

**A N N U A L**  
**R E P O R T**

**2011**

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# 1 Foreword

I am pleased to present the annual report of the Department of Statistics and Operations Research, which documents some of the many achievements in 2011. The Department of Statistics and Operations Research is part of the Faculty of Business, Economics and Statistics of the University of Vienna. Faculty members are active in research in various fields of Statistics, Econometrics, Operations Research, Applied Mathematics, and Computer Science. The department offers degree programs in Statistics at the bachelor, master, and PhD-level. During the academic year 2010/11 the department taught also many undergraduate and graduate courses for programs run by other departments, including the Department of Business Administration and the Department of Economics.

In 2011, our department has been strengthened by the arrival of Bitu Analui, Ivana Milovic, David Preinerstorfer, Lukas Steinberger, and Reinhard Ullrich as assistants and Ivana Ljubic as assistant professor.

Regrettably, there were also several departures. Stefan Gollowitzer and Philipp Thoma left the department to pursue new professional opportunities. We wish them well in their new positions.

I would like to express special thanks to Vera Lehmwald for editing the Annual Report 2011.

Benedikt Pötscher (HoD)

Vienna, June 2012

## 2 Faculty and Staff

### 2.1 Regular Faculty

Immanuel M. Bomze (Prof.)	Operations Research and Quantitative Decision Support, Game Theory and Modelling of Behaviour, Optimization Theory and Application, Asymptotic Statistics, Stochastic Modelling, Dynamical Systems
Andreas Futschik (Assoc. Prof.)	Asymptotic Statistics, Applied Statistics, Bioinformatics
Stefan Gollowitz (Dipl.-Ing.)	Combinatorial Optimization, (Mixed) Integer Programming, Network Design
Walter J. Gutjahr (Assoc. Prof.)	Operations Research, Evolutionary Computation, Software Engineering
Nina Huber (Mag.)	Mathematical Statistics, Predictive Inference, Shrinkage Estimation in High Dimensions, Nonparametric Regression
Irene Klein (Assoc. Prof.)	Stochastic Finance
Hannes Leeb (Prof.)	Model Selection, Regularization, and Shrinkage, Statistical Analysis of High-Dimensional Data, Spectral Analysis of Large Random Matrices
Ivana Ljubic (Ass. Prof.) (on leave)	Algorithmic Operations Research, Algorithm Engineering
Ivana Milovic (MSc)	Model Selection in High-Dimensional Linear Models
Richard Nickl (Dr.) (on leave)	Probability and Statistics in Infinite Dimensions
Georg C. Pflug (Prof.)	Mathematical Statistics, Stochastic Optimization, Risk Management
Alois Pichler (Dr.)	Stochastic Optimization, Risk Management
Benedikt M. Pötscher (Prof.)	Econometrics, Statistics, Time Series Analysis
David Preinerstorfer (MMag.)	Mathematical Statistics, Econometrics, Time Series Analysis, Psychometrics
Erhard Reschenhofer (Assoc. Prof.)	Time Series Analysis, Financial Econometrics, Automatic Model Selection, Chronobiology
Werner Schachinger (Assoc. Prof.)	Optimization, Probabilistic Analysis of Algorithms
Lukas Steinberger (Mag.)	Mathematical Statistics, Statistical Analysis of High-Dimensional Data
Reinhard Ullrich (MMag.)	Evolutionary Game Theory and Dynamical Systems

## 2.2 Externally Funded Faculty

Bitá Analui (MSc)	Stochastic Optimization, Sensitivity Analysis in Multistage Stochastic Optimization under Model Uncertainty, Energy Portfolio Optimization
Johanna Bertl (Mag.)	Biostatistics, Approximate Inference
David Hirschmann (Mag.)	Energy Markets, Numerical Methods of Optimal Control, Dynamical Games, Jump Diffusion Processes
Raimund Kovacevic (Dr.)	Stochastic Optimization, Quantitative Risk Management, Stochastic Processes in Finance and Insurance
Philipp Thoma (Dipl.-Ing.)	Stochastic Processes and Optimization, Stochastic Finance
Anna Timonina (MSc)	

## 2.3 External Lecturers (Academic Year 2010/11)

Andreas Baierl (Dr.), Peter Bauer (Prof., Medical University Vienna), Johanna Bertl (Mag.), Johann Brandstetter (Dr.), Stela-Liana Brannath (Mag.), Manfred Deistler (Prof., University of Technology Vienna), Stefano Demichelis (Prof., University of Pavia), Evelina Erlacher (Dr.), Florian Frommlet (Dr.), Wilfried Grossmann (Prof., CS Didactics and Learning Research Center, University of Vienna), Clemens Hanel (Mag.), Georg Heinze (Assoc. Prof., Medical University Vienna), David Hirschmann (Mag.), Dirk Holste (Dr.), Marcus Hudec (Assoc. Prof., CS Didactics and Learning Research Center, University of Vienna), Carolin Kosiol (Dr.), Raimund Kovacevic (Dr.), Christoph Krall (Dr.), Markus Leitner (Dr.), Ivana Ljubic (Dr.), Thomas Micheler (Mag.), Herbert Nagel (Dr.), Alois Pichler (Dipl.-Ing., Mag.), Peter Putz (Dipl.-Ing.), Stefan Rath (Mag.), Peter Reiter (Dr.), Felix Ruhaltinger (Dipl.-Ing.), Gabriel Strasser (Mag.), Harald Schwab (Dr.), Philipp Thoma (Dipl.-Ing.), Alessandro Tomazic (Dipl.-Math.), Gabriele Uchida (Assoc. Prof., CS Didactics and Learning Research Center, University of Vienna), Reinhard Ullrich (MMag.), Claus Vogl (Dr., University of Veterinary Medicine Vienna), Bertram Wassermann (Mag.), Nancy Wozabal (Dr.), Sonja Zehetmayer (Dr.)

