



VU Institute of Mathematics and Informatics

Annual Report 2016



Akademijos str. 4, LT-08663 Vilnius
Tel. (+370 5) 210 9300, fax (+370 5) 272 9209
E-mail: info@mii.vu.lt
<http://www.mii.lt>

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

STAFF

73 research fellows (including 11 doctors habilitatus and 51 doctors),
54 doctoral students.

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1. RESEARCH AREAS

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

2. DOCTORAL DISSERTATIONS MAINTAINED IN 2016

Agnė SKUČAITĖ – in *Mathematics (01 P)* – defended on [28th of September](#), 11:00 a.m.
Scientific Supervisor: *prof. dr. Artūras Štikonas*;

["Investigation of the spectrum for Sturm-Liouville problem with a nonlocal integral condition"](#) [EN] ([summary](#) [LT])

Vytautas JANČAUSKAS – in *Physical sciences, Informatics – 09 P* – defended on [8th of June](#),

Scientific Supervisor: *Prof. habil. dr. Antanas Žilinskas*;

["Evaluating the Performance of Multi-objective Particle Swarm Optimization Algorithms"](#) [EN] ([summary](#) [EN], [LT])

Mindaugas KURMIS – in *Informatics Engineering – 07 T* – defended on the [27th of May](#),

Scientific Supervisor: *Prof. dr. Dalė Dzemydienė*;

["Development of heterogeneous services integration capabilities for changing topology vehicular communication networks"](#) [LT] ([summary](#) [EN], [LT])

3. MAIN CONFERENCES ORGANIZED IN 2016

7th International Doctoral Consortium *Informatics Engineering Education Research*,

November 30 – December 3, 2015, Druskininkai, Lithuania

<http://ims.mii.lt/ims/renginiai/Consortium/consortium.htm>

8th International Seminar *Data Analysis Methods for Software Systems*,

December 3–5, 2015, Druskininkai, Lithuania

https://www.mii.lt/damss/index.php?page=DAMSS_2016&lang=en

4. DEPARTMENTS OF THE INSTITUTE

4.1 DEPARTMENT OF INFORMATICS METHODOLOGY

Akademijos str. 4 , LT-08663 Vilnius

Tel. (+370 5) 210 9732

E-mail: valentina.dagiene@mii.vu.lt

Head - Prof. Dr. *Valentina Dagiene*

STAFF

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

Senior research fellow: Dr. J. Kurilov.

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

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

Junior research fellows: Dr. E. Jasutė.

Specialists: V. Dagsys, Dr. B. Skūpas, Dr. J. Skūpienė, G. Stupurienė, L. Vinikienė.

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

RESEARCH INTERESTS.

Application of Intelligent Technologies in Education

Computer Science Education
Computing Engineering Education Research
Personalised Learning
Software Localisation
Technology Enhanced Learning

RESEARCH PROJECTS CARRIED OUT IN 2016

Projects Supported by University Budget

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

Main results:

The engineering solutions for improving teaching and learning by implementing intelligent technologies were created; the personalised learning methods and activities as well as ontologies to teach and learn informatics engineering were created. The personalised engineering solutions for mobile learning were created; The e-learning recommendations based on semantic web were created. The methodologies to evaluate the quality of distance learning courses and learning object repositories were created; The computational thinking operational model; research on its application in general education and in Informatics competition "Bebras" were created.

Main publications:

1. J. Kurilov, I. Vinogradova, S. Kubilinskienė. New MCEQLS fuzzy AHP methodology for evaluating learning repositories: a tool for technological development of economy // Technological and economic development of economy. Vilnius ; London: Technika ; Routledge-Taylor & Francis group. ISSN: 2029-4913, eISSN: 2029-4921. 2016, Vol. 22, no 1, p. 142-155. (IF=1.952)
2. J. Kurilov. Evaluation of quality and personalisation of VR/AR/MR learning systems // Behaviour & Information Technology. Oxford: Taylor & Francis. ISSN: 0144-929X, eISSN: 1362-3001. 2016, Vol. 35, No. 11, p. 998-1007. (IF=1.211)
3. E. Jasutė, S. Kubilinskienė, A. Juškevičienė, J. Kurilov, Personalised learning methods and activities for computer engineering education // International journal of engineering education. Dublin: Tempus Publications. ISSN: 0949-149X. 2016, Vol. 32, No. 3, Part A, p. 1078-1086. (IF=0.559)
4. J. Kurilov, V. Dagienė. Computational thinking skills and adaptation quality of virtual learning environments for learning informatics // International journal of engineering education. Dublin: Tempus Publications. ISSN: 0949-149X. 2016, Vol. 32, no 4, p. 1596-1603. (IF=0.559)

International Research Project

F7-SCIENCE-IN-SOCIETY-2012-1 **Mathematics and Science for Life** – MaScil. Consortium Agreement for the Project *Mascil* 2013-06-12 Nr. 320.693, Coordinator: Pädagogische Hochschule Freiburg (Germany), Partners: Austria, Greece, Netherlands, Spain, Lithuania, Cyprus, United Kingdom, Czech Republic, Norway, Germany, Bulgaria, Romania, Turkey.

International Projects

Erasmus+ KA2 **Intercultural Learning in Mathematics and Science:** Initial Teacher Education (IncluSMe), 2016-1-DE01-KA203-002910. Coordinator: Pädagogische Hochschule

Freiburg (German). Partners: Czech Republic, Greece, Spain, Cyprus, Lithuania, Malta, Netherlands, Norway, Slovakia, Sweden

Erasmus+ CBHE **Structuring cooperation in doctoral research, transferrable skills training, and academic writing instruction in Ukraine's regions** / DocHub, Project N: 8 574064-EPP-1-2016-1- LT-EPPKA2-CBHE-SP. Coordinator: Vilnius University (Lithuania). Partners: France, Finland, Sweden, Ukraine

Nordplus Horizontal NordNICE: **Nordplus Network of Innovative Computing Education** (No. NPHZ 2015/1053). Coordinator: Vilnius University IMI (Lithuania). Partners: Estonia, Latvia, Lithuania, Finland, Sweden.

