12, 2018, <https://fedcsis.org/2018/sew-iwcps>.

Prof. Dr. D. Dzemydienė

- editorial board member of the *Scientific Journal of Riga Technical University: Applied Computer Systems*, <https://ortus.rtu.lv/science/en/series/16>;
- editorial board member of the journal *Technological and Economic Development of Economy*, <https://journals.vgtu.lt/index.php/TEDE/editorialboard>;
- editorial board member of the *International Journal of Electronic Security and Digital Forensics*, <https://www.inderscience.com/jhome.php?jcode=ijesdf>;
- editorial board member of the *International Journal of Strategic Property Management*, <https://journals.vgtu.lt/index.php/IJSPM/editorialboard>;

- organizing and program committee member of the 13th International Baltic Conference on Databases and Information Systems (BalticDB&IS 2018), Trakai, Lithuania, July 1-4, 2018, <https://www.mii.lt/balticDBIS2018/index.php?q=conference-organisation>;
- program committee member of the international conference „Advanced Learning Technologies and Applications. Games for Education” (ALTA’18), Kaunas, Lithuania, December 5, 2018, <https://ndma.lt/alta2018/en/programme-committee/>.

Assoc. Prof. Dr. A. Lupeikienė

- editorial board member of the *Scientific Journal of Riga Technical University: Applied Computer Systems*, <https://ortus.rtu.lv/science/en/series/16>;
- steering committee member and program committee co-chair of the 13th International Baltic Conference on Databases and Information Systems (BalticDB&IS 2018), Trakai, Lithuania, July 1-4, 2018, <https://www.mii.lt/balticDBIS2018/index.php?q=conference-organisation>;
- doctoral consortium co-chair of the 30th International Conference on Advanced Information Systems Engineering (CaiSE’18), <https://caise2018.ut.ee/committees/>;
- program committee member of the 22nd East European Conference on Advances in Databases and Information Systems (ADBIS 2018), Budapest, Hungary, September 2-5, 2018, <http://www.adbis2018.org/committees/>;
- program committee member of the 10th International Conference on Agents and Artificial Intelligence (ICART 2018), Funchal, Madeira, Portugal, January 16-18, 2018, <http://www.icaart.org/ProgramCommittee.aspx>.

Dr. S. Maskeliūnas

- chairman of the Council of the Lithuanian Computer Society, <http://www.iks.lt/en/modules/tinycontent/index.php?id=3>;
- organizing chair and program committee member of the 13th International Baltic Conference on Databases and Information Systems (Baltic DB&IS 2018), Trakai, Lithuania, July 1-4, 2018, <https://www.mii.lt/balticDBIS2018/index.php?q=conference-organisation>.
- co-chair of the 10th International Workshop on Data Analysis Methods for Software Systems (DAMSS), Druskininkai, Lithuania, November 29 - December 1, 2018, <https://www.mii.lt/damss/index.php?page=organizers&lang=en>;
- organizing committee member of the International Conference „Constructionism 2018“, Vilnius, Lithuania, August 21-25, 2018, <http://www.constructionism2018.fsf.vu.lt/committees/>;
- program committee member of the 14th International Conference „Beyond Databases, Architectures and Structures“ (BDAS 2018) during IFIP World Computer Congress (IFIP WCC), Poznan, Poland, September 18-20, 2018, <http://bdas.polsl.pl/default.asp?service=opis&tekst=4>;
- program committee member of the 15th International Conference „Beyond Databases, Architectures and Structures“ (BDAS 2019) during IFIP World Computer Congress (IFIP WCC), Ustron, Poland, May 28-31, 2019, <http://bdas.polsl.pl/default.asp?service=opis&tekst=4>.

Dr. J. Miliauskaitė

- organizing committee member of the 13th International Baltic Conference on Databases and Information Systems (Baltic DB&IS 2018), Trakai, Lithuania, July 1-4, 2018, <https://www.mii.lt/balticDBIS2018/index.php?q=conference-organisation>;
- organizing committee member of the 10th International Workshop on Data Analysis Methods for Software Systems (DAMSS), Druskininkai, Lithuania, November 29 - December 1, 2018, <https://www.mii.lt/damss/index.php?page=organizers&lang=en>.

L. Paliulionienė

- organizing committee member of the 13th International Baltic Conference on Databases and Information Systems (Baltic DB&IS 2018), Trakai, Lithuania, July 1-4, 2018, <https://www.mii.lt/balticDBIS2018/index.php?q=conference-organisation>;
- organizing committee member of the 10th International Workshop on Data Analysis Methods for Software Systems (DAMSS), Druskininkai, Lithuania, November 29 - December 1, 2018, <https://www.mii.lt/damss/index.php?page=organizers&lang=en>.

Prof. Dr. Habil. S. Jukna

- scientific board member of the *Electronic Colloquium on Computational Complexity* (ECCC), http://eccc.hpi-web.de/colloquium/scientific_board/;
- editorial board member of the *Lithuanian Mathematical Journal*, <https://www.mii.lt/lmj/>.

Assoc. Prof. Dr. Habil. R. Pliuškevičius

- editorial board member of the *Lithuanian Mathematical Journal*, <https://www.mii.lt/lmj/>.

EDUCATION SYSTEM GROUP

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<https://www.mii.lt/struktura/moksliniai-padaliniai/educaciniu-sistemu-grupe>

Head – Prof. Dr. Valentina Dagiienė

STAFF

Chief research fellow: Prof. Dr. V. Dagiienė.