## 2.4 Teaching Assistants (Academic Year 2010/11)

Karl Ewald, Christine Wallisch, Michaela Zehetner

## 2.5 Tutors (Academic Year 2010/11)

Buket Kul, Aysegül Engin, Julia Gruber, Christina Häusler, Benjamin Hofer, Kerstin Hoi, Lukas Marksteiner, Franz Peter Ostrizek, Daniel Obszelka, David Preinerstorfer, Miriam Reiss, Christoph Scheuch, Elvira Sinkovits, Carolina Torossian

## **2.6 Administrative Assistants**

Birgit Ewald, Simone Hackl, Gerald Kamhuber, Vera Lehmwald, Manuela Nicham-Zorn

## **2.7 Systems Administrators**

Jürgen Berlakovich, Georg Fochler, Stefan Geißler, Rolf Karner, Svetlana Mihajlovic

## **3 Visitors**

David Ramsey (University of Limerick), Simon Boitard (INRA Toulouse), Eduardo Álvarez-Miranda (DEIS, University of Bologna)

## 4 Teaching

### 4.1 Courses Taught (Academic Year 2010/11)

#### *Winter Term 2010/11*

<b>Lecturer</b>	<b>Course Title</b>
Andreas Baierl/Marcus Hudec	UK Programming in Statistics
Andreas Baierl/Sonja Zehetmayer	UK Biostatistics
Johanna Bertl	UE Linear Models (3 sections)
Immanuel Bomze	SE ISDS-Colloquium VO Linear Algebra UK Applied Optimization
Johann Brandstetter	UK Introduction to Business Mathematics VK Introduction to Business Mathematics FK WMS: Business Mathematics 2
Stela-Liana Brannath	FK WMS: Business Mathematics 1 (2 sections)
Stefano Demichelis	UK Selected Topics in Statistics
Evelina Erlacher	UE Linear Algebra
Florian Frommlet	UE Exercises in Markov Processes VO Exercises in Probability
Andreas Futschik	SE Statistical Inference in Biostatistics and Genetics UK Case Studies in Statistics
Andreas Futschik/Erhard Reschenhofer	PR Practical Course
Andreas Futschik/Elisabeth Pernicka	VO Advanced Biostatistics
Andreas Futschik/Reinhard Bürger/Joachim Hermisson/Christian Schlötterer	SE Seminar (Mathematical population genetics)
Andrea Gaunersdorfer	EK Quantitative Methods for Business Decisions
Wilfried Grossmann	UK Applied Statistics
Walter Gutjahr	UK Decision Support VO+UE Network Analysis
Walter Gutjahr/Peter Reiter	EK KFK OR: Operations Research I VU Computational Techniques
Walter Gutjahr/Stefan Rath	EK KFK CTR/OR/ORGA/PÖ: Game Theory
Clemens Hanel	UE Linear Algebra
David Hirschmann	VK Introduction to Business Mathematics
Dirk Holste/Thomas Micheler	UK Statistical Genetics and Bioinformatics
Marcus Hudec	UK Complex Statistical Methods

<b>Lecturer</b>	<b>Course Title</b>
Irene Klein	VO Markov Processes UK Financial and Insurance Mathematics
Raimund Kovacevic/Alois Pichler	UK Mathematical Statistics
Christoph Krall	FK WMS: Business Statistics 1 (3 sections)
Hannes Leeb	UK Probability Theory 1
Hannes Leeb/Nina Huber	UK Asymptotic Statistics
Ivana Ljubic	FK WMS: Business Mathematics 2 UK Machine Learning
Herbert Nagel	FK WMS: Business Statistics 1 FK WMS: Business Statistics 2 (2 sections)
Georg Pflug	UK Introduction to Financial Mathematics VO PhD-AW: Stochastic Models in Finance
Georg Pflug/Raimund Kovacevic	UK Basic Principles of Statistics
Alois Pichler	UE Exercises in Probability
Benedikt Pötscher	VO Linear Models UK PhD-VGSE: Asymptotic Properties of M-Estimators
Benedikt Pötscher/Manfred Deistler/Hannes Leeb	SE PhD-AW: Research Privatissimum in Econometrics/Statistics
Peter Putz	VK Introduction to Business Mathematics (2 sections)
Erhard Reschenhofer	UK Time Series Analysis
Felix Ruhaltinger	UE Exercises in Probability (2 sections)
Werner Schachinger	VO Advanced Analysis UE Advanced Analysis
Werner Schachinger/Stefano Demichelis/Irene Klein	UK PhD-AW: Random Graphs and Social Networks
Harald Schwab	VK Introduction to Business Mathematics FK WMS: Business Mathematics 1 (2 sections)
Gabriel Strasser	VK Introduction to Business Mathematics (2 sections) UE Linear Algebra
Philipp Thoma	UE Exercises in Probability
Alessandro Tomazic	VK Introduction to Business Mathematics FK WMS: Business Mathematics 2
Reinhard Ullrich	FK WMS: Business Mathematics 2 UE Linear Algebra (2 sections)
Claus Vogl	UK Biometrics 2
Bertram Wassermann	FK WMS: Business Statistics 2
David Wozabal	UE Exercises in Probability