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

Aalto University (Finland)
University of Eastern Finland of Joensuu and Kuopio (Finland)
Freie Universitaet Berlin (Germany)
Radboud University Nijmegen (The Netherlands)
Lithuanian Computer Society (Lithuania)

OTHER SCIENTIFIC ACTIVITIES

Prof. V. Dagienė –

- editor-in-Chief of the journal *Informatics in Education*, http://www.mii.lt/informatics_in_education/ (Thomson Reuters Web of Science Core Collection);
- editor of the journal *Olympiads in Informatics* (Scopus);
- coordinator of the Nordplus Network on Innovative Computing Education;
- representative of Lithuania in Education Committee TC3 under the International Federation for Information Processing (IFIP);
- member of Steering Committee of International Olympiads in Informatics.

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.iariajournals.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)

4.2 DEPARTMENT OF NUMERICAL ANALYSIS

Akademijos str. 4, LT-08663 Vilnius

Tel. (+370 5) 210 9734

E-mail: kristina.skucaite-bingele@mii.vu.lt

Head – Assoc. Prof. Dr. *Artūras Štikonas*

STAFF

Principal researcher: Doc. Dr. Artūras Štikonas.

Senior researcher: Prof. Dr. Stasys Rutkauskas

Researcher: Dr. Regimantas Čiupaila.

Affairs manager: Kristina Skučaitė-Bingelė.

Research fellows: Gailė Paukštaitė, Dr. Jurij Novickij

Professor Emeritus: Mifodijus Sapagovas

Doctoral student: Kristina Skučaitė-Bingelė (*Mathematics*)

RESEARCH INTERESTS

Differential equations and applications. Investigation of the spectrum and boundary value problems for differential and difference operators with nonlocal conditions, investigation of degenerate at line elliptic equation.

RESEARCH PROJECTS CARRIED OUT IN 2015

Projects Supported by University Budget

1SM1.68. Boundary value problems with nonlocal conditions and boundary value problems for singular elliptic operators (2016–2018), Supervisor **A. Štikonas**:

The Dirichlet type boundary value problem for elliptical equation in the cylindrical area, equation is degenerating in cylinder axis was investigated. The existence and uniqueness of the solution is proved in a class of smooth function.

The convergence of an iterative method for finite difference scheme approximating two-dimensional elliptic equation with variable coefficients and integral boundary conditions was investigated.

The generalized Green's function for the m -order linear discrete problems with m nonlocal conditions was considered.

1. **S. Rutkauskas.** Exact solutions of Dirichlet type problem to elliptic equation, which type degenerates at the axis of cylinder. I, *Boundary Value Probl.* (2016). 2016:183 DOI 10.1186/s13661-016-0690-8

2. **S. Rutkauskas.** Exact solutions of Dirichlet type problem to elliptic equation, which type degenerates at the axis of cylinder. II, *Boundary Value Problems* (2016) 2016:182 DOI 10.1186/s13661-016-0691-7
3. **M. Sapagovas, O. Štikonienė, R. Čiupaila, Ž. Jokšienė.** Convergence of iterative methods for elliptic equations with integral boundary conditions. *Electronic Journal of Differential Equations*. 2016(118): 1–14, 2016.

National Research Projects

Research Council of Lithuania. Investigation of stationary problems with nonlocal conditions, numerical analysis and applications (No. MIP-047/2014). A. Štikonas. 2014–2016.

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

Belarus State University, Minsk (Belarus)

OTHER SCIENTIFIC ACTIVITIES

Prof. Dr. A. Štikonas -

- Deputy-Editor-in-Chief of the journal “*Nonlinear Analysis: Modelling and Control*”.
- Editorial board member of the journal “*Mathematical Modelling and Analysis*”.
- Editorial board member of the “*Lithuanian Mathematical Journal*”;

M. Sapagovas –

- Editorial board member of journal “*Lithuanian mathematical journal*”;
- Editorial board member of journal “*Nonlinear Analysis: Modelling and Control*”.

S. Rutkauskas –

- Editorial board member of journal “*Lithuanian mathematical journal*”.
- Associate Editor of journal “*Lietuvos matematikos rinkinys. Proc. of the Lithuanian Mathematical Society, Ser. A*” and Ser. B.
- Editorial board member of journal “*Mathematical Modelling and Analysis*”.

4.3 DEPARTMENT OF PROBABILITY THEORY AND STATISTICS

Akademijos str. 4, LT-08663 Vilnius
 Tel. (+370 5) 210 9731
 E-mail: kestutis.kubilius@mii.vu.lt

Head – Prof. Dr. Habil. *Kęstutis Kubilius*

Principal researchers: Prof. Habil. Dr. Kęstutis Kubilius
 Prof. Habil. Dr. Artūras Dubickas (discharged since 30 June 2016)
 Affiliated scientist Prof. Dr. Liudas Giraitis
 Prof. Habil. Dr. Remigijus Leipus
 Affiliated scientist Dr. Juozas Juvencijus Mačys
 Prof. Habil. Dr. Eugenijus Manstavičius
 Affiliated scientist Prof. Dr. Remigijus Mikulevičius
 Prof. Habil. Dr. Rimas Norvaiša (discharged since 30 June 2016)

Dr. Saulius Norvidas
Prof. Habil. Dr. Jonas Kazys Sunklodas
Prof. Habil. Dr. Donatas Surgailis (discharged since 30 August 2016)

Senior researchers: Dr. Arvydas Astrauskas
Dr. Olga Januškevičienė
Dr. Marijus Vaičiulis
Dr. Marijus Radavičius
Prof. Habil. Dr. Rimantas Rudzkis

Researchers: Andrius Čiginas
Dr. Valentas Kurauskas
Dr. Viktor Skorniakov
Dr. Dainius Dzindzalieta

Specialists: Šarūnas Dirmeikis
Ieva Grublytė
Vytautė Pilipauskaitė
Raivydas Šimėnas (discharged since 30 June 2016)

Affairs manager: Jurgita Zinkevičienė

Doctoral students: Vygantas Butkus
Šarūnas Germanas
Ieva Grublytė
Vytautė Pilipauskaitė
Andrius Škarnulis
Šarūnas Dirmeikis
Lina Dreižienė
Monika Lapėnaitė Gedvilė
Rūta Užupytė

RESEARCH INTERESTS: statistical inference for long memory processes, statistical hypothesis testing, heavy tails, aggregation, random fields, self-similar processes, Levy processes, rough paths, concrete functional calculus, random Hamiltonians, finite population statistics and statistical analysis of data, extremal problems in harmonic analysis, random graphs, combinatorics, discrete mathematics.