Senior research fellow: Dr. J. Kurilov.

Research fellows: Dr. T. Jevsikova, Dr. A. Juškevičienė

Junior research fellows: Dr. E. Jasutė, G. Stupurienė, V. Dolgopolovas

Doctoral students: A. Berniukevičius, V. Dvareckienė, V. Dolgopolovas, D. Gudonienė, I. Krikun, G. Stupurienė, O. Mirzianov, A. Urbaitytė, L. Vinikienė

Affiliated senior research fellows: Assoc. Prof. Dr. G. Grigas, Dr. L. Markauskaitė.

RESEARCH INTERESTS

- Application of intelligent technologies in education
- Computer science (Informatics) education research
- Computing engineering education research
- Personalised learning
- Software localisation
- Technology enhanced learning

RESEARCH PROJECTS CARRIED OUT IN 2018

Projects supported by the Vilnius University Budget

Research on Intelligent Technologies Application for Teaching, Learning and Cultural Environment. Prof. Dr. V. Dagienė, 2015–2019.

Creation of engineering solutions for improving teaching and learning by implementing intelligent technologies; creation of personalised learning methods and activities as well as ontologies to teach and learn informatics engineering. Creation of personalised engineering solutions for mobile learning; creating of e-learning recommendations based on semantic web. Creation of methodologies to evaluate the quality of distance learning courses and learning object repositories;

Creation of computational thinking operational model; research on its application in general education and in Informatics and Computational Thinking contest "Bebras".

MAIN PUBLICATIONS:

1. **Dolgopolas, Vladimiras; Dagienė, Valentina; Jasutė, Eglė; Jevsikova, Tatjana.** Design science research for computational thinking in constructionist education: a pragmatistic perspective // Constructionism 2018: Constructionism, computational thinking and educational innovation: conference proceedings / Edited by V. Dagienė, E. Jasutė. Vilnius: Vilnius University, 2018. eISBN 9786099576015. p. 180-192. http://www.constructionism2018.fsf.vu.lt/file/repository/Proceeding_2018_Constructionism.pdf.
2. **Jevsikova, Tatjana; Dagienė, Valentina; Dolgopolas, Vladimiras.** On preferences of novice software engineering students: temperament style and attitudes towards programming activities // Informatics in schools: fundamentals of computer science and software engineering: 11th international conference on informatics in schools: situation, evolution, and perspectives, ISSEP 2018, St. Petersburg, Russia, October 10-12, 2018: Proceedings / Editors: S. N. Pozdniakov, V. Dagienė. Cham: Springer, 2018. ISBN 9783030027490. eISBN 9783030027506. p. 101-113. (Lecture Notes in Computer Science, ISSN 0302-9743, eISSN 1611-3349; vol. 11169). DOI: [10.1007/978-3-030-02750-6_8](https://doi.org/10.1007/978-3-030-02750-6_8).
3. **Dolgopolas, Vladimiras; Jevsikova, Tatjana; Dagienė, Valentina.** From Android games to coding in C-An approach to motivate novice engineering students to learn programming: a case study // Computer applications in engineering education. Hoboken : Wiley. ISSN 1061-3773. eISSN 1099-0542. 2018, Vol. 26, no 1, p. 75-90. DOI: [10.1002/cae.21862](https://doi.org/10.1002/cae.21862).

INTERNATIONAL RESEARCH PROJECTS

NordNICE: Nordplus Network of Innovative Computing Education (No. NPHZ 2015/1053)
<http://nordnice.wix.com/nordplus>

Intercultural Learning in Mathematics and Science: Initial Teacher Education (IncluSMe),
2016-1-DE01-KA203-002910

Structuring Cooperation in Doctoral Research, Transferrable Skills Training, and Academic Writing instruction in Ukraine's regions (DocHub). 574064-EPP- 1-2016- 1- LT-EPPKA2- CBHE-SP

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

ETH Zurich (Switzerland)

KTH (Sweden)

Lancaster University (UK)

Nikon University (Japan)

Radboud University Nijmegen (The Netherlands)

OTHER SCIENTIFIC ACTIVITIES

Prof. Dr. V. Dagienė –

Editor-in-Chief of the journal Informatics in Education,
http://www.mii.lt/informatics_in_education (Clarivate Analytics Web of Science Core Collection; Scopus; etc.);

Editor of the journal Olympiads in Informatics (Scopus, etc);

Area Editor (Computing Didactics) of the „Baltic Journal of Modern Computing“,
<https://www.bjmc.lu.lv> (Clarivate Analytics Web of Science Core Collection; Scopus; etc.);

Editorial board member of the Journals: „International Journal of Digital Literacy and Digital Competence“; „International Journal of Instruction“; „Acta Paedagogica Vilnensia“;

Coordinator of the Nordplus Network on Innovative Computing Engineering Education Research;

Representative of Lithuania in Education Committee TC3 under the International Federation for Information Processing (IFIP);

Expert of the Programme EUREKA Eurostars.