**Lecturer****Course Title*****Summer Term 2011***

Andreas Baierl/Marcus Hudec	UK Computational Statistics
Immanuel Bomze	SE PhD-AW: ISOR-Colloquium VO Analysis
Immanuel Bomze/Irene Klein/Werner Schachinger	UK PhD-AW: Advanced Optimization
Johann Brandstetter	UK Introduction to Business Mathematics VK Introduction to Business Mathematics FK WMS: Business Mathematics 2
Marcus Cerman/Erhard Reschenhofer	VO Quantitative Methods of Economic Sciences for Historians
Evelina Erlacher	UE Exercises in Analysis
Florian Frommlet	UK Linear Multivariate Statistics UK Biometrics 1
Andreas Futschik	VO Introduction to Statistical Inference PR Statistical Genetics and Bioinformatics
Andreas Futschik/Andreas Baierl	VO Introduction to Biostatistics
Andreas Futschik/Carolin Kosiol	SE Research Privatissimum in Biostatistics and Genetics
Andreas Futschik/Reinhard Bürger/Joachim Hermisson/Christian Schlötterer	SE Seminar (Mathematical population genetics)
Andreas Futschik/Georg Heinze/Sonja Zehetmayer	PR Statistical Consulting
Stefan Gollowitzer	VK Introduction to Business Mathematics (2 sections)
Wilfried Grossmann	FK nBWM INF: Appl. Multivariate Stat.f.Business Stud. - Applied Multivariate Statistics for Business Students
Wilfried Grossmann/Marcus Hudec	UK Generalized Linear Model
Walter Gutjahr	UK Methods of Decision Support SE KFK OR: Computational Operations Research VU Game Theory
David Hirschmann	VK Introduction to Business Mathematics FK WMS: Business Mathematics 1
Nina Huber	UE Exercises in Statistical Inference (2 sections)
Marcus Hudec	UK Classification, Clustering and Discrimination
Irene Klein	UK Stochastic Processes UE Exercises in Statistical Inference (2 sections)
Raimund Kovacevic	VK Introduction to Business Mathematics UK Introduction to Insurance Mathematics

<b>Lecturer</b>	<b>Course Title</b>
Christoph Krall	FK WMS: Business Statistics 1 (3 sections)
Hannes Leeb	UK Probability Theory 2
Ivana Ljubic	UK Graph Algorithms and Network Flows
Ivana Ljubic/Peter Reiter	UK KFK OR: Operations Research II
Herbert Nagel	FK WMS: Business Statistics 1 FK WMS: Business Statistics 2 (2 sections)
Alois Pichler	UE Exercises in Analysis SE Seminar in Statistics
Benedikt Pötscher	UK Introduction to Econometrics UK Econometrics
Benedikt Pötscher/Manfred Deistler/Hannes Leeb	SE Research Privatissimum in Econometrics/Statistics
Peter Putz	VK Introduction to Business Mathematics (2 sections)
Erhard Reschenhofer	UK Multivariate Time Series Analysis FK nBWM IA, FE: Financial Econometrics
Felix Ruhaltinger	UE Exercises in Statistical Inference
Werner Schachinger	UK Stochastic Models UE Exercises in Analysis
Harald Schwab	FK WMS: Business Mathematics 1 (3 sections)
Gabriel Strasser	FK WMS: Business Mathematics 1 (2 sections) UE Exercises in Analysis
Philipp Thoma	UE Exercises in Statistical Inference
Alessandro Tomazic	FK WMS: Business Statistics 1 (2 sections) FK WMS: Business Mathematics 2
Gabriele Uchida	PR KFK OR: Software Applications in Operations Research
Reinhard Ullrich	FK WMS: Business Mathematics 2 (2 sections) UE Exercises in Analysis
Bertram Wassermann	FK WMS: Business Statistics 2
David Wozabal/Nancy Wozabal	UK Nonparametric Inference and Resampling

## 4.2 Theses Supervised

### 4.2.1 PhD Theses

<b>Supervisor</b>	<b>Author</b>	<b>Title</b>
Immanuel Bomze Walter J. Gutjahr*	Bertram Wassermann	Operations Research in action: a project for designing telecommunication access networks
Andreas J. Futschik	Johanna Bertl	Approximate Statistical Inference in Population Genetics
Andreas J. Futschik*	Elisabeth Pernicka	Nutrition in Hospital and Outcome – Results on some Special Issues in the European Multicenter "nutritionDay" Study
Walter J. Gutjahr*	Markus Kraus	Strategic Benchmarking for Hospitals
Walter J. Gutjahr*	Michael Schilde	Solution Methods for the Dynamic Stochastic Dial-a-Ride Problem with Time-Dependent Travel Speeds
Walter J. Gutjahr*	Matteo Borrotti (University of Bologna)	An Evolutionary Approach to the Design of Experiments for Combinatorial Optimization with an Application to Enzyme Engineering
Walter J. Gutjahr*	Philipp Thurnher (University of Innsbruck)	Kapazitierte zweistufige Losgrößenplanung
Walter J. Gutjahr*	Stefan Holzmann (University of Innsbruck)	Ein hybrider evolutionärer Mehrzieloptimierungsalgorithmus zur simultanen Losgrößen-, Reihenfolgen- und Personaleinsatzplanung bei parallelen Maschinen
Walter J. Gutjahr	Stefan Rath	Location Problems in Disaster Relief Operations with Multiple Objectives
Hannes Leeb	Nina Huber	Shrinkage estimation for prediction out of sample
Hannes Leeb	Ivana Milovic	Model selection in high-dimensional linear models in situations where the number of explanatory variables is substantially larger than the sample size
Hannes Leeb	Lukas Steinberger	Statistical inference when fitting linear models to high dimensional data
Hannes Leeb*	Sabyasachi Das	Essays in information economics and post model selection inference

