Program and General Information

LeGO - 14th Int'l Global Optimization Workshop

18th-21st of Sept. 2018, Leiden The Netherlands

Leiden Institute of Advanced Computer Science, Mathematical Institute of Leiden University, International Society of Global Optimization

Michael Emmerich André Deutz Sander Hille Iryna Yevseyeva
Yaroslav Sergeyev

This workshop is financially supported by Leiden University Fund `https://www.luf.nl`, *Mathematical Institute Leiden University, and Leiden Institute of Advanced Computer Science.*

Welcome to LeGO 2018

This booklet contains information on the LeGO - 14th International Global Optimization Workshop. This includes information about the organizers, the venue, the contributed papers and the program schedule.

We wish you a nice conference in Leiden and that you get inspired and your ideas inspire other researchers in the interesting research field of global optimization. This year a special focus is on the topic of multiobjective optimization, where global optimization techniques are increasingly used and needed. Also in single-objective global optimization, there are still many challenges to be met, such as exploiting different generalizations of convexity and continuity, finding global optima with performance and accuracy guarantees, and finding efficient ways to solve large scale problems.

Moreover, we hope that you enjoy your stay in the historical university town of Leiden, and have the opportunity to see some of the many historical sites or enjoy the visit of the historical city center with its canals and floating cafés.

Last but not least, we thank you for your valuable contribution and we are eager to learn about new, exciting results.

The organizers.

Venue

The program is located on 18th of September in the lecture rooms of

Huygens Lab, Room 211-214, Niels Bohrweg 2, 2333CA Leiden

Snellius, Room 412, Niels Bohrweg 1, 2333CA Leiden

and on 19th, 20th and 21st of September at

Poortgebouw, Congreszaal, Rijnsburgerweg 10, 2333AA Leiden

(both of Leiden University).

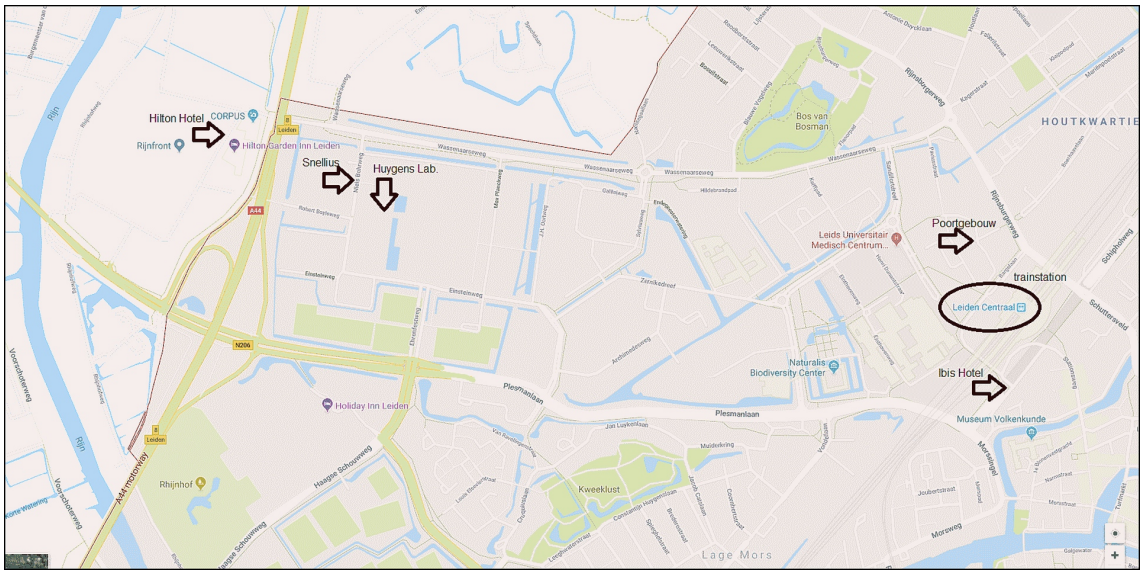

Figure 1: Conference and hotel locations (Source: Open Street Maps).