Member of Steering Committee of International Olympiads in Informatics;

Member of Joint Doctoral Committee of Education (Vytautas Magnus University; Vilnius University; Klaipėda University; Riomeris University; and Aveiro University), 2015–2019

Assoc. Prof. Dr. J. Kurilov –

Executive Editor of the journal Informatics in Education,
http://www.mii.lt/informatics_in_education/ (Thomson Reuters Web of Science Core Collection);

Guest Editor of the journal International Journal of Engineering Education (Tempus Publications, Ireland), Special Issue on Computer Engineering Education, <http://www.ijee.ie/> (Thomson Reuters Web of Science);

Co-editor Europe of the journal International Journal of Knowledge Society Research (IGI Global, USA), <http://www.igi-global.com/journal/international-journal-knowledge-society-research/1180>;

Associate Editor of the Journal of Engineering and Computer Innovations (Academic Journals), <http://www.academicjournals.org/JECI/index.htm>;

Editorial board member of the journal International Journal On Advances in Software (IARIA journal, USA), <http://www.ariajournals.org/software/index.html>;

Editorial board member of the Journal of Studies in Education (Macrothink Institute, USA), <http://www.macrothink.org/journal/index.php/jse/index>.

Dr. T. Jevsikova –

Member of International Federation for Information Processing (IFIP) TC3 WG 3.1 (Informatics for Secondary Education);

Dr. A. Juškevičienė –

PostDoc: “Algorithmic thinking enhancement by modern technologies in basic education”, Lithuanian Research Council, 2017-2019

GLOBAL OPTIMIZATION GROUP

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Head – Prof. Dr. (HP) Julius Žilinskas

STAFF

Principal researchers: Prof. Dr. (HP) Julius Žilinskas, Prof. Habil. Dr. Antanas Žilinskas

Senior researchers:

Researchers: Dr. Algirdas Lančinskas

Doctoral students: Rima Kriauzienė, Eglė Zikarienė

RESEARCH INTERESTS

Optimization and high-performance computing.

RESEARCH PROJECTS CARRIED OUT IN 2017

Projects Supported by University Budget

Project title: Global optimization. Prof. dr. Julius Žilinskas

Aim: Development of global optimization algorithms and application of them to optimization problems.

Main results:

1. Created global optimization algorithms with rectangular subregions;
2. Created heuristic algorithms for competitive facility location problems.

Publication:

- Paulavičius, Remigijus; Chiter, Lakhdar; **Žilinskas, Julius**. Global optimization based on bisection of rectangles, function values at diagonals, and a set of Lipschitz constants // Journal of global optimization. New York, NY : Springer New York LLC. ISSN 0925-5001. eISSN 1573-2916. 2018, Vol. 71, iss. 1, spec. iss. SI, p. 5-20. DOI: [10.1007/s10898-016-0485-6](https://doi.org/10.1007/s10898-016-0485-6).
- Calvin, James; Gimbutienė, Gražina; Phillips, William O.; **Žilinskas, Antanas**. On convergence rate of a rectangular partition based global optimization algorithm // Journal of global optimization. Dordrecht : Springer. ISSN 0925-5001. eISSN 1573-2916. 2018, vol. 71, iss. 1, spec. iss. SI, p. 165-191. DOI: [10.1007/s10898-018-0636-z](https://doi.org/10.1007/s10898-018-0636-z).
- Fernandez, Pascual; Pelegrin, Blas; **Lančinskas, Algirdas; Žilinskas, Julius**. The Huff versus the Pareto-Huff customer choice rules in a discrete competitive location model // Computational science and its applications – ICCSA 2018: 18th international conference, Melbourne, VIC, Australia, July 2–5, 2018: proceedings / Osvaldo Gervasi, Beniamino Murgante, Sanjay Misra, ... [et al.] (Eds.). Cham : Springer, 2018. ISBN 9783319951645. eISBN 9783319951652. p. 583-592. (Lecture notes in computer science, ISSN 0302-9743, eISSN 1611-3349 ; vol. 10961). DOI: [10.1007/978-3-319-95165-2_41](https://doi.org/10.1007/978-3-319-95165-2_41).

National Research Projects

Research Council of Lithuania. ***Development and parallelization of ranking-based optimization algorithms*** (No. 09.3.3-LMT-K-712-02-0087) Dr. A. Lančinskas, 2017-2019.

Description: The project will deal with combinatorial optimization algorithms and their application to high-performance computing systems.

The objective of the project is to develop a ranking-based algorithm for solving combinatorial optimization problems using high-performance computing systems.

The project is based on two activities: development of the ranking-based algorithm and its application to high-performance computing systems.

The goal of the first activity is to develop the ranking-based algorithm suitable to solve combinatorial optimization problems. Beside well-known combinatorial optimization test problems, various instances of competitive facility location problems will be used in an experimental investigation. It is planned to organize a research visit at University of Murcia, where researchers have experience in modelling and solving facility location problems.

The goal of the second activity is to develop parallel versions of the algorithm ensuring effective communication between processors. For this purpose, it is necessary to search for novel solution in high-performance computing in order to create an optimal communication strategy. Computational experiments will be performed using high-performance computing system at Vilnius University. It is also planned to collaborate with Edinburgh Parallel

Computing Centre in developing the parallel algorithm for large-scale high-performance computing systems.

In the case of success, a ranking-based algorithm for solving combinatorial optimization problems using high-performance computing systems will be proposed and experimentally investigated. The proposed algorithm will allow to solve complex combinatorial optimization problems encountered in various research and industry areas. The proposed principal solutions to create and parallelize the algorithm will contribute to further researches in development and parallelization of similar algorithms.

Research Council of Lithuania. (No. S-MIP-17-97/LSS-580000-1328) Prof. Habil. Dr. Antanas Žilinskas, 2017-2019.