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\* reviewer

<b>Supervisor</b>	<b>Author</b>	<b>Title</b>
Georg C. Pflug Walter J. Gutjahr*	Philipp Thoma	Efficient calculation of the Greeks: An application of Measure Valued Differentiation
Georg C. Pflug	Bitu Analui	Sensitivity Analysis of Multi-Stage Stochastic Optimization Problems in Energy
Georg C. Pflug	Anna Timonina	Multi-stage stochastic optimization and approximation with applications
Benedikt Pötscher	David Preinerstorfer	Autocorrelation-robust testing in time-series regression models

#### **4.2.2 Master Theses**

<b>Supervisor</b>	<b>Author</b>	<b>Title</b>
Andreas J. Futschik	Thomas Glaser	Non-response in sample surveys
Walter J. Gutjahr	Karol Dzubik	Multiple Criteria Decision Analysis in Environmental Applications
Walter J. Gutjahr	Hans-Christian Zohmann	Genetic Algorithms to solve Multi-Objective Optimization Problems – Adopting NSGA-II to a Periodic Vehicle Routing Problem

#### **4.3 Bachelor Theses**

Andreas Futschik (3), Georg Pflug (1), Alois Pichler (2), Benedikt Pötscher (1)

## 5 Publications

### 5.1 Journal Articles

- Bomze, Immanuel**, Jarre, Florian, Rendl, Franz: Quadratic factorization heuristics for copositive programming. *Mathematical Programming Computation* **3**, 37-57, 2011.
- Doerner, Karl F., **Gutjahr, Walter J.**, Van Wassenhove, Luk N. (Editorial): Optimization in disaster relief. *OR Spectrum* **33**, 445-449, 2011.
- Gollowitzer, Stefan, Ljubic, Ivana**: MIP Models for Connected Facility Location: A Theoretical and Computational Study. *Computers & Operations Research* **38**, 435-449, 2011.
- Gutjahr, Walter J.**: Optimal dynamic portfolio selection for projects under a competence development model. *OR Spectrum* **33**, 173-206, 2011.
- Gutjahr, Walter J.**: Recent trends in metaheuristics for stochastic combinatorial optimization. *Central European Journal of Computer Science* **1**, 58-66, 2011.
- Kofler, Robert, Orozco-terWengel, Pablo, De Maio, Nicola, Pandey, Ram Vinay, Nolte, Viola, **Futschik, Andreas**, Kosiol, Carolin, Schlötterer, Christian: PoPoolation: a toolbox for population genetic analysis of next generation sequencing data from pooled individuals. *PLoS One* **6**, 2011.
- Kovacevic, Raimund, Pflug, Georg C.**: Does insurance help to escape the poverty trap? – A ruin theoretic approach. *The Journal of Risk and Insurance* **78**, 1003-1028, 2011.
- Lin, Kao, Li, Haipeng, Schlötterer, Christian, **Futschik, Andreas**: Distinguishing positive selection from neutral evolution: boosting the performance of summary statistics. *Genetics* **187**, 229–244, 2011.
- Peneder, T. M., Scholze, P., Berger, M. L., Reither, H., Heinze, G., **Berti, Johanna**, Bauer, J., Richfield, E. K., Hornykiewicz, O., Pifl, C.: Chronic exposure to manganese decreases striatal dopamine turnover in human alpha-synuclein transgenic mice. *Neuroscience* **180**, 280-292, 2011.
- Pötscher, Benedikt M.**, Gach, Florian: Nonparametric Maximum Likelihood Density Estimation and Simulation-Based Minimum Distance Estimators. *Mathematical Methods of Statistics* **20**, 288-326, 2011.
- Pötscher, Benedikt M.**, Schneider, Ulrike: Distributional Results for Thresholding Estimators in High-Dimensional Gaussian Regression Models. *Electronic Journal of Statistics* **5**, 1876-1934, 2011.
- Reschenhofer, Erhard**, Schilde, Michael, Oberecker, Eva, Payr, Ellen, Tandogan, Hasan T., Wakolbinger, Lea M.: Identifying the determinants of foreign direct investment: a data-specific model selection approach. *Statistical Papers* (available online since 26<sup>th</sup> February 2011, DOI 10.1007/s00362-011-0377-2)
- Reschenhofer, Erhard**: Amplitude-phase relationship in stock index returns. *International Research Journal of Applied Finance* **II**, 1029-1034, 2011.
- Rota Bulò, Samuel, **Bomze, Immanuel M.**: Infection and immunization: a new class of evolutionary game dynamics. *Games and Economic Behavior* **71**, 193-211, 2011.
- Rota Bulò, Samuel, Pelillo, Marcello, **Bomze, Immanuel**: Graph-Based Quadratic Optimization: A Fast Evolutionary Approach. *Computer Vision and Image Understanding* **115**, 984-995, 2011.