RESEARCH PROJECTS CARRIED OUT IN 2016

Projects supported by the Research Council of Lithuania:

Existence of solutions of stochastic differential equations and estimation of parameters
SDL (no. MIP-048/2014) K.Kubilius, 2014-2016.

Main results:

Properties of random fields and their relation to extreme value theory for eigenvalues of the Anderson Hamiltonian and Anderson parabolic model localization properties were considered.

At observation of a large number of AR(1) time series with random autocorrelation coefficient by methods of nonparametric statistics was estimated the distribution of this coefficient and was proved consistency and asymptotic normality of the estimator.

Main publications:

1. **Astrauskas, Arvydas**. From extreme values of i.i.d. random fields to extreme eigenvalues of finite-volume Anderson Hamiltonian // Probability surveys. Berkeley: Probability surveys, 2016, Vol. 13, p. 156-244.
2. **Leipus, Remigijus**; Philippe, Anne; **Pilipauskaitė, Vytautė**; **Surgailis, Donatas**. Nonparametric estimation of the distribution of the autoregressive coefficient from panel random-coefficient AR(1) data // Journal of multivariate analysis, 2017, Vol. 153, p. 121-135.

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.

Prof. A. Dubickas --

- editorial board member of *Uniform Distribution Theory* <https://math.boku.ac.at/udt/>;
- editorial board member of *European Journal of Mathematics*;
- editorial board member of *Conference Papers in Mathematics* <http://www.springer.com/mathematics/algebra/journal/40879/PSE?detailsPage=editorialBoard>;
- section editor of *Lithuanian Mathematical Journal* <http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member of *Šiauliai Mathematical Seminar* http://www.su.lt/index.php?option=com_content&view=article&id=16758&Itemid=17530&lang=en.

Prof. R. Leipus --

- editorial board member of *Lithuanian Mathematical Journal* <http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- editorial board member editor of *Pinigų studijos (Monetary Studies)* https://www.lb.lt/pinigu_studijos_redkolegija

Prof. E. Manstavičius –

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

- editorial board member of the *International Journal of Number Theory*,
<http://www.worldscientific.com/page/ijnt/editorial-board>;
- editorial board member of the *ISRN Combinatorics*,
<http://www.isrn.com/journals/combinatorics/editors/>;
- member of the Lithuanian Academy of Sciences,
http://lma.lt/index.php?option=com_k2&view=item&layout=item&id=366&Itemid=230&lang=en .

Prof. R. Norvaiša --

- Managing editor of *Lithuanian Mathematical Journal*
<http://www.springer.com/mathematics/journal/10986?detailsPage=editorialBoard>;
- Associate editor of *North-Western European Journal of Mathematics*
<http://math.univ-lille1.fr/~nwejm/>.

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. D. Surgailis --

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

4.4 DEPARTMENT OF RECOGNITION PROCESSES

Akademijos 4, LT-08663 Vilnius

Tel. (+370 5) 210 9304

E-mail: julius.zilinskas@mii.vu.lt

Head – Prof. Dr. (HP) *Julius Žilinskas*

STAFF

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

Senior researchers:, Assoc. Prof. Dr. Rimantas Pupeikis, Dr. Remigijus Paulavičius

Affiliated researchers: Prof. Habil. Dr. Adolfas Laimutis Telksnys

Researchers: Dr. Algirdas Lančinskas, Dr. Gražina Korvel, Dr. Gintautas Tamulevičius

Junior researchers: Gražina Gimbutienė

Specialists, engineering and expert staff: Jonas Kaukėnas

Doctoral students: Deividas Eringis, Giedrius Graževičius, Rima Kriauzienė, Ieva Meržvinskaitė, Robertas Smaliukas, Linas Stripinis, Eglė Zikarienė

RESEARCH INTERESTS

Random processes analysis and recognition.

Optimization and high-performance computing.

RESEARCH PROJECTS CARRIED OUT IN 2016

Project Supported by University Budget

Project title: Analysis, recognition, optimization, and control of non-linear systems and signals with complex structure Prof. Dr. (HP) J. Žilinskas

Description: Optimization algorithms for speech models, engineering structures, location and other problems. Analysis of the information protection methods and cryptanalysis strength enhancement. Identification and management methods algorithms of self-regulation of nonlinear systems, consisting of a linear block and a static nonlinearity combinations, analysis by the way of computer simulation.

Main results:

1. Proposed and investigated optimization algorithms;
2. Proposed and investigated an algorithm for the design of the substitution tables of the block cipher systems;
3. The fast Fourier transform procedure is modified in order to calculate the spectrum values in real time applications, when in a fixed period a small portion of old observations is changed by a new one;
4. A harmonic generator is applied for Lithuanian vowel synthesis. An autoregressive model based speech analysis is applied for spectral estimation, evaluation of phonation process and vocal fold functionality.

Publications:

- Korvel, Gražina; Šimonytė, Virginija; Slivinskas, Vytautas. A phoneme harmonic generator // Information technology and control = Informacinės technologijos ir valdymas, ISSN: 1392-124X, 45(1) 7-12, 2016.
- Kazys Kazlauskas, Rimantas Pupeikis. Advanced methods for short signal spectrum estimation // Shaker Verlag, Aachen, 2016.
- R. Paulavičius, J. Žilinskas (2016) Advantages of simplicial partitioning for Lipschitz optimization problems with linear constraints. Optimization Letters, ISSN 1862-4472, 10(2), 237-246. doi:10.1007/s11590-014-0772-4

National Research Project

1. Research Council of Lithuania. **Creation and development of algorithms for global optimization** (No. MIP-051/2014) Prof. Dr. (HP) J. Žilinskas. 2014-2016.