Figure 2: Huygens Lab, Leiden University

Figure 3: Snellius, Leiden University

Figure 4: Poortgebouw, Leiden University

LeGO 2018 – Program

Program: subject to minor changes

The program is Single Track, keynote address on first day is in Huygens, lectures in Snellius (day 1); the venue for days 2, 3, and 4 is Poortgebouw – all 3 locations are at Leiden University.

Tuesday, 18th of September, 2018 (@ Huygens and Snellius)

From 9:00: Registration is open; coffee/tea available @Huygens 211-214

9:45 - 10:00: Welcome by the local organizers and iSoGO
@Huygens 211-214 *Chair: Michael Emmerich*

10:00 - 11:00: Keynote lecture - Panos Pardalos @Huygens 211-214 *Chair: Yaroslav Sergeyev*

Coffee break (20min) @Huygens 211-214

remainder of the day takes place in Snellius 412 and Snellius 408 is available as a workspace

11:20 - 13:00: Presentation sessions (4x 25 min) *Chair: Andreas Lundell*

11:20: Sufficient Conditions for Pseudoconvexity by Using Linear Interval Parametric Techniques
Milan Hladík, Lubomir Kolev and Iwona Skalna

11:45: A comparison of three Differential Evolution strategies in terms of early convergence with different population sizes
Anil Yaman, Giovanni Iacca and Fabio Caraffini

12:10: Weighted Ensembles in Model-based Global Optimization
Martina Friese, Thomas Bartz-Beielstein, Thomas Bäck, Boris Naujoks and Michael Emmerich

12:35: On regular simplex division in copositivity detection
José Manuel García Salmerón, Leocadio G. Casado and Eligius Hendrix

Lunch

Tuesday, 18th 0f September, 2018 (@Snellius)

14:00 - 15:40: Presentation sessions (4x 25 min) *Chair: Konstantin Barkalov*

14:00: Selection of a covariance function for a Gaussian random field aimed for modeling global optimization problems
Antanas Žilinskas, Anatoly Zhigljavsky, Vladimir Nekrutkin and Vladimir Kornikov

14:25: Combining Local Surrogates and Adaptive Restarts for Global Optimization of Moderately Expensive Functions
Taimoor Akhtar and Christine A. Shoemaker

14:50: A Flexible Generator of Constrained Global Optimization Test Problems
Victor Gergel, Konstantin Barkalov, Ilya Lebedev, Maria Rachinskaya and Alexander Sysoyev

15:15: Sequential Model Based Optimization with black-box constraints via Machine Learning based feasibility determination
Antonio Candelieri and Francesco Archetti

Tea break (30min)

16:10 - 17:25: Presentation sessions (3x 25 min) *Chair: Sonia Cafieri*

16:10: Ill-Conditioning Provoked by Scaling in Univariate Global Optimization and Its Handling on the Infinity Computer
Dmitri Kvasov, Marat Mukhametzhanov and Yaroslav Sergeyev

16:35: Integration of Polyhedral Outer Approximation Algorithms with MIP Solvers Through Callbacks And Lazy Constraints
Andreas Lundell and Jan Kronqvist

17:00: Univariate Global Optimization with Point-Dependent Lipschitz Constants
Oleg Khamisov and Mikhail Posypkin

Coffee break (20 min)

17:45 - 18:35: Presentation sessions (2x25 min) *Chair: Eligius Hendrix*

17:45: A Stochastic Coordinate Descent for Bound Constrained Global Optimization
Ana Maria A. C. Rocha, M. Fernanda P. Costa and Edite M. G. P. Fernandes

18:10: Sliding to the Global Optimum: How to Benefit from Non-Global Optima in Multimodal Multi-Objective Optimization
Christian Grimme, Pascal Kerschke, Michael T. M. Emmerich, Mike Preuss, André H. Deutz and Heike Trautmann

18:35 - 20:00: Reception

Wednesday, 19th of September, 2018 (@ Poortgebouw)