Tseng, Paul, **Bomze, Immanuel, Schachinger, Werner**: A first-order interior-point method for linearly constrained smooth optimization. *Mathematical Programming* **127**, 399-424, 2011.

## 5.2 Contributions to Proceedings and Edited Books

Alvarez-Miranda, Eduardo, **Ljubic, Ivana**, Toth, Paolo: Exact Solutions for the Robust Prize-Collecting Steiner Tree Problem. In: *Proceedings of the 3<sup>rd</sup> International Congress on Ultra Modern Telecommunications and Control Systems (ICUMT 2011)*. *IEEE Xplore*, 1-7, 2011.

Arulselvan, Ashwin, Bley, Andreas, **Gollwitzer, Stefan, Ljubic, Ivana**, Maurer, Olaf: MIP modeling of Incremental Connected Facility Location. In: *Proceedings of the 5<sup>th</sup> International Network Optimization Conference (INOC 2011)*. *Lecture Notes in Computer Science* **6701**, 490-502, 2011.

**Futschik, Andreas**: Improving common population genetic estimators by using shrinkage. In: *Proceedings of the 58<sup>th</sup> World Statistics Congress (ISI2011)*.

**Gollwitzer, Stefan**, Gouveia, Luis, **Ljubic, Ivana**: A Node Splitting Technique for Two Level Network Design Problems with Transition Nodes. In: *Proceedings of the 5<sup>th</sup> International Network Optimization Conference (INOC 2011)*. *Lecture Notes in Computer Science* **6701**, 57-70, 2011.

**Gollwitzer, Stefan**, Gouveia, Luís, **Ljubic, Ivana**: The Two Level Network Design Problem with Secondary Hop Constraints. In: *Proceedings of the 5<sup>th</sup> International Network Optimization Conference (INOC 2011)*. *Lecture Notes in Computer Science* **6701**, 71-76, 2011.

**Gollwitzer, Stefan**, Pereira, Dilson Lucas, Wojciechowski, Adam: New models for and numerical tests of the Hamiltonian  $p$ -median problem. In: *Proceedings of the 5<sup>th</sup> International Network Optimization Conference (INOC 2011)*. *Lecture Notes in Computer Science* **6701**, 385-394, 2011.

**Gutjahr, Walter J.**: A note on the utility-theoretic justification of the Pareto approach in stochastic multi-objective combinatorial optimization. In: Zadnik Stirn, L., Zerovnik, J., Povh, J., Drobne, S., Liseč, A. (Eds.): *Proceedings of the 11<sup>th</sup> International Symposium on Operational Research in Slovenia (SOR '11), Sept. 28-30, 2011, Dolenjske Toplice, Slovenia*, 7-12, 2011.

**Gutjahr, Walter J.**: Ant colony optimization: recent developments in theoretical analysis. In: Auger, Anne, Doerr, Benjamin (Eds.): *Theory of Randomized Search Heuristics: Foundations and Recent Developments*. World Scientific Publishing, Singapore, Hackenjack, 225-254, 2011.

**Ljubic, Ivana**, Putz, Peter, Salazar González, Juan José: A Heuristic Algorithm for a Prize-Collecting Local Access Network Design Problem. In: *Proceedings of the 5<sup>th</sup> International Network Optimization Conference (INOC 2011)*. *Lecture Notes in Computer Science* **6701**, 139-144, 2011.

**Pflug, Georg C., Pichler, Alois**: Approximations for Probability Distributions and Stochastic Optimization Problems. In: Bertocchi, Marida, Consigli, Giorgio, Dempster, Michael A. (Eds.): *Stochastic Optimization Methods in Finance and Energy. International Series in Operations Research and Management Science* **163**. Springer, New York, 343-387, 2011.

Ramsey, David, **Futschik, Andreas**: Optimal DNA pooling for the detection of single nucleotide polymorphisms using new generation genome sequencers. In: *Proceedings of the 58<sup>th</sup> World Statistics Congress (ISI2011)*.

Ramsey, David, **Futschik, Andreas**: Optimal DNA pooling for the detection of single nucleotide polymorphisms. In: *Proceedings of the 26<sup>th</sup> International Workshop on Statistical Modelling, July 11-15, 2011, Valencia, Spain*. Copiformes S. LO., Valencia, 499-502, 2011.

**Rath, Stefan**, Doerner, K. F., **Gutjahr, Walter J.**: Warehouse location routing problem for disaster relief. In: Voss, S., Caserta, M. (Eds.): *Proceedings of the 8<sup>th</sup> Metaheuristics International Conference (MIC 2009), July 13-16, 2009, Hamburg, Germany*, 2011.

### 5.3 Technical Reports and Working Papers

Boitard, Simon, Schlötterer, Christian, Nolte, Viola, **Andreas, Futschik**: Detecting selective sweeps from pooled next generation sequencing samples. To appear in: *Molecular Biology and Evolution* (doi: 10.1093/molbev/mss090) (ahead-of-print-publication).

**Bomze, Immanuel M.**, Eichfelder, Gabriele: Copositivity detection by difference-of-convex decomposition and  $\omega$ -subdivision. *TR 2011-05* (revised version of *TR 2010-01*).

**Bomze, Immanuel M.**: Copositive optimization – recent developments and applications. *European Journal of Operational Research* (accepted, available online since 30<sup>th</sup> July 2011).