Description: The aim of the project is to create and develop global optimization algorithms. Statistical, heuristic, and deterministic algorithms, their hybrids and parallel versions are developed and investigated in this project. We will aim to investigate which algorithms on which problems perform better and propose recommendations for solution of practical optimization problems.

International Research Projects

1. COST action **Mathematical Optimization in the Decision Support Systems for Efficient and Robust Energy Networks TD1207** Member of Managing Committee Prof. Dr. (HP) J. Žilinskas. 2013-2017, http://www.cost.eu/domains_actions/ict/Actions/TD1207?management

Description: Energy Production and Distribution (EP&D) is among the biggest challenges of our time, since energy is a scarce resource whose efficient production and fair distribution is associated with many technical, economical, political and ethical issues like environmental protection and people health. EP&D networks have rapidly increased their size and complexity, e.g. with the introduction and interconnection of markets within the EU. Thus, there is an increasing need of systems supporting the operational, regulatory and design decisions through a highly inter-disciplinary approach, where experts of all the concerned fields contribute to the definition of appropriate mathematical models. This is particularly challenging because these models require the simultaneous use of many different mathematical optimization tools and the verification by experts of the underlying engineering and financial issues.

2. 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.

3. COST action **Improving Applicability of Nature-Inspired Optimisation by Joining Theory and Practice (ImAppNIO) CA15140** Member of Managing Committee Dr. A. Lančinskas. 2016-2020, http://www.cost.eu/COST_Actions/ca/CA15140

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 INOVATION) PARTNERS

1. Hospital Kauno klinikos of Lithuanian University of Health Sciences (Lithuania)
2. Vilnius University Hospital Santariskiu klinikos (Lithuania)

3. UAB “Algoritmu sistemas” (Lithuania)
4. UAB “Inogama” (Lithuania)
5. Universidad de Almería (Spain)
6. Universidad de Murcia (Spain)
7. Università della Calabria (Italy)

OTHER SCIENTIFIC ACTIVITIES

Prof. Dr. (HP) J. Žilinskas –

- Member of editorial boards of international journals:
 - *Central European Journal of Computer Science* (Springer/Versita), <http://www.springer.com/computer/journal/13537?detailsPage=editorialBoard>
 - *Central European Journal of Engineering* (Springer/Versita), <http://www.springer.com/engineering/journal/13531?detailsPage=editorialBoard>
 - *Informatica* (IOSPress/VU), <http://www.mii.lt/informatica/editors.htm>
 - *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>
 - *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), http://europt.iam.metu.edu.tr/h_contactyeni.html
- 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
 - GOW 2016: XIII Global Optimization Workshop, Braga, Portugal, September 4-8, 2016.
 - MOD 2016: The International Workshop on Machine learning, Optimization and big Data, Volterra, Italy, August 26-29, 2016.
 - EUROPT 2016: 14th EUROPT Workshop on Advances in Continuous Optimization, Warsaw, Poland, July 1-2, 2016.
 - NUMTA2016: The 2nd International Conference and Summer School on Numerical Computations: Theory and Algorithms, Calabria, Italy June 19-25, 2016.

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 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 journal *Informatica*, <http://www.mii.lt/Informatica/editors.htm>
- Editorial board member of the international journal *Information Technology and Control*, <http://www.itc.ktu.lt/index.php/ITC/about/editorialTeam>
- 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/>
- Editorial board member of the international journal *Tamkang Journal of Science and Engineering*, http://www2.tku.edu.tw/~tkjse/editorial_board-en.htm
- 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. R. Pupeikis –

- Reviewer for the international journals:
 - *Informatica*, <http://www.mii.lt/Informatica/>
 - *Information Technology and Control*
 - *Journal of Zhejiang University*
 - *Measurement*
 - *Signal Processing*
 - *Applied Mathematical Modelling*
- member of Lithuanian Computer Society, <http://www.liks.lt>;
- member of Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>;
- member of Lithuanian Scientific Society, <http://www.lms.lt/?q=en/members>.

Dr. G. Tamulevičius –

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

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).
- Reviewer of international journals:
 - *Journal of Global Optimization*
 - *Central European Journal of Computer Science*
 - *Central European Journal of Engineering*

- *Informatica*
- *Optimization Letters*
- *Baltic Journal of Modern Computing*

Dr. R. Paulavičius –

- Affiliate member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), <http://www.hipeac.net>.
- 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*

Dr. Gražina Korvel –

- Member of Lithuanian Computer Society, <http://www.liko.lt>;
- Member of Lithuanian Society of Young Researchers <http://www.ljms.lt/>;
- Reviewer of international journals:
- *Information Technology and Control*

4.5 DEPARTMENT OF SOFTWARE ENGINEERING

Akademijos 4, LT-08663 Vilnius

Tel. (+370 5) 2109 340, fax (+370 5) 2729209

E-mail: saulius.gudas@mii.vu.lt

WWW: <http://www.mii.lt/PSIS/indexEN.php>

Head – Prof. Dr. *Saulius Gudas*

STAFF

Chief research fellows: Prof. Dr. Saulius Gudas, Prof. Dr. D. Dzemydienė (part-time).

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

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

Chief Specialist: Prof. Dr. A. Čaplinskas.

Assistant research fellow: L. Paliulionienė.

Doctoral students: A. Miliauskas, A. Šaikūnas, A. Valatavičius, E. Žulkas, M. Jusis, R. Savukynas.

Sector of Mathematical Logic

Research fellows: Dr. R. Alonderis, Assoc. Prof. Dr. J. Sakalauskaitė.

Affiliated principal researcher: Prof. Habil. Dr. S. Jukna.