08:00 - 08:30 coffee/tea

8:30 - 10:10: Presentation sessions (4x 25 min) *Chair: Ana Maria Rocha*

8:30: Well-Posedness for a Class of Variational Inequalities
Morteza Oveisiha

8:55: Perspective Envelopes for Bilinear Functions
Hassan Hijazi

9:20: Decomposition-based Successive Approximation Methods for Global Optimization
Ivo Nowak and Pavlo Muts

9:45: Multi-objective evolutionary algorithm for Evaluation of Shape and Electrostatic Similarity
S. Puertas-Martín, J. L. Redondo, H. Pérez-Sánchez and P. M. Ortigosa

Coffee break (20min)

10:30-12:10: Presentation sessions (4x25 min) *Chair: Gilles Trombettoni*

10:30: Reliable Bounds for Convex Relaxation in Interval Global Optimization Codes
Frédéric Messine and Gilles Trombettoni

10:55: Improved versions of the GLOBAL optimization algorithm and the GlobalJ modularized toolbox
Balázs Bánhelyi, Tibor Csendes, Balázs László Lévai, Dániel Zombori and László Pál

11:20: Memetic Differential Evolution using Network Centrality Measures
Viktor Homolya and Tamás Vinkó

11:45: Covering a Square with Six Circles by Deterministic Global Optimization
Sonia Cafieri, Pierre Hansen and Frédéric Messine

Lunch

Wednesday, 19th of September, 2018 (@ Poortgebouw)

13:05-14:05: Keynote lecture - Antanas Žilinskas *Chair: André Deutz*

Coffee break (20 min)

Wednesday, 19th of September, 2018 (@ Poortgebouw)

14:25 - 15:40: Presentation sessions (3x 25 min) *Chair: Anatoly Zhigljavsky*

14:25: On the Application of Danskin's Theorem to Derivative-Free Minimax Problems
Abdullah Al-Dujaili, Shashank Srikant, Erik Hemberg and Una-May O'Reilly

14:50: AbsTaylor: Finding Inner Regions for Nonlinear Constraint Systems with Linearizations and Absolute Values
Ignacio Araya and Victor Reyes

15:15: Ranking-based Algorithm for Facility Location with Constraints
Algirdas Lančinskas, Pascual Fernández, Blas Pelegrín and Julius Žilinskas

Tea break (30min)

16:10 - 17:25: Presentation sessions (3x 25 min) *Chair: A. Strekalovskiy*

16:10: A Generic Interval Branch and Bound Algorithm for Parameter Estimation
Bertrand Neveu, Martin de La Gorce, Pascal Monasse and Gilles Trombettoni

16:35: Convex optimization for matrix completion with application to forecasting
Jonathan Gillard and Konstantin Usevich

17:00: Quadratic Regularization for Global Optimization
Anatolii Kosolap

Coffee break (20min)

17:45 - 19:00: Presentation sessions (3x 25 min) *Chair: Leocadio G. Casado*

17:45: Rectangle Covering
Kristóf Kovács and Boglárka G.-Tóth

18:10: Convex Hull Formulations for Mixed-Integer Multilinear Functions
Harsha Nagarajan, Kaarthik Sundar, Hassan Hijazi and Russell Bent

18:35: A Two-Phase Approach in a Global Optimization Algorithm Using Multiple Estimates of Hölder Constants
Daniela Lera and Yaroslav Sergeyev

Thursday, 20th of September, 2018 (@ Poortgebouw):

08:00 - 08:30 coffee/tea

8:30 - 10:10 Presentation sessions (4x 25 min) *Chair: Sander Hille*

8:30: Multi-Objective Global Optimization for Interplanetary Space Trajectory Design
Martin Schlueter and Masaharu Munetomo

8:55: Monomial Tropical Cones for Multicriteria Optimization
Michael Joswig and Georg Loho

9:20: Using a B&B Algorithm from Multiobjective Optimization to Solve Constrained Optimization Problems
Gabriele Eichfelder, Kathrin Klamroth and Julia Niebling

9:45: A Novel Expected Hypervolume Improvement Algorithm For Lipschitz Multi-Objective Optimisation: Almost Shubert's Algorithm In A Special Case
Heleen Otten and Sander Hille