Description: The goal of the project is the creation of a unified stochastic global optimization (GO) theory. It is aimed at the breakthrough in the development of GO algorithms which will be based on fundamental postulates of the theory of rational decision making under uncertainty supplemented by the statistical models which represent considered classes of problems. The research is aimed at the reduction of complexity of auxiliary computations, and increase of dimensionality of practically solvable problems. The research is focused on single objective algorithms but some theoretical results are also generalized for multi-objective case. In the field of random search, the rate of convergence of general algorithms in the case of large dimension is investigated. In particular, we study precision of statistical estimates of the global minimum in the case of large dimensions, and show the degree in which these estimates suffer the so-called curse of dimensionality. Additionally, we study advantages and disadvantages of the use of quasi-random points in place of the random ones in large dimensions. Special versions of the algorithms are developed for the perspective computer patented as “the infinity computer” and their theoretical efficiency is assessed. The results of application of the developed algorithm to a real world problem are provided.

International Research Projects

1. COST action **Network for Sustainable Ultrascale Computing (NESUS) IC1305**
Member of Managing Committee Dr. A. Lančinskas. 2014-2018,
http://www.cost.eu/COST_Actions/ict/Actions/IC1305

Description: Ultrascale systems are envisioned as large-scale complex systems joining parallel and distributed computing systems that will be two to three orders of magnitude larger than today's systems. The EU is already funding large scale computing systems research, but it is not coordinated across researchers, leading to duplications and inefficiencies. The goal of the NESUS Action is to establish an open European research network targeting sustainable solutions for ultrascale computing aiming at cross fertilization among HPC, large scale distributed systems, and big data management. The network will contribute to glue disparate researchers working across different areas and provide a meeting ground for researchers in these separate areas to exchange ideas, to identify synergies, and to pursue common activities in research topics such as sustainable software solutions (applications and system software stack), data management, energy efficiency, and resilience. Some of the most active research groups of the world in this area are members of this proposal. This Action will increase the value of these groups at the European-level by reducing duplication of efforts and providing a more holistic view to all researchers, it will promote the leadership of Europe, and it will increase their impact on science, economy, and society.

2. COST action **Improving Applicability of Nature-Inspired Optimisation by Joining Theory and Practice** (ImAppNIO) CA15140. Member of Managing Committee Dr. A. Lančinskas. 2016–2020.

Description: Nature-inspired search and optimisation heuristics are easy to implement and apply to new problems. However, in order to achieve good performance it is usually necessary to adjust them to the problem at hand. Theoretical foundations for the understanding of such approaches have been built very successfully in the past 20 years but there is a huge disconnect between the theoretical basis and practical applications. The development of powerful analytical tools, significant insights in general limitations of different types of nature-inspired optimisation methods and the development of more practically relevant perspectives for theoretical analysis have brought impressive advances to the theory-side of the field. However, so far impact on the application-side has been limited and few people in the diverse potential application areas have benefitted from these advances.

The main objective of the COST Action is to bridge this gap and improve the applicability of all kinds of nature-inspired optimisation methods. It aims at making theoretical insights more accessible and practical by creating a platform where theoreticians and practitioners can meet and exchange insights, ideas and needs; by developing robust guidelines and practical support for application development based on theoretical insights; by developing theoretical frameworks driven by actual needs arising from practical applications; by training Early Career Investigators in a theory of nature-inspired optimisation methods that clearly aims at practical applications; by broadening participation in the ongoing research of how to develop and apply robust nature-inspired optimisation methods in different application areas.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

1. Universidad de Almería (Spain)
2. Universidad de Murcia (Spain)
3. Universidad La Laguna (Spain)
4. Università della Calabria (Italy)
5. Cardiff University (UK)
6. New Jersey Institute of Technology (USA)

OTHER SCIENTIFIC ACTIVITIES

Prof. Dr. (HP) J. Žilinskas –

- Member of editorial boards of international journals:
 - *Informatica* (IOSPress/VU), <http://www.mii.lt/informatica/editors.htm>
 - *Information Technology and Control* (KTU),
<http://itc.ktu.lt/index.php/ITC/about/editorialTeam>
 - *Journal of Global Optimization* (Springer),
<http://www.springer.com/business+%26+management/operations+research/journal/10898?detailsPage=editorialBoard>
 - *Mathematical Methods of Operations Research* (Springer)
<http://www.springer.com/mathematics/journal/186/PSE?detailsPage=editorialBoard>
 - *Mathematical Modelling and Analysis* (Taylor&Francis/VGTU),
<http://www.tandfonline.com/action/journalInformation?show=editorialBoard&journalCode=tmma20>

- *Open Computer Science* (De Gruyter), <https://www.degruyter.com/view/j/comp>
- *Open Engineering* (De Gruyter), <https://www.degruyter.com/view/j/eng>
- *Optimization Letters* (Springer),
<http://www.springer.com/mathematics/journal/11590?detailsPage=editorialBoard>
- Chair of managing board of Continuous Optimization Working Group of The Association of European Operational Research Societies (EURO), <https://www.euro-online.org/websites/continuous-optimization/managing-board/>
- Member of board of Lithuanian Operational Research Society (member society of EURO and IFORS), head of working group Optimization Methods and Applications, <http://www.mii.lt/LitORS/>
- Member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), <http://www.hipeac.net>
- Member of Program/Scientific Committees
 - 9th International Workshop Data Analysis Methods for Software Systems, Druskininkai, Lithuania, November 30 - December 2, 2017.
 - PPAM 2017: 12th International Conference on Parallel Processing and Applied Mathematics Lublin, Poland, September 10-13, 2017.
 - Euro-Par 2017: International European Conference on Parallel and Distributed Computing, Santiago de Compostela, Spain, August 28 - September 1, 2017.
 - EUROPT 2017: 15th EUROPT Workshop on Advances in Continuous Optimization, Montreal, Canada, July 12-14, 2017.
 - LION11: 11th Learning and Intelligent Optimization Conference, Nizhny Novgorod, Russia, June 19-21, 2017.
 - GOC 2017: Global Optimization Conference, College Station, TX, USA, March 30 - April 1, 2017.

