### BLOCKCHAIN TECHNOLOGIES GROUP

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**Head** – Dr. Remigijus Paulavičius

***STAFF***

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

**Lector:** dr. Aleksandr Igumenov

**Junior researcher:** Linas Stripinis

**Doctoral students:** Linas Stripinis, Vaidas Jusevičius, Andrius Adamonis, Saulius Grigaitis, Jaroslava Arsenjeva, Rytis Bieliauskas

***RESEARCH INTERESTS***

Blockchain technologies

Global optimization

Optimization Software

Multi-objective optimization

High-Performance Computing

Artificial Intelligence

Image Processing

Big Data

***RESEARCH PROJECTS CARRIED OUT IN 2019***

**Projects Supported by University Budget**

**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 efficient DIRECT-type derivative-free algorithm for general global optimization problems was developed.
* A review of the blockchain technology has been carried out, the areas most frequently using blockchain technology have been identified, the main existing technological challenges emphasized, and possible future directions of the technology have been highlighted.

**Main publications:**

1. **L. Stripinis**, **R. Paulavičius**, J. Žilinskas (2019) Penalty functions and two-step selection procedure based DIRECT-type algorithm for constrained global optimization. *Structural and Multidisciplinary Optimization* 59 (6), p. 2155-2175, [DOI: 10.1007/s00158-018-2181-2](https://doi.org/10.1007/s00158-018-2181-2).
2. **R. Paulavičius**, **S. Grigaitis**, **A. Igumenov**, **E. Filatovas** (2019) A Decade of Blockchain: Review of the Current Status, Challenges, and Future Directions. *Informatica*, 30 (4), p. 729-748, [DOI: 10.15388/Informatica.2019.227](https://doi.org/10.15388/Informatica.2019.227)

**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 results:**

* Data batching strategies for the SOM neural network retraining to detect anomalies in streaming maritime traffic data were proposed and investigated; the effectiveness of strategies in terms of modeling precision and the data processing time were estimated on real sensor data.

**Main publications:**

1. J. Venskus, P. Treigys, J. Bernatavičienė, G. Tamulevičius, **V. Medvedev**. Real-time maritime traffic anomaly detection based on sensors and history data embedding // Sensors. Basel: MDPI. ISSN 1424-8220. 2019, 19 (17), art. no. 3782, p. 1-10. [DOI: 0.3390/s19173782](https://doi.org/10.3390/s19173782).

**Contractual Research**

1. Contract (No. GLG-2018-0658) with UAB Girteka logistics - “*Creation of the conceptual model for the pickup and delivery problem with time windows (PDPTW)*”
2. Contract (No. GLG-2019-0115) with UAB Girteka logistics - “*Experimental comparative analysis of algebraic modeling languages, investigation of the potential of combining several modeling languages*”
3. Contract (No. GLG-2019-0306) with UAB Girteka logistics - “Development of an efficient algorithm for large-scale transportation planning problem”

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

1. Imperial College London (UK)
2. Universidad de Almería (Spain)
3. Systems Research Institute, Polish Academy of Sciences (Poland)
4. UAB Girteka Logistics (Lithuania)
5. Bank of Lithuania (Lithuania)

***OTHER SCIENTIFIC ACTIVITIES***

**dr. R. Paulavičius –**

* Member of the Young Academy of the Lithuanian Academy of Sciences.
* Affiliate member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), [www.hipeac.net](http://www.hipeac.net).
* Member of the American Institute of Chemical Engineers (AIChE), [www.aiche.org](http://www.aiche.org)
* Member of the Mathematical Optimization Society (MOS), <http://www.mathopt.org/>
* Member of Program/Scientific Committees:
  + [LOD2020: The Sixth International Conference on Machine Learning, Optimization, and Data Science](https://lod2020.icas.xyz/), Sienna, Italy, 2020.
  + [NUMTA-2019: The 3rd International Conference and Summer School](http://si.dimes.unical.it/~yaro/numta2019/scientific-committe/), Crotone, Italy, 2019.
  + [1st Workshop on Blockchain and Smart Contract Technologies (BSCT 2018)](http://bis.ue.poznan.pl/bis2018/workshops/bsct/), Poznan, Poland, 2018.
  + [LION12: Learning and Intelligent Optimization Conference](http://apolo.dps.uminho.pt/gow16), Kalamata, Greece, 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*

**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:
  + *Engineering Optimization*
  + *Complexity*
  + *Journal of Global Optimization*
  + *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
* Member of Program/Scientific Committees:
  + International Workshop on Secure Mobile Cloud Computing (IWoSeMC-20), <http://iwosemc.eu/>. Melbourne (Australia), 2020 gegužės 11–14 d.
* Reviewer of international journals:

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| * + *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).* |

**A. Lančinskas –**

* Reviewer of international journals: Applied Mathematical Modelling, Baltic Journal of Modern Computing, Central European Journal of Computer Science, Computers and Industrial Engineering, Computers and Operation Research, Informatica, Journal of Global Optimization, Nonlinear Analysis: Modelling and Control, Open Engineering, Optimization Letters, Research in Transportation Economics.
* Affiliate member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), www.hipeac.net.
* Member of Program/Scientific Committees:
  + 16th International Conference on Parallel Problem Solving from Nature (PPSN 2020)
  + Black Box Discrete Optimization Benchmarking (BB-DOB) Workshop at the Genetic and Evolutionary Computation Conference (GECCO 2019)
  + 3rd International Workshop on Theoretical Approaches to Performance Evaluation, Modeling and Simulation (TAPEMS 2019).