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

RESEARCH INTERESTS

Information system engineering:

- Theoretical foundations
- Model driven development

Software engineering:

- Software service engineering
- Computer-aided software engineering

Knowledge-based systems

Mathematical Logic:

- Proof theory of non-classical logics
- Automated deduction
- Decision procedures
- Boolean function complexity
- Lower bounds

RESEARCH PROJECTS CARRIED OUT IN 2016

Projects Supported by University Budget

Research of software engineering methods arrangement with semantic modelling methods of business management. Construction of calculi and solving procedures for modal logics and lower bounds of complexity for discrete optimisation problems Prof. Dr. S. Gudas (leader), Prof. Dr. A. Čaplinskas, Prof. Dr. D. Dzemydienė, Assoc. Prof. Dr. A. Lupeikienė, Dr. S. Maskeliūnas, Dr. J. Miliauskaitė, A. Miliauskas, A. Šaikūnas, L. Paliulionienė. Assoc. Prof. Habil. Dr. R. Pliuškevičius, Dr. R. Alonderis, Habil. Dr. S. Jukna, Assoc. Prof. Dr. J. Sakalauskaitė. 2015-2017.

Main results obtained in 2016:

1. An internal modeling paradigm is defined and used for model-driven enterprise software development technique, which begins with the semantic modeling of causal dependencies of business management activities from the self-managed systems viewpoint. The key concepts of *management transaction* and *management functional dependency* ensure the integrity of data, knowledge and goals modeling at business management level. Two frameworks are deployed for internal modeling: Detailed supply chain model (DTGM) is helpful for identification of the management transactions, and Elementary management cycle is effective for specification of goal-driven management information transformations.
2. First general lower bounds for tropical (min,+) and (max,+) circuits solving non-homogeneous optimization problems are obtained. Previously known lower bounds held only in the case of homogeneous problems. The first truly-exponential lower bound for tropical circuits is found. General lower bounds for counting arithmetic (+,x) circuits are obtained. Previously only a lower bound for one problem was known: counting the number of perfect matchings in bipartite graphs. A proof is provided that the classical Bellman-Ford shortest path dynamic programming algorithm is optimal. The powers of tropical and counting circuit are proved to be incomparable.

Publications:

1. S. Gudas, A. Lopata. Towards internal modelling of the information systems application domain. *Informatica*, 2016, Vol. 27, No. 1, p. 1-29. ISSN 0868-4952.
2. S. Gudas. Information Systems Engineering and Knowledge-Based Enterprise Modelling: Towards Foundations of Theory. In: Androniki Kavoura et al. (eds.), *Strategic Innovative Marketing, Springer Proceedings in Business and Economics*, 2016, p. 481-497. ISBN 978-3-319-33865-1.
3. S. Jukna. Lower bounds for monotone counting circuits. *Discrete Applied Mathematics (Elsevier)*, Vol. 213, 2016, p. 139-152. ISSN: 0166-218X.
4. S. Jukna and G. Schnitger. On the optimality of Bellman-Ford-Moore shortest path algorithm. *Theoretical Computer Science (Elsevier)*, Vol. 628 (2016), p. 101-109.

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

University of Latvia (Latvia)
 University of Tartu (Estonia)
 University of Maribor (Slovenia)
 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>;
- editorial board member of the journal *Informacijos mokslai*, <http://www.vu.lt/leidyba/lt/mokslo-zurnalai/informacijos-mokslai/redakcine-kolegija>.
- reviewer of the journal *Enterprise Information Systems (EIS)*, <http://www.tandfonline.com/toc/teis20/current>;
- reviewer of the *Baltic Journal of Modern Computing*, <http://www.bjmc.lu.lv/>;
- reviewer of the *Journal of Systemics, Cybernetics and Informatics (JSCI)*, <http://www.iiisci.org/journal/sci/JournalReviewers.asp?var=>;
- reviewer of the journal *Informatica*, <https://www.mii.lt/informatica/>;
- program committee member of the 22nd International Conference on Information and Software Technologies (ICIST 2016), <http://icist.if.ktu.lt/index.php/ICIST/pages/view/Chairs&Commitee>;
- program committee member of the Central and Eastern European Software Engineering Conference in Russia (CEE-SECR 2016), <http://2016.secr.ru/lang/en/>;
- program committee member of the 1st Workshop on Managed Complexity (ManComp 2016), <http://wwwswt.informatik.uni-rostock.de/ManComp2016/comm>.

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 committee member of the annual East European Conference on Advances in Databases and Information Systems (ADBIS), <http://adbis2016.vsb.cz/committees/>;
- steering committee member of the International Baltic Conference on Databases and Information Systems (BalticDB&IS), <http://www.dbis.lu.lv/conference-organisation/>;
- program committee member of the 19th East European Conference on Advances in Databases and Information Systems (ADBIS), Prague, Czech Republic, September 14-16, 2016, <http://adbis2016.vsb.cz/committees/>;
- program committee member of the 12th International Baltic Conference on Databases and Information Systems (BalticDB&IS), Riga, Latvia, July 4-6, 2016, <http://www.dbis.lu.lv/conference-organisation/>;
- program committee member of the 6th International Conference on Business Intelligence and Technology (BUSTECH 2016), Rome, Italy, March 20-24, 2016, <https://www.iaia.org/conferences2016/ComBUSTECH16.html>;
- program committee member of the 22nd International Conference on Information and Software Technologies (ICIST 201), Druskininkai, Lithuania, October 13-15, 2016, <http://icist.if.ktu.lt/index.php/ICIST/pages/view/Chairs&Commitee>;
- program committee member of the 8th International Conference on Advanced Cognitive Technologies and Applications COGNITIVE 2016, Rome, Italy, March 20-24, 2016, <https://www.iaia.org/conferences2016/ComCOGNITIVE16.html>;
- program committee member of the 9th Workshop on Information Logistics and Knowledge Supply (ILOG 2016), Prague, Czech Republic, September 14-16, 2016, https://win.informatik.uni-rostock.de/lehrstuhl_fuer_wirtschaftsinformatik/win_research/konferenzenworkshops/ilog20150/;
- program committee member of the 28th International Conference on Advanced Information Systems Engineering (CAISE'16), Ljubljana, Slovenia, June 13-17, 2016, <http://caise2016.si/committees/program-board/>;
- program committee member of 8th International Workshop on Data Analysis Methods for Software Systems (DAMSS), Druskininkai, Lithuania, December 1-3, 2016, <https://www.mii.lt/damss/index.php?page=organizers&lang=en>;
- program committee member of the Central and Eastern European Conference on Software Engineering Conference in Russia (CEE-SECR 2015), Moscow, Russia, October 22-24, 2015, <http://2015.secr.ru/lang/ru/about/program-committee>;
- program committee member of the 1st Workshop on Managed Complexity (ManComp 2016), Prague, Czech Republic, September 14, 2016, <http://wwwswt.informatik.uni-rostock.de/ManComp2016/comm>;
- program committee member of the 9th IFIP WG 8.1 Working Conference on The Practice of Enterprise Modeling (PoEM) Skövde, Sweden, November 8-10, 2016, <http://www.his.se/Poem20/poem2016/Comitee/?id=14806&epslanguage=sv>.