Prof. Habil. Dr. A. Žilinskas –

- Member of IFIP working group WG 7.6 Optimization-Based Computer Aided Modeling and Design, <http://www.ifip.org/bulletin/bulltcs/memtc07.htm>
- Member of American Mathematical Society <http://www.ams.org/cml>
- Member of programme committees of the following International conferences:
 - CompSysTech 2015, Dublin, Ireland, 25-26 June 2015
 - World Congress on Global Optimization, 2015, Gainesville, Florida, Fed 22-25, 2015
 - 8th Workshop on Computational Optimization, Lodz, Poland, 13-16 September, 2015
- Member of editorial boards of international journals:
 - *Journal of Global Optimization* (Springer),
<http://www.springer.com/business+%26+management/operations+research/journal/10898?detailsPage=editorialBoard>
 - *Informatica* (IOSPress/VU), <http://www.mii.lt/Informatica/editors.htm>
 - Control and Cybernetics, control.ibspan.waw.pl:3000/mainpage
 - *Statistics, Optimization and Information Computing*, www.iapress.org/index.php/soic
 - *Journal of Intelligent Learning Systems and Applications*,
<http://www.scirp.org/journal/jilsa/>
 - *International Journal of Grid and High Performance Computing*, <http://www.igi-global.com/Bookstore/TitleDetails.aspx?TitleId=1105&DetailsType=ReviewBoard>
 - *The Open Cybernetics and Systemics Journal*,
<http://www.bentham.org/open/tocsj/EBM.htm>
 - *Baltic Journal of Modern Computing* <http://www.bjmc.lu.lv/editorial-board/>

- Member of the Lithuanian Academy of Sciences, <http://lma.lt>
http://lma.lt/index.php?option=com_k2&view=item&layout=item&id=235&Itemid=243&lang=lt

Dr. A. Lančinskas –

- Affiliate member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), <http://www.hipeac.net>.
- Member of management committee of COST action IC1305 Network for Sustainable Ultrascale Computing (NESUS).
- Member of management committee of COST action CA15140 Improving Applicability of Nature-Inspired Optimisation by Joining Theory and Practice (ImAppNIO).
- Reviewer of international journals:
 - *Journal of Global Optimization*
 - *Central European Journal of Computer Science*
 - *Central European Journal of Engineering*
 - *Informatica*
 - *Optimization Letters*
 - *Computers & Operations Research*
 - *Baltic Journal of Modern Computing*

IMAGE AND SIGNAL ANALYSIS GROUP

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Head – Assoc. Prof. Dr. Povilas Treigys

STAFF

Senior research fellows: Assoc. Prof., Dr. Povilas Treigys.

Affiliated research fellows: Prof. Habil. Dr. K. Kazlauskas, Prof. Habil. Dr. Adolfas Laimutis Telksnys.

Research fellows: Dr. G. Korvel, Assoc. Prof., Dr. G. Tamulevičius.

Senior specialist: G. Navickas

Doctoral students: M. Morkūnas, J. Venskus.

RESEARCH INTERESTS

Audio and image signal processing; random processes analysis and recognition.

RESEARCH PROJECTS CARRIED OUT IN 2018

Project Supported by University Budget

Project title: Digital signal analysis and modelling.

Tasks in 2018:

- To develop machine learning based algorithms for histological image cell segmentation and classification.
- To explore speech signal feature spaces and build model for spoken word classification.

Main results:

- Developed model for histological image cell segmentation and classification.

- Explored audio signal feature spaces and built classifier. Developed test bet for Lithuanian speech phoneme automated segmentation.

International Research Projects

COST action „A new Network of European BioImage Analysts to advance life science imaging (NEUBIAS)“ Member of Managing Committee Assoc. Prof. Dr. P.Treigys 2016-2020

This Action is a programme for establishing a network of BioImage Analysts (BIAlysts), to maximize the impact of advances in imaging technology on the Life-Sciences (LSc), and to boost the productivity of bioimaging-based research projects in Europe. BIAlysts have recently emerged in various research institutions, but these experts are still not well recognised in the LSc community. The Action aims to provide a stronger identity to BIAlysts by organising a new type of meeting fostering interactions between all stakeholders including Life scientists, BIAlysts, microscopists, developers and the private sector.