Coffee break (20min)

10:30 - 11:30: Keynote lecture - Kaisa Miettinen *Chair: Antanas Žilinskas*

Coffee break (20 min)

11:50 - 13:05: Presentation sessions (3x25 min) *Chair: Andrzej Skulimowski*

11:50: On Efficiency of Bicriteria Optimization
James Calvin and Antanas Žilinskas

12:15: Lower and Upper Bounds For The General Multiobjective Optimization Problem
Ignacy Kaliszewski and Janusz Miroforidis

12:40: Multi-objective mixed integer programming: An objective space algorithm
William Pettersson and Melih Ozlen

Lunch

14:00 - 15:40: Presentation sessions (4x 25 min) *Chair: Kaisa Miettinen*

14:00: Nonlinear Bi-Objective Optimization: Improving the Upper Envelope using Feasible Line Segments
Damir Aliquintui, Ignacio Araya, Franco Ardiles and Braulio Lobo

14:25: On the hierarchical structure of Pareto critical sets
Bennet Gebken, Sebastian Peitz and Michael Dellnitz

14:50: An Adaptive Population-based Candidate Search Algorithm with Surrogates for Global Multi Objective Optimization of Expensive Functions
Christine A. Shoemaker and Taimoor Akhtar

15:15: A model of anytime algorithm performance for biobjective optimization problems
Alexandre D. Jesus, Luís Paquete and Arnaud Liefooghe

Tea break (30min)

Thursday, 20th of September, 2018 (@ Poortgebouw):

16:10 - 17:50: Presentation sessions (4x 25 min) *Chair: Ignacy Kaliszewsky*

16:10: Sliding to the Global Optimum: How to Benefit from Non-Global Optima in Multimodal Multi-Objective Optimization
Christian Grimme, Pascal Kerschke, Michael T. M. Emmerich, Mike Preuss, André H. Deutz and Heike Trautmann

16:35: Exact Extension of the Direct Algorithm to Multiple Objectives
Alberto Lovison and Kaisa Miettinen

17:00: Predicting The Spread Of Epidemiological Diseases By Using A Multi-Objective Algorithm
Miriam R. Ferrández, Benjamin Ivorra, Juana L. Redondo, Angel M. Ramos and Pilar M. Ortigosa

17:25: On monotonicity in simplicial branch and bound
Eligius Hendrix, Leocadio G. Casado and José Manuel García Salmerón

19:30 - . . . Conference dinner (optional)

Friday, 21th of September, 2018 (@ Poortgebouw):

8:30-10:10: Presentation sessions (4x 25 min) *Chair: Kaifeng Yang*

8:30: On a class of vector optimization problems
Ariana Pitea

8:55: Generalized Ideal Points
Andrzej M.J. Skulimowski

9:20: Towards Multi-objective Mixed Integer Evolution Strategies
Koen van der Blom, Kaifeng Yang, Thomas Bäck and Michael Emmerich

9:45: Joint Scheduling of Production and Transport with Alternative Job Routing in Flexible Manufacturing Systems
Seyed Mahdi Homayouni and Dalila B.M.M. Fontes

10:10 - 10:30 coffee/tea

10:30 - 11:30: Keynote lecture - Yaroslav Sergeyev *Chair: Panos Pardalos*

Coffee break (20min)

11:50 – 13:05: Presentation sessions (3x 25 min) *Chair: Boglárka Gazdag-Tóth*

11:50: Improving (1+1) Covariance Matrix Adaptation Evolution Strategy: a simple yet efficient approach
Fabio Caraffini, Giovanni Iacca and Anil Yaman

12:15: The R2 Indicator: a Study of its Expected Improvement in Case of Two Objectives
André Deutz, Kaifeng Yang and Michael Emmerich

12:40: Global Optimization for Image Registration
James Calvin, Craig Gotsman and Cuicui Zheng

Lunch

Friday, 21th of September, 2018 (@ Poortgebouw)