**Bomze, Immanuel**, Grippo, Luigi, Palagi, Laura: Unconstrained formulation of standard quadratic optimization problems. To appear in: *TOP*.

**Bomze, Immanuel**, Ling, Chen, Qi, Liqun, Zhang, Xinzhen.: Standard bi-quadratic optimization problems and unconstrained polynomial reformulations. To appear in: *Journal of Global Optimization*.

**Bomze, Immanuel**, Locatelli, Marco: Separable standard quadratic optimization problems. To appear in: *Optimization Letters*.

**Bomze, Immanuel, Schachinger, Werner**, Uchida, Gabriele: Think co(mpletely)positive ! Matrix properties, examples and a clustered bibliography on copositive optimization. To appear in: *Journal of Global Optimization*.

Breuer, Th., **Kovacevic, Raimund**: Multiperiod Maximum Loss is Time Unit Invariant. Submitted to: *Journal of Banking and Finance*.

Denis, Emmanuel, **Klein, Irene**, Ostafe, Lavinia: Asymptotic Arbitrage for small transaction costs.

Engau, Alexander, Anjos, Miguel F., **Bomze, Immanuel M.**: Computational Experience with Copositive Programming-Based Approximations of the Stability Number. *TR 2011-04*.

**Gollowitzer, Stefan**, Gouveia, Luis, **Ljubic, Ivana**: The Two Level Network Design Problem with Transition Facilities. Submitted to: *European Journal of Operational Research*.

**Gollowitzer, Stefan, Ljubic, Ivana**: Hop Constrained Connected Facility Location: A Hierarchy of Formulations. Submitted to: *Discrete Optimization*.

Gottfried, Michael, Pauli, Harald, **Futschik, Andreas** et al.: Continent-wide response of mountain vegetation to climate change. To appear in: *Nature Climate Change* **2**, 111-115, 2012 (doi:10.1038/nclimate1329).

**Gutjahr, Walter J.**: A note on the utility-theoretic justification of the Pareto approach in stochastic multi-objective combinatorial optimization.

**Gutjahr, Walter J.**: Recent trends in metaheuristics for stochastic combinatorial optimization.

- Huber, Nina, Leeb, Hannes:** Shrinkage estimators for prediction out-of-sample: Conditional performance. To appear in: *Communications in Statistics – Theory Methods*.
- Kovacevic, Raimund, Pflug, Georg C.:** Are time consistent valuations information monotone?
- Kovacevic, Raimund, Wozabal, David:** A semiparametric model for EEX spot prices. Submitted to: *IIE transactions*.
- Kovacevic, Raimund:** Conditional risk and acceptability mappings as Banach lattice valued mappings. *Statistics & Risk Modeling* (accepted).
- Kovacevic, Raimund:** Maximum-loss, minimum-win and the Esscher pricing principle. *IMA Journal of Management Mathematics* (accepted).
- Kovacevic, Raimund:** Robust credit migration models based on the von Neumann Divergence. Submitted to: *Journal of Banking and Finance*.
- Leeb, Hannes:** On the conditional distributions of low-dimensional projections from high-dimensional data (manuscript).
- Ljubic, Ivana, Putz, Peter, Salazar González, Juan José:** Exact Approaches to the Single-Source Network Loading Problem. To appear in: *Networks*, 2012.
- Pflug, Georg C., Pichler, Alois, Wozabal, David:** The 1/N investment strategy is optimal under high model ambiguity. To appear in: *Journal of Banking and Finance* **36**, 410-417, 2012.
- Pflug, Georg C., Pichler, Alois:** A distance for multi-stage stochastic optimization models. To appear in: *SIAM Journal of Optimization* **22**, 1-23, 2012.
- Pflug, Georg C., Pichler, Alois:** On Dynamic Decomposition of Multistage Stochastic Programs.
- Pflug, Georg C., Thoma, Philipp:** Efficient calculation of the Greeks for Exponential Lévy processes: An application of Measure Valued Differentiation.
- Pichler, Alois:** On the Geometry of Acceptability Functionals.
- Pötscher, Benedikt M.:** On the Order of Magnitude of Sums of Negative Powers of Integrated Processes.
- Ramsey David, **Futschik, Andreas:** DNA pooling and statistical tests for the detection of single nucleotide polymorphisms. To appear in: *Statistical Applications in Genetics and Molecular Biology*.
- Reschenhofer, Erhard, Ploberger, W., Lehecka, G. V.:** Detecting fuzzy periodic patterns in futures spreads.
- Reschenhofer, Erhard, Preinerstorfer, David, Steinberger, Lukas:** Non-monotonic penalizing for the number of structural breaks.
- Tricoire, Fabien, Graf, Alexandra, **Gutjahr, Walter J.:** The bi-objective stochastic covering tour problem.