Main results:

- Machine learning algorithms for tumour classification.
- Feature space analysis for machine based recognition.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

- Hospital Kauno klinikos of Lithuanian University of Health Sciences (Lithuania)
- Vilnius University Hospital Santaros klinikos (Lithuania)
- National Cancer Institute (Lithuania)
- JSC NetCode (Lithuania)
- Brno University of Technology (Czech Republic)
- Gdansk University of Technology, Faculty of Electronics, Telecommunications and Informatics, Audio Acoustics Laboratory

OTHER SCIENTIFIC ACTIVITIES

Assoc. Prof. Dr. P. Treigys –

- reviewer of the journal *Informatica*, <http://www.mii.lt/informatica>;
- reviewer of the journal *Nonlinear Analysis: Modelling and Control Journal*, <http://www.mii.lt/NA>;

Prof. Habil. Dr. A. L. Telksnys –

- member of Council on Digitization of Lithuanian Cultural Heritage;
- board member of the Ministry of Culture of the Republic of Lithuania Archives;
- member of the IEEE Technical Committee on eHealth;
- member of the Working group WG 7.1 Modeling and Simulation of the International Federation of Information Processing (IFIP);
- member of th Lithuanian Academy of Sciences;
- member of Commission of the Seimas of the Republic of Lithuania on Lithuanian traditions and heritage actualization;
- editorial board member of the international journals: *Informatica*, <http://www.mii.lt/Informatica/editors.htm>; *Information Technology and Control*, <http://www.itc.ktu.lt/index.php/ITC/about/editorialTeam>; *Tamkang Journal of Science and Engineering*, http://www2.tku.edu.tw/~tkjse/editorial_board-en.htm;
- editorial board member of the journal *Informacijos mokslai*, <http://www.leidykla.vu.lt/lt/mokslo-darbai/informacijos-mokslai/informacijos-mokslai-2011-55-tomas/redaktoriu-kolegija/>;

- Prepared the Concept of Lithuanian speech into Electronic Media Research Development in 2014–2020 *LIEPA 2*.

Prof. Habil. Dr. K. Kazlauskas –

- member of Lithuanian Computer Society, <http://www.liks.lt>;
- member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>;
- reviewer of international journals: *IEEE Trans. On Signal Processing*; *IEEE Trans. On Circuits and Systems*; *Informatica*; *Information Technology and Control*.

Assoc. Prof. Dr. G. Tamulevičius –

- reviewer for the international journals: *Informatica*, <http://www.mii.lt/Informatica/>; *Baltic Journal of Modern Computing*, www.lu.lv/baltic-journal-of-modern-computing;
- member of IEEE Computer society and Signal processing society sections.

Dr. G. Korvel –

- member of Lithuanian Computer Society, <http://www.liks.lt>;
- member of Lithuanian Society of Young Researchers. <http://www.ljms.lt/>;
- reviewer of international journals: reviewer of international journals: *Journal of the Audio Engineering Society* www.aes.org/journal; *Archives of Acoustics* acoustics.ippt.gov.pl; *Metrology and Measurement Systems* <http://www.metrology.pg.gda.pl>, *Journal of Intelligent Information Systems* <https://link.springer.com/journal/10844>; *Information Technology and Control* <http://itc.ktu.lt>;

INTELLIGENT TECHNOLOGIES RESEARCH GROUP

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Head – Dr. *Virginijus Marcinkevičius*

STAFF

Principal researchers: Prof. Habil. Dr. Leonidas Sakalauskas, Prof. Dr. Rimvydas Laužikas

Senior researchers: Dr. Virginijus Marcinkevičius, Prof. Dr. Saulius Minkevičius, Prof. Dr. Darius Plikynas

Affiliated researchers: Assoc. Prof. dr. Stasys Steišiūnas, Prof. Habil. Dr. Leonidas Sakalauskas

Researchers: Assoc. Prof. Dr. Igoris Belovas

Junior Researchers: Arūnas Miliauskas, Vytautas Dulskis

Specialists and engineering staff: Dr. Gintautas Jakimauskas, Dr. Vilma Zubaitienė, Raimundas Savukynas, Povilas Jurčys.

Doctoral students: Donatas Kavaliauskas, Julija Kurilova, Jūratė Vaičiulytė, Liudas Ališauskas, Albertas Jurgelevičius, Raimundas Savukynas, Mantas Stankevičius, Vytautas Dulskis, Paulius Vaitkevičius.

RESEARCH INTERESTS

- Machine learning and its application.
- Artificial intelligence and its application.
- Natural language processing.
- Cyber security.
- Mathematical modeling.
- Image analysis.

- Visual odometry and localization.
- Data mining and visualization.
- Application of modeling, classification and clustering methods in medicine (e.g. in genetics) and economics.
- Optimization. Application of stochastic optimization methods in engineering.
- Multi-agent systems: simulation and application in social research.

RESEARCH PROJECTS CARRIED OUT IN 2018

Projects Supported by University Budget

Project title: Application of statistical modeling and stochastic programming in big data analysis. Prof. Habil. Dr. L. Sakalauskas 2015–2018

Main results:

1. Developed planning algorithm for an experimental series using geometry of distance matrices with fractional degree indices
2. A recursive algorithm for hidden Markov chains was created.
3. Developed a novel metrics for the quantitative measuring of social capital and social cohesion.

Publications:

1. Jurgelevicius A. Sakalauskas L. (2018) Big Data Mining Using Public Distributed Computing. Information Technology and Control, Vol 47, No 2, pp. 236-248
2. Belovas I., Sakalauskas L. (2018) Limit Theorems For The Coefficients Of The Modified Borwein Method For The Calculation Of The Riemann Zeta-Function Values. Colloquium Mathematicum, Vol. 151, No 2, pp 217-227
3. A. Laukaitis, D. Plikynas, E. Ostasius (2018) Sentence Level Alignment of Digitized Books Parallel Corpora. Informatica. Vol. 29, No. 4, 1–18.

Project title: Theoretical and Engineering Aspects of e-Service Technology Development and Application in High - performance Computing Platforms.

Dr. Virginijus Marcinkevičius 2017– 2018.