14:00 – 15:40: Presentation sessions (4x 25 min) *Chair: Iryna Yevseyeva*

14:00: Towards Single- and Multiobjective Bayesian Global Optimization for Mixed Integer Problems
Kaifeng Yang, Koen van der Blom, Thomas Bäck and Michael Emmerich

14:25: A Lightweight Heliostat Field Post-Optimizer
N.C. Cruz, S. Salhi, J.L. Redondo, J.D. Álvarez, M. Berenguel and P.M. Ortigosa

14:50: Structural bias in Differential Evolution: a preliminary study
Fabio Caraffini and Anna V. Kononova

15:15: Towards Self-Adaptive Efficient Global Optimization
Hao Wang, Michael Emmerich and Thomas Bäck

Coffee break (20min)

16:00 - 17:00: Keynote lecture - Sergiy Butenko *Chair: Panos Pardalos*

17:05 - 17:30: Closing of workshop *Chair: Michael Emmerich and Yaroslav Sergeyev*

Keynote speakers

Sergiy Butenko (Professor at Texas A&M University, USA)

Kaisa Miettinen (Professor at the University of Jyväskylä, Finland)

Panos M. Pardalos (Distinguished Professor at the University of Florida, USA)

Yaroslav D. Sergeyev (Distinguished Professor University of Calabria, Italy)

Antanas Žilinskas (Professor at Vilnius University, Lithuania)

Organizers

Michael T.M. Emmerich (Leiden University, LIACS)

André H. Deutz (Leiden University, LIACS)

Sander C. Hille (Leiden University, Mathematical Institute)

Yaroslav D. Sergeyev (University of Calabria, Italy)

Organizer of Special Track on Multiobjective Global Optimization

Iryna Yevseyeva (De Montfort University, Leicester, UK)

Keynotes and Keynote Abstracts

Panos M. Pardalos: On the Limits of Computation in Non-convex Optimization

Large scale problems in engineering, in the design of networks and energy systems, the biomedical fields, and finance are modeled as optimization problems. Humans and nature are constantly optimizing to minimize costs or maximize profits, to maximize the flow in a network, or to minimize the probability of a blackout in a smart grid. Due to new algorithmic developments and the computational power of machines (digital, analog, biochemical, quantum computers etc), optimization algorithms have been used to "solve" problems in a wide spectrum of applications in science and engineering. But what do we mean by "solving" an optimization problem? What are the limits of what machines (and humans) can compute?

Panos M. Pardalos: Center for Applied Optimization, University of Florida `www.ise.ufl.edu/pardalos`

Antanas Žilinskas: On some challenges of the Bayesian approach to global optimization

During recent years the interest in Bayesian approach to global optimization is increasing. Nevertheless, some challenges deserve be investigated more intensively. In the talk the following problems will be considered discussing ways of their solution. The discussion includes the selection of a statistical model of objective functions and the estimation of its parameters, the main ideas of the corresponding global optimization algorithms, their convergence and implementation. In the talk will be presented also the recent results of the author about the bi-objective selection in global search, and about including the information on gradients in a search algorithm..

Sergiy Butenko: A Lagrangian Bound on the Clique Number and an Exact Algorithm for the Maximum Edge Weight Clique Problem

Joint work with Seyedmohammadhossein Hosseinian and Dalila B.M.M. Fontes

We explore the connections between the classical maximum clique problem and its edge-weighted generalization, the maximum edge weight clique (MEWC) problem. As a result, a new analytic upper bound on the clique number of a graph is obtained and an exact algorithm for solving the MEWC problem is developed. The bound on the clique number is derived using a Lagrangian relaxation of an integer (linear) programming formulation of the MEWC problem. Furthermore, coloring-based bounds on the clique number are utilized in a novel upper-bounding scheme for the MEWC problem. This scheme is employed within a combinatorial branch-and-bound framework, yielding an exact algorithm for the MEWC problem. Results of computational experiments demonstrate a superior performance of the proposed algorithm compared to existing approaches.