## 6 Presentations

### 6.1 Conference Presentations

	<b>Conference</b>	<b>Title of Presentation</b>
Johanna Bertl	Otto Warburg International Summer School and Research Symposium on Evolutionary Genomics, Berlin, Germany	Approximate inference for coalescent models (poster)
Immanuel M. Bomze	OP11 (Siam Conference on Optimization), TU Darmstadt, Germany	Building a completely positive factorization
Immanuel M. Bomze	Optimization 2011, Nova University of Lisbon, Portugal	Recent advances in standard (bi-)quadratic optimization
Immanuel M. Bomze	AIRO 2011 (42 <sup>nd</sup> Annual Conference "Operational Research in Transportation and Logistics"), Brescia, Italy	Recent advances in standard (bi-)quadratic optimization
Immanuel M. Bomze	AFG'11 (15 <sup>th</sup> Austrian-French-German conference on Optimization), Toulouse, France	Recent advances in standard (bi-)quadratic optimization
Andreas Futschik	ISI2011 (58 <sup>th</sup> World Statistics Congress), Dublin, Ireland (invited)	Improving common population genetic estimators by using shrinkage
Andreas Futschik	Workshop on Biologically Inspired Mathematics, Kazimierz Dolny, Poland (invited)	Testing for SNPs using pooled NGS data
Stefan Gollowitzer	INOC 2011 (5 <sup>th</sup> International Network Optimization Conference), Hamburg, Germany	A two level network design problem with transition nodes
Stefan Gollowitzer	Optimization Days, Montreal, Canada	New models for and numerical tests of the Hamiltonian $p$ -median problem
Walter J. Gutjahr	SOR '11 (11 <sup>th</sup> International Symposium on Operational Research), Dolenjske Toplice, Slovenia (invited plenary talk)	Multi-objective combinatorial optimization under uncertainty
Nina Huber	17 <sup>th</sup> European Young Statisticians Meeting, Lisbon, Portugal	Shrinkage estimators for prediction out-of-sample
Raimund M. Kovacevic	OR 2011 (International Conference on Operations Research), Zurich, Switzerland (invited)	Are time consistent risk functionals information monotone?

	<b>Conference</b>	<b>Title of Presentation</b>
Raimund M. Kovacevic	CMS 2011 (8 <sup>th</sup> International Conference on Computational Management Science), Neuchâtel, Switzerland (invited)	Stochastic bilevel problems in electricity trading
Hannes Leeb	The 58 <sup>th</sup> Session of the International Statistical Institute, Dublin, Ireland	Shrinkage estimation of a univariate normal mean
Hannes Leeb	Nonparametrics and Geometry, Prague, Czech Republic (invited)	On the conditional distributions of low-dimensional projections from high-dimensional data
Ivana Ljubic	15 <sup>th</sup> Combinatorial Optimization Workshop, Aussois, France	A two level network design problem with transition nodes
Ivana Ljubic	INOC 2011 (5 <sup>th</sup> International Network Optimization Conference), Hamburg, Germany	The two level network design problem with secondary hop constraints
Alois Pichler	Workshop on Optimization under Uncertainty, UC Davis, USA	Multistage distance
Georg C. Pflug	Workshop on Optimization under Uncertainty, UC Davis, USA (invited)	Shape restricted nonparametric regression
Georg C. Pflug	Workshop on Stochastic Models and Control (SMC), Bad Herrenalb, Germany (invited)	Weak derivatives and applications
Georg C. Pflug	Workshop on Stochastic Economics and Finance, University of Bergen, Norway (invited)	On bilevel stochastic programs
Georg C. Pflug	2 <sup>nd</sup> NTH Workshop on Finance and Insurance Mathematics, TU-Braunschweig, Germany (invited)	Time consistency and information monotonicity
Georg C. Pflug	Conference on Nonparametrics and Geometry, Charles University, Prague, Czech Republic (invited)	Shape restricted nonparametric regression
Georg C. Pflug	OR 2011 (International Conference on Operations Research), Zurich, Switzerland	On the approximation quality of stochastic programs
Benedikt M. Pötscher	2 <sup>nd</sup> IMS-APRM Meeting, Tokyo, Japan (invited) (meeting cancelled due to earthquake and tsunami)	Distributional results for penalized maximum likelihood and thresholding estimators in Gaussian regression

## 6.2 Outside Seminar Presentations

	<b>Institution</b>	<b>Title</b>
Immanuel M. Bomze	DEIOC, University of La Laguna, Tenerife, Spain	Copositive optimization - principles and applications
Andreas Futschik	INRA Toulouse, France	Optimal designs for SNP discovery using pooled NGS samples
Stefan Gollowitzer	Operations Research Center, University of Lisbon, Portugal	New models for and numerical tests of the Hamiltonian $p$ -median problem
Raimund M. Kovacevic	University of Southampton, UK	Swing options as multistage stochastic bilevel problems
Ivana Ljubic	Decision, Operations and Information Technologies Seminar, University of Maryland, USA	The generalized regenerator location problem
Georg C. Pflug	NTNU – Trondheim (Norwegian University of Science and Technology), Norway	Ambiguity in stochastic optimization
Georg C. Pflug	Free University Amsterdam, The Netherlands	Time consistency and information monotonicity
Georg C. Pflug	University of Bergamo, Italy	Approximations of stochastic programs
Georg C. Pflug	Humboldt University of Berlin, Germany	On bilevel stochastic programs
Alois Pichler	University of Chiba, Japan	Acceptability functionals and their relation to multistage optimization
Alois Pichler	Humboldt University of Berlin, Germany	Distance for stochastic processes