Description: The goal of the project is to expand the capabilities of Web services technology development and use of these services in high performance computing platforms. The main tasks are such: to improve the access mechanisms to services and to enhance the analysis and realization techniques for service quality forecasting and matching the right, to develop the innovative solutions using Web services technologies for high performance computing platforms.

Main results:

1. Estimated supervised machine learning techniques for CERN CMS offline data certification.
2. Developed localization algorithm for UAV using particle filter and visual odometry.
3. Created a dataset of aerial imagery from robotics simulator.

Publications:

1. Stankevičius, Mantas; Marcinkevičius, Virginijus; Rapševičius, Valdas. Comparison of supervised machine learning techniques for CERN CMS offline data certification // Joint Proceedings of Baltic DB&IS 2018 Conference Forum and Doctoral Consortium co-located with the 13th International Baltic Conference on Databases and Information Systems (Baltic DB&IS 2018), Trakai, Lithuania, July 1-4, 2018 / edited by Audronė Lupeikienė, Raimundas Matulevičius, Olegas Vasilecas. Aachen : CEUR-WS. 2018, p. 170-176.
2. Jurevičius, R., Marcinkevičius, V., and Šeibokas J. (2018). Robust GPS Denied Localization for UAV Using Particle Filter and Visual Odometry. Machine Vision and Applications, Springer (in review).
3. Jurevičius, R., Marcinkevičius, V., AIR: A Dataset Of Aerial Imagery From Robotics Simulator. Robotics And Automation Letters (in review)

National Research Projects

Project title: Social Impact of Cultural Processes: Development of Metrics, Conceptual and Simulation Model. Dr. Darius Plikynas 2017– 2019.

Main goal is development of the measuring metrics, conceptual and agent-based simulation model aimed at investigation of the social impact of cultural processes.

Main results:

1. Conceptual modelling of social impact to the cultural processes (events, agents and objects) using CIDOC-CRM methodic.
2. Development of a novel metrics for the quantitative measuring of social capital and social cohesion.
3. Standardized ODD protocol (used for the development of the agent-based simulation tools) employment for the detailed (technical) description of the conceptual model.
4. Algorithmization and mathematical modelling using the detailed (technical) ODD description.
5. Selection and adaptation of an agent-based simulation platform [NetLogo](#), that is used for the programming implementation of the mathematical model.
6. Successful passing of the interim report reviewed by Lithuania science council experts.

Publications:

Accepted:

1. A. Laukaitis, D. Plikynas, E. Ostasius (2018) Sentence Level Alignment of Digitized Books Parallel Corpora. Informatica. Vol. 29, No. 4, 1–18.
2. D. Plikynas, L. Sakalauskas, R. Laužikas, A. Miliauskas, V. Dulskis. Agent-Based Simulation of Cultural Events Impact on Social Capital Dynamics. IntelliSys2019 conference proceedings in the Springer series "Advances in Intelligent Systems and Computing".

In review:

1. R. Laužikas, D. Plikynas, L. Sakalauskas, A. Miliauskas, V. Dulskis. A Conceptual Model for Social Impact of Cultural Processes. Social Indicators Research. (WoS, IF=1,65)
2. D. Plikynas, L. Sakalauskas, A. Raudys. Conceptual Modelling of Brain State Dynamics as Free Energy and Entropy-based Processes. Journal of Biological physics (WoS, IF=1,0).

Conference announcements:

R. Laužikas, D. Plikynas, L. Sakalauskas. A Conceptual Model for Social Impact of Cultural Processes. *Conference CAA-2018*, Tübingen, 2018.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INOVATION) PARTNERS

SAP (Germany)

Neurotechnology (Lithuania)

University of Tartu (Estonia)

Vilnius Gediminas Technical University (Lithuania)

Ghent University (Belgium)

Warsaw University of Technology (Poland)

Lithuanian Culture Research Institute (Lithuania)

OTHER SCIENTIFIC ACTIVITIES

Prof. L. Sakalauskas –

- Editorial board member of Journal Technological and Economic Development of Economy <http://www.tandf.co.uk/journals/journal.asp?issn=2029-4913&linktype=145>
- Elected member of International Statistical Institute (2001) <http://isi-web.org>;
- Member of European Working Group on Continuous Optimization <http://www.iam.metu.edu.tr/EUROPT>
- Member of European Working Group on Stochastic Optimisation <http://www.mii.lt/EWGSO>
- Member of European Working Group on Civil Engineering and Sustainable Development <http://http://www.orsdce.vgtu.lt>
- President of Lithuanian Operational Research Society, <http://www.mii.lt/LitORS>
- Chair of Lithuanian Conference on Operations Research and Application in Business and Technics <http://www.mii.lt/OT-2016>.
- Reviewer of international journals:
 - Annals of Operation Research (Springer)
 - European Journal of Operational Research (Elsevier)
 - Informatica(IOSPress/VU)
 - Central European Journal of Operational Research (Springer),
 - Information Technology and Control (KTU),
 - International Transactions on Operational Research (Wiley&Sons)
 - Methodology and Computing in Applied Probability (Springer)
 - Technological and Economic Development of Economy (Francis&Taylor)

Prof. D. Plikynas -

- Reviewer in
 - Computational and Mathematical Organization Theory (Springer)
 - Entropy (MDPI)
 - PeerJ
 - Economics (VU)
 - Information Technology and Control (KTU)
- Member of
 - Artificial Intelligence section of Lithuanian Computer Society (LIKS-AIS)
 - ESSA (European Social Simulation Association)
 - ECCAI (European Coordinating Committee for Artificial Intelligence)