Kaisa Miettinen: Three Approaches for Computationally Expensive Multiobjective Optimization Problems

Abstract: Real-life optimization problems typically have several conflicting objective functions to be optimized simultaneously and they often are nonlinear. Multiobjective optimization methods are needed to find the best balance between the objectives. In so-called Pareto optimal solutions, improvement in one objective function necessitates allowing impairment in at least one of the others. Because we typically have many Pareto optimal solutions, we need additional preference information from a domain expert, a decision maker, to find the most preferred Pareto optimal solution to be implemented. We can classify multiobjective optimization methods according to the role of the decision maker in the solution process. We characterize four classes with the main focus on interactive methods, where the decision maker iteratively directs the solution process with one's preference information. Simultaneously, (s)he learns and gains insight about the interdependencies of the objectives and can adjust one's preferences while learning.

In e.g. simulation based optimization, function evaluations may be time-consuming. We present three types of approaches for dealing with computationally expensive functions. The first idea is to fit a metamodel to each expensive objective function. Alternatively, we can generate a representative set of Pareto optimal solutions in advance and fit a computationally inexpensive metamodel to replace the single objective scalarizing function that the multiobjective optimization method employs. The third approach is to create a surrogate problem that is computationally inexpensive and employ different interactive multiobjective optimization methods to solve it. This approach is also based on a pregenerated representative set. We illustrate the three approaches with example methods. Finally, we share some experiences in solving real problems.

Kaisa Miettinen: University of Jyvaskyla, Industrial Optimization Group, Faculty of Information Technology, P.O. Box 35 (Agora), FI-40014 University of Jyvaskyla, Finland, kaisa.miettinen@jyu.fi `http://users.jyu.fi/~miettine/engl.html` `orcid.org/0000-0003-1013-4689`

Short bio: Kaisa Miettinen is Professor of Industrial Optimization of the University of Jyvaskyla. Her research interests include theory, methods, applications and software of nonlinear multiobjective optimization including interactive and evolutionary approaches. She heads the Research Group on Industrial Optimization and is the director of the thematic research area called Decision Analytics utilizing Causal Models and Multiobjective

Optimization. She has authored over 160 refereed journal, proceedings and collection papers, edited 14 proceedings, collections and special issues and written a monograph Nonlinear Multiobjective Optimization. She is a member of the Finnish Academy of Science and Letters, Section of Science and the Immediate-Past President of the International Society on Multiple Criteria Decision Making (MCDM). She belongs to the editorial boards of six international journals and the Steering Committee of Evolutionary Multi-Criterion Optimization. She has previously worked at IIASA, International Institute for Applied Systems Analysis in Austria, KTH Royal Institute of Technology in Stockholm, Sweden and at Helsinki School of Economics in Finland. In 2017, she received the Georg Cantor Award of the International Society on MCDM for independent inquiry in developing innovative ideas in the theory and methodology.

Yaroslav D. Sergeyev: Deterministic Lipschitz global optimization algorithms and their comparison with nature-inspired methods

Joint work with Dmitri E. Kvasov, Daniela Lera, and Marat S. Mukhametzhanov

Deterministic Lipschitz global optimization algorithms are considered in this lecture. Derivative-free methods and methods proposed for solving problems with Lipschitz first derivatives are discussed. In both cases, a special attention is dedicated to techniques used to estimate Lipschitz constants and to balance global and local information. Several modifications are presented and compared with widely used multidimensional metaheuristic global optimization methods: genetic algorithms, differential evolution, particle swarm optimization, artificial bee colony algorithms, and firefly algorithms. For this purpose, there has been introduced a methodology allowing one to compare stochastic methods with deterministic ones by using operational characteristics originally proposed for working with deterministic algorithms only. As a result, a visual comparison of methods having different nature on classes of randomly generated test functions becomes possible. A detailed description of the new methodology for comparing, called operational zones, is given and results of broad numerical experiments are reported.

Yaroslav D. Sergeyev: Dipartimento di Ingegneria Informatica, Modellistica, Elettronica e Sistemistica, Università della Calabria, Rende (CS), Italy, Department of Software and Supercomputing Technologies, Lobachevsky State University of Nizhni Novgorod, Russia