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>;

Doc. Dr. A. Lupeikienė

- editorial board member of the journal *Informatica*, <http://www.mii.lt/informatica/editors.htm>;
- 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 of the International Baltic Conference on Databases and Information Systems (BalticDB&IS), <http://ati.ttu.ee/dbis2014/index.php?page=8>;
- program committee member of the 19th East European Conference on Advances in Databases and Information Systems (ADBIS), Prague, Czech Republic, September 14-16, 2016, <http://adbis2016.vsb.cz/committees/>;
- program committee member of the 12th International Baltic Conference on Databases and Information Systems (BalticDB&IS), Riga, Latvia, July 4-6, 2016, <http://www.dbis.lu.lv/conference-organisation/>.

Dr. S. Maskeliūnas

- chairman of 7th International Workshop on Data Analysis Methods for Software Systems (DAMSS), Druskininkai, Lithuania, December 1-3, 2016, <https://www.mii.lt/damss/index.php?page=organizers&lang=en>;
- chairman of the Council of the Lithuanian Computer Society, <http://www.liks.lt/en/modules/tinycontent/index.php?id=3>.

Prof. Habil. Dr. 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*, http://www.mii.lt/index.php?siteaction=pages.browse&page=lmj_an&lang=en.

Assoc. Prof. Habil. Dr. R. Pliuškevičius

- editorial board member of the *Lithuanian Mathematical Journal*, http://www.mii.lt/index.php?siteaction=pages.browse&page=lmj_an&lang=en
-

4.6 DEPARTMENT OF SYSTEMS ANALYSIS

Akademijos 4, LT-08663 Vilnius

Tel. (+370 5) 210 9300

E-mail: gintautas.dzemyda@mii.vu.lt

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

STAFF

Principal researchers: Prof. Habil. Dr. Gintautas Dzemyda, Prof. Habil. Dr. Leonidas Sakalauskas, Prof. Habil. Dr. Antanas Žilinskas, Prof. Habil. Dr. Rimantas Želvys, Assoc. Prof. Dr. Olga Kurasova

Senior researchers: Prof. Dr. Saulius Minkevičius, Dr. Virginijus Marcinkevičius, Dr. Daniele Ettore Otera, Dr. Audronė Jakaitienė, Prof. Dr. Darius Plikynas

Affiliated researchers: Prof. Habil. Dr. Algis Garliauskas, Dr. Audris Mockus, Dr. Stasys Steišūnas, Prof. Habil. Dr. Jonas Mockus, Prof. Dr. Algirdas Pakštas

Researchers: Assoc. Prof. Dr. Igor Belov, Dr. Jolita Bernatavičienė, Dr. Juozas Gordevičius, Dr. Rasa Karbauskaitė, Dr. Viktor Medvedev, Assoc. Prof. Dr. Povilas Treigys, Dr. Ernestas Filatovas

Junior Researchers: Dr. Aurimas Rapečka, Tomas Grigalis, Karolis Koncevičius, Martynas Sabaliauskas

Specialists and engineering staff: Vytautas Tiešis, Dr. Laura Ringienė, Dr. Gintautas Jakimauskas, Ana Ušpurienė, Povilas Gibas, Vytautas Dulskis, Algimantas Krikščiūnas

Doctoral students: Liudas Ališauskas, Mykolas Jurgis Bilinskas, Denisas Bykovas, Andrius Daranda, Albertas Gimbutas, Gražina Gimbutienė, Ališer Antony Haidari, Gintautas Jakštas, Vytautas Jakštys, Justinas Jucevičius, Rokas Jurevičius, Albertas Jurgelevičius, Donatas Kavaliauskas, Julija Kurilova, Mindaugas Morkūnas, Kotryna Paulauskienė, Natalija Pozniak, Rimantė Rybniková, Giedrius Stabingis, Dovilė Stumbrienė, Darius Tamašauskas, Jevgenij Tichonov, Julius Venskus, Jelena Zubova

RESEARCH INTERESTS

Analysis of large data sets;

Artificial neural networks;

Creation and computational realization of complex simulation models in epidemiology, education, economics, and energy supply systems and of various other origin with uncertainty;

Data mining;

Deep learning;

Development of decision support systems;

Bioinformatics;

Geometric group theory, geometric topology, finite groups;

Global optimization methods;

Multi-objective optimization;

Image analysis, feature detection, image reconstruction, medical image processing;

Internet data mining;

Local optimization methods;

Medical data analysis and decision support;

Multiple criteria decision support;

Operations research;

Optimal control applications;

Parallel computing;

Queueing theory;

Statistical simulation;
Stochastic programming;
Visualization of multidimensional data;
Swarm intelligence;
Web service development.

RESEARCH PROJECTS CARRIED OUT IN 2016

Projects Supported by University Budget

Project title: Optimal solutions in data mining tasks. Prof. Habil. Dr. G. Dzemyda. 2014–2016

Description: The volumes and diversity of data are rapidly increasing in our days. Optimization, visualization and simulation methods for specific data (biomedical, financial, visual etc.) help us to analyze and take decisions. However there is a need to get new knowledge from existing data. Therefore it is necessary to develop new hybrid data mining and optimization methods that can help you to find and reveal an important new knowledge. Parallel computing is also an important tool for these challenges.