Assoc. Prof. Dr. I. Belovas –

- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Reviewer of international journal Mathematical Modelling and Analysis (Taylor & Francis)

Assoc. Prof. Dr. S. Minkevičius –

- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Reviewer of international journal Informatica (IOSPress/VU)

Dr. V. Marcinkevičius –

- Member of Council of Lithuanian Computer Society, <http://www.liks.lt/en/modules/tinycontent/index.php?id=3>
- Member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Member of Lithuanian Operational Research Society, <http://www.mii.lt/LitORS/>
- Member of European Working Group on Stochastic Optimisation <http://www.mii.lt/EWGSO>
- Reviewer of international journal Informatica (IOSPress/VU)

STATISTICS AND PROBABILITY GROUP

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Head – Prof. Habil. Dr. Kęstutis Kubilius

STAFF

Principal researchers: Prof. Habil. Dr. Kęstutis Kubilius

Dr. Saulius Norvidas

Dr. Stasys Rutkauskas (until 28 October)

Senior researchers:

Dr. Otera Daniele Ettore

Dr. Marijus Radavičius

Prof. Habil. Dr. Rimantas Rudzkis

Dr. Marijus Vaičiulis

Researchers:

Dr. Arvydas Astrauskas

Dr. Andrius Čiginas

Dr. Dainius Dzindzalieta

Dr. Valentas Kurauskas

Affiliated researchers: Dr. Juozas Juvencijus Mačys

Prof. Dr. Remigijus Mikulevičius

Prof. Habil. Dr. Jonas Kazys Sunklodas

Emerite:

Professor Emeritus Mifodijus Sapagovas

Doctoral students:

Monika Lapėnaitė Gedvilė

Aidas Medžiūnas

Rūta Užupytė

RESEARCH INTERESTS: statistical inference for long memory processes, statistical hypothesis testing, heavy tails, self-similar processes, rough paths, econometrics, biostatistics, finite population statistics and statistical analysis of data, extremal problems in harmonic analysis, random graphs, combinatorics, discrete mathematics, algebraic geometry.

RESEARCH PROJECTS CARRIED OUT IN 2018

Projects Supported by University Budget

Analysis of probabilistic models and the study of asymptotic properties. Prof. Habil. Dr. K. Kubilius. 2017–2019.

Several inequalities of the Littlewood – Offord type for arbitrary groups are established. The resulting inequalities are optimal if the base group contains an element of a certain order.

The *stability* of a finite difference scheme for Schrödinger, Kuramoto–Tsuzuki and parabolic equations, subject to *non-local* conditions with *complex* coefficients, is dealt with. The stability conditions, which have to be met by complex coefficients in non-local conditions, have been determined.

Main publications:

1. **Kubilius, Kęstutis;** Mishura, Yuliya; Ralchenko, Kostiantyn. Parameter estimation in fractional diffusion models. Cham : Springer International Publishing, 2017. XIX, 390 p. (Bocconi & Springer Series, ISSN 2039-1471, eISSN 2039-148X ; vol. 8). ISBN 9783319710297. eISBN 9783319710303. DOI: 10.1007/978-3-319-71030-3
2. **Sapagovas, Mifodijus;** Meškauskas, Tadas; Ivanauskas, Feliksas. Influence of complex coefficients on the stability of difference scheme for parabolic equations with non-local conditions // Applied mathematics and computation New York : Elsevier Science. ISSN 0096-3003. eISSN 1873-5649. 2018, Vol. 332, p. 228-240. DOI: 10.1016/j.amc.2018.03.072

OTHER SCIENTIFIC ACTIVITIES

Prof. K. Kubilius –

- co-editor-in-chief of the *Modern Stochastics: Theory and Applications*, <https://www.i-journals.org/vtxpp/VMSTA/> ;
- editorial board member of the *Lithuanian Mathematical Journal*, <http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member of the *Mathematical Modelling and Analysis*, <http://inga.vgtu.lt/~art/> ;
- board member of the Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/index_en.html.
- Member of 12-th International Vilnius conference on Probability theory and mathematical statistics and 2018 IMS Annual meeting on Probability and statistics <http://ims-vilnius2018.com/organization/>; Organizer of invited session on this <http://ims-vilnius2018.com/invited-sessions/conference>

Prof. S. Norvidas –

- editorial board member of the *Lithuanian Mathematical Journal*,
<http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>.

Doc. M. Radavičius –

- editorial board member of the *Lithuanian Mathematical Journal*,
<http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member of the *Modern Stochastics: Theory and Applications*,
<https://www.i-journals.org/vtxpp/VMSTA/> .

Prof. R. Rudzkis –

- editorial board member of the *Lithuanian Mathematical Journal*,
<http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member of the journal *Прикладная эконометрика*,
<http://www.applieconometrics.ru/r/board/>;
- editorial board member of the journal *Lietuvos statistikos darbai (Statistics Journal)*,
<http://www.statisticsjournal.lt>;
- editorial board member of the journal *Pinigų studijos (Monetary Studies)*,
http://www.lb.lt/pinigu_studijos_redkolegija.

Prof. M. Sapagovas –

- editorial board member of the *Lithuanian Mathematical Journal*,
<http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member of the journal *Nonlinear Analysis: Modelling and Control*,
<https://www.mii.lt/NA/>

Prof. S. Rutkauskas –

- editorial board member of the *Lithuanian Mathematical Journal*,
<http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member of the journal *Mathematical Modelling and Analysis*,
<http://inga.vgtu.lt/~art/> .