Main results:

1. Developed new methods for non-convex multi-objective optimization; one of publications of these results is among 1% highly cited WOS publications of 2016.
2. Semi-automatic algorithm proposed for Doppler spectrum image analysis for grading aortic valve stenosis severity.
3. A new method proposed for detection of the road pothole contour in raster images.
4. The fractal-based methods are examined for estimation of the intrinsic dimensionality of multidimensional data.
5. A preference-based multi-objective evolutionary algorithm with stochastic local search has been developed and investigated.
6. Several decidability results in 3-dimensional topology were proved, in particular for finite simplicial 3-complexes with a finite fundamental group.

Publications:

1. Žilinskas Antanas, Zhigljavsky Anatoly. Branch and probability bound methods in multi-objective optimization // OPTIMIZATION LETTERS 2016, Vol. 10, Issue: 2, p. 341-353.
2. Niakšu, Olegas; Balčiūnaitė, Giedrė; Kizlaitis, Romualdas Jonas; Treigys, Povilas. Semi-automation of Doppler spectrum image analysis for grading aortic valve stenosis severity // *Methods of information in medicine. Stuttgart: Schattauer GmbH. ISSN: 0026-1270. 2016, Vol. 55, Iss. 1, p. 23-30.*
3. Jakštys, Vytautas; Marcinkevičius, Virginijus; Tichonov, Jevgenij; Treigys, Povilas. Detection of the road pothole contour in raster images // *Information technology and control. Kaunas: Technologija. ISSN: 1392-124X. 2016, Vol. 45, no. 3, p. 300-307.*
4. Karbauskaitė, Rasa; Dzemyda, Gintautas. Fractal-based methods as a technique for estimating the intrinsic dimensionality of high-dimensional data: a survey // *Informatica. Vilnius: Vilnius University Institute of Mathematics and Informatics; Lithuanian Academy of Sciences. ISSN: 0868-4952. 2016, Vol. 27, no 2, p. 257-281.*
5. Filatovas, Ernestas; Lančinskas, Algirdas; Kurasova, Olga; Žilinskas, Julius. A preference-based multi-objective evolutionary algorithm R-NSGA-II with stochastic local search // *Central european journal of operations research. Heidelberg: Springer. ISSN: 1435-246X. 2016, first on line, p. 1-20.*
6. D.E. Otera, An application of Poenaru's zipping theory, *Indagationes Mathematicae, New Series, vol. 27, n. 4, 1003-1012, (2016).*

Project title: Application of statistical simulation and stochastic programming to big data mining. Prof. Habil. Dr. Leonidas Sakalauskas. 2016–2018

Main results:

1. Linear and nonlinear stochastic programming methods and algorithms have been developed, applied to processing and analysis of big data.
2. Big data interpolation methods have been developed by using fractional Euclidean distance matrices.

Publications:

1. Minkevičius, Saulius; Dolgopолоvas, Vladimiras; Sakalauskas, Leonidas. A law of the iterated logarithm for the sojourn time process in queues in series // *Methodology and computing in applied probability*. New York: Springer New York LLC. ISSN: 1387-5841. 2016, Vol. 18, no 1, p. 37-57.
2. Jakimauskas, Gintautas; Sakalauskas, Leonidas. Note on the singularity of the Poisson–gamma model // *Statistics and probability letters*. Amsterdam: Elsevier. ISSN: 0167-7152. 2016, Vol. 114, p. 86-92.

National Research Projects

1. Research Council of Lithuania. **Lithuanian education system status and its influencing factors modeling** (No. MIP-024/2015) Dr. A. Jakaitienė. 2015-2017.

Description: The project has two main goals: the international PISA survey data analysis and education system monitoring index construction. In 2016 we applied multilevel linear regression for the comparison of countries educational stratification approaches and compared the education systems of the Baltic countries and three „old“ EU member states (UK, Germany and Finland) using the distinction along different types of welfare states according OECD PISA 2012 survey data. Moreover we constructed a composite indicator for the education monitoring through following five stages: data treatment, data normalization, weighting, aggregation and comparing the indices. At the first stage we used single imputation for missing data. More over all indicators were treated as the profit type - “the larger the better”. At the second stage we standardized data by subtracting the mean of the data and dividing by the standard deviation. At the data weighting stage we used two different methodologies in order to compare how the different approaches affect the results. The first one is principal components analysis and the second one is the application of data envelopment analysis known as the “benefit of the doubt” approach.

2. Research Council of Lithuania. **Groups of geometry and topology** (No. MIP-046/2014) Dr. D.E. Otera. 2014-2016.

Description: The main aim of the Project concerns the study of the geometry of discrete groups, from the topological viewpoint at infinity. Project’s main topics were the asymptotic topology of manifolds and geometric invariants of groups.

Publications:

- D.E. Otera, *Topological tameness conditions of spaces and groups. Results and developments*, Lithuanian Mathematical Journal, vol. 56, n. 3, 357-376, (2016).
- D.E. Otera, *An application of Poenaru's zipping theory*, Indagationes Mathematicae, New Series, vol. 27, n. 4, 1003-1012, (2016).
- D.E. Otera; F.G. Russo, *On topological filtrations of groups*, Periodica Mathematica Hungarica, 72 (n.2), 218-223, 2016.

3. Research Council of Lithuania. **Identification of epigenetic markers for early diagnosis of colorectal cancer** (No. MIP-043/2014) Dr. J. Gordevičius. 2014-2016.

Description: In this project we propose to perform data analysis of epigenetic profiles in blood circulating DNA to detect epigenetic biomarkers for early CRC diagnosis. Our goal is to apply novel algorithmic methods that will reveal epigenetic aberrations in extended regions when comparing cancer patients to controls. The detected regions will be used to train machine learning algorithms and to build and evaluate an early diagnostic CRC classifier. The bioinformatics analysis conducted in this project may provide novel, non-invasive markers, with the potential for translation into clinical practice.

International Research Projects

1. COST action **Big Data Era in Sky and Earth Observation TD1403** Member of Managing Committee Assoc. 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 College London, UK
2. Poznan Supercomputing and Networking Center, Poland
3. Middle East Technical University, Ankara, Turkey
4. National Cancer Institute
5. Hospital of Lithuanian University of Health Sciences Kauno klinikos
6. Maribor University (Brumen)

OTHER SCIENTIFIC ACTIVITIES

Prof. Habil. Dr. G. Dzemyda –

- Full member of Lithuanian Academy of Science, <http://lma.lt>
- 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/>
- 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
- Editorial board member:
 - *Baltic Journal of Modern Computing* (Editor in Chief) <http://www.lu.lv/baltic-journal-of-modern-computing/>
 - *Informatica* (Editor in Chief) <http://www.mii.lt/Informatica/editors.htm>
 - *Informatics in Education*, http://www.mii.lt/informatics_in_education/editors.htm

- *Journal of Civil Engineering and Management*,
http://www.jcem.vgtu.lt/en/?page=2&sub=RED_KOLEGIJA
- *Nonlinear Analysis; Modelling and Control*, (Deputy Editor in Chief),
<http://www.mii.lt/NA/>
- *Vestnik BSU. Series 1. Physics. Mathematics. Informatics*
<http://www.bsu.by/en/main.aspx?guid=208151>
- *Scientific Proceedings of Riga Technical University. Computer Science, Information Technology and Management Science*
- Chairman of the 8th International Workshop „Data Analysis Methods for Software Systems“, Druskininkai, Lithuania, December 1-3, 2016, <http://www.mii.lt/DAMSS/>
- Member of programme committees of the following International conferences:
 - International Conference on Operations Research and Enterprise Systems (ICORES 2016), <http://www.icores.org/>
 - International conference on Psychological Computing Systems (PhyCS 2016), www.phyics.org
 - International Conference on Sensor Networks (SENSORNET 2016), <http://www.sensornets.org/?y=2016>
- On 2016, participated at 11 committees for defenses of PhD dissertations.
- Administrative work:
 - Director of the Institute of Mathematics and Informatics of Vilnius University
 - Member of Rectorate of Vilnius University

Prof. Habil. Dr. 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 Board of European Working Group on Stochastic Programming
<http://www.mii.lt/EWGSP;>
- Member of European Working Group on Civil Engineering and Sustainable Development <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. 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 2016, 17-th International Conference on Computer Systems and Technologies, 23–24 June 2016, Palermo, Italy, <http://www.compsystech.org/>,
- XIII Global Optimization Workshop, University of Minho, Campus de Gualtar, Braga, Portugal, 4-8 September, 2016, GOW'16 - <http://apolo.dps.uminho.pt/gow16/>,
- NUMTA 2016, Numerical Computations: Theory and Algorithms, Pizzo Calabro, Italy, 19–25 June 2016, <http://si.dimes.unical.it/~yaro/numta2016/>,
- 9th International Workshop on computational Optimization (WCO'16), Gdansk, Poland, 11–14 September, 2016, <https://fedcsis.org/2016/wco>,
- The International Workshop on Machine learning, Optimization and big Data (MOD 2016), SIAF - Volterra - Tuscany, Italy, from August 26 to 29, 2016, <http://www.taosciences.it/mod/>.
- 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>
 - *Statistics, Optimization and Information Computing*, (International Academic Press), <http://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

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>

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. 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>

- Informatica, <http://www.mdpi.com/journal/informatics>
- Member of Council of Lithuanian Computer Society, <http://www.liko.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/>
- Reviewer of international journals:
 - *Informatica (IOSPress/VU)*
 - *Mathematical Modelling and Analysis (Taylor & Francis)*
 - *Journal of Visualization (Springer)*
 - *Mechanical Systems and Signal Processing (Elsevier)*
 - *Informatica in Education (VU)*
 - *Central European Journal of Computer Science (Springer)*,
 - *Neural Processing Letters (Springer)*,
 - *Optimization Letters (Springer)*,
 - *Information Technology and Control (KTU)*,
 - *Neurocomputing (Elsevier)*

Assoc. Prof. Dr. S. Minkevičius –

- reviewer of international journal *Informatica (IOSPress/VU)*
- reviewer of international journal *Nonlinear Analysis; Modelling and Control*
<http://www.mii.lt/NA/>

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.liko.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. E. Filatovas –

- Member of International Society on Multiple Criteria Decision Making (MCDM)
<http://mcdmsociety.org/members/country.php?country=LITHUANIA>
- Member of Council of Lithuanian Computer Society,
<http://www.liko.lt/en/modules/tinycontent/index.php?id=3>
- Reviewer of international journals:
 - *Baltic Journal of Modern Computing*
 - *Central European Journal of Operations Research (Springer)*
 - *IEEE Transactions on Systems, Man, and Cybernetics: Systems*
 - *Informatica (IOSPress/VU)*

Dr. R. Karbauskaitė –

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

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/>
- Reviewer of international journal *Informatica* (IOSPress/VU)

Dr. V. Medvedev –

- 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 SERVICE COMPUTATION 2013–2016 Technical Program Committee, <http://www.iaria.org/conferences2014/ComSERVICECOMPUTATION14.html>
- reviewer of international journals:
 - *Informatica* (IOSPress/VU)
 - *Mathematical Modelling and Analysis* (Taylor & Francis)
 - *Journal of Global Optimization* (Springer)
 - *Pattern Recognition Letters* (Elsevier)
 - *International Journal of Applied Mathematics and Computer Science* (University of Zielona Góra and the Lubuskie Scientific Society in Zielona Góra, Poland)
 - *Applied Computing and Informatics* (Elsevier)
 - *The Baltic Journal of Road and Bridge Engineering* (Technika/VGTU, Lithuania)
 - *Baltic Journal of Modern Computing*

Dr. D. Otera –

- Member of the Italian geometers group G.N.S.A.G.A, <http://www.altamatematica.it/gnsaga/>
- Member of the Lithuanian Mathematical Society, <http://www.mif.vu.lt/lmd/>
- Referee for international journals:
 - *Bulletin of the London Mathematical Society*
 - *Quaestiones Mathematicae*
 - *Lithuanian Mathematical Journal*
- Reviewer for Zentralblatt MATH

Assoc. Prof. Dr. P. Treigys –

- Reviewer of the international journal *Informatica* (IOSPress/VU)

V. Tiešis –

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