### 6.3 Departmental Seminars

- A. Yildirim (Bilkent University, Ankara): Core sets in optimization: a unifying framework (January, 10)
- T. Breuer (FH Dornbirn): Stress tests: from arts to science (January, 17)
- Marcello Pelillo (University of Venice): What is a cluster? Perspectives from game theory (January, 24)
- Stefan Gollowitzer (University of Vienna): Public presentation of Abraham-Wald-Ph.D. project (January, 31)
- Richard Kiener (Vienna University of Economics and Business): Public presentation of Abraham-Wald-Ph.D. project (January, 31)
- Peter Putz (University of Vienna): New heuristics for extensions of the LAN problem (March, 14)
- Peter Grünwald (CWI Amsterdam): The catch-up phenomenon in model selection and model averaging (March, 21)
- Ernst Eberlein (University of Freiburg): Bid and ask: some consequences of a two prices approach (April, 04)
- Mirjam Dür (University of Groningen): Recent developments in copositive programming (April, 11)
- Cristian Dobre (University of Groningen): Exploiting algebraic symmetry in SDP bounds for structured combinatorial optimization problems (May, 23)
- J. Micheler (EZB Frankfurt): Support Vector Machines as a rating methodology in banking and finance (May, 30)
- Tatyana Krivobokova (University of Goettingen): Simultaneous confidence bands with the volume-of-tube formula and spline estimators (June, 06)
- Bitá Analui (University of Vienna): Public presentation of Abraham-Wald-Ph.D. project (June, 20)
- Johanna Bertl (University of Vienna): Public presentation of Abraham-Wald-Ph.D. project (June, 20)
- Vladimir M. Veliov (TU Vienna): Distributed optimal control models in population dynamics and economics (June, 27)
- Efstathios Papanicolaou (University of Cyprus): Some recent results on bootstrapping time series (October, 10)
- Terry Rockafellar (University of Washington): The quadrangle of risk in optimization and statistics (October, 11)
- Tillmann Gneiting (University of Heidelberg): Making and evaluating point forecasts (October, 17)
- David Kraus (EPFL Lausanne): Second-order comparison of functional data (October, 24)
- Pierre Alquier (University of Paris 7): Sparse single-index model (October, 31)
- Ole Barndorff-Nielsen (Aarhus University): Volatility and variation (November, 14)
- Alexei Onatski (University of Cambridge): Asymptotic power of Sphericity Tests for high-dimensional Data (November, 21)
- Stefanie Kritzingner (University of Vienna): A variable neighborhood search framework for solving different vehicle routing problems (November, 28)
- Vygantas Paulauskas (University of Vilnius): On two problems connected with autoregressive and linear random fields with low dimensional indices (December, 05)

Arnaud Durand (University of Paris-Sud 11): Detection of an anomalous cluster in a network (December, 12)

## 7 Grants and Projects

Andreas Futschik (Project-Coordinator)	Probabilistic and Statistical Problems in Genetics, funded by OeAD-WTZ Poland, 2010-2011
Andreas Futschik (Project-Coordinator)	New statistical methods in population genetics, funded by ICM grant for travel and cooperation, 2011-2012
Maarten Janssen (Project-Coordinator) Research Associates: Hannes Leeb, Benedikt Pötscher	Doktoratskolleg Economics, funded by FWF, 2010-2014
Ivana Ljubic (Project-Coordinator) Research Associates: Immanuel Bomze, Peter Putz	Flow-Projection Results in Telecommunication: Models and Algorithms, funded by OeAD, 2010-2011
Ivana Ljubic	Network Design Under Uncertainty: Algorithmic Aspects of Stochastic and Robust Optimization – APART Fellowship, funded by ÖAW, 2011-2013
Georg C. Pflug (Project-Coordinator) Research Associate: Raimund Kovacevic	Multiperiod risks in portfolio selection, funded by FWF, 2008-2011
Georg C. Pflug (Project-Coordinator) Research Associate: Philipp Thoma	Gradient estimation by measure valued differentiation-calculation of “the Greeks”, funded by Austrian National Bank, 2009-2011
Georg C. Pflug (Project-Coordinator) Research Associate: Anna Timonina	Approximation and convergence in multi-stage stochastic optimization with application to finance and energy, funded by FWF, 2010-2013
Georg C. Pflug (Project-Coordinator) Research Associates: David Hirschmann, Raimund Kovacevic, Bitu Analui	Energy Policies and Risk Management for the 21 <sup>st</sup> Century, funded by WWTF, 2010-2013
Stefan Rath	Solution Methods for Stochastic and Multiobjective Warehouse Location Problems in Disaster Relief, funded by Marietta Blau Grant (BMWF), 2010-2011
Christian Schlötterer (Project-Coordinator) Research Associate: Andreas Futschik	Doktoratskolleg Populationsgenetik, funded by FWF, 2010-2014

## 8 Research Stays at Other Institutions

	<b>Institution</b>	<b>Research Topic</b>	<b>Weeks</b>
Immanuel M. Bomze	University of La Laguna, Tenerife, Spain	Efficient algorithms for statistical disclosure control	2
Andreas Futschik	INRA Toulouse, France	Biostatistics	1
Stefan Gollowitzer	Operations Research Center, University of Lisbon, Portugal	The Hamiltonian $p$ -median problem	2
Irene Klein	ETH Zurich, Switzerland	Bond markets and large financial markets	1
Ivana Ljubic	TU Dortmund, Germany	Two-stage stochastic network design problems	1
Ivana Ljubic	Robert H. Smith School of Business, University of Maryland, College Park, MD, USA	Network design under uncertainty	22
Alois Pichler	Humboldt University of Berlin, Germany	Multistage distance	4
Georg C. Pflug	Tinbergen Institute, Amsterdam, The Netherlands	Measure valued derivatives	5
Georg C. Pflug	University of Bergamo, Italy	Stochastic optimization	2
Georg C. Pflug	Finance University Moscow, Russia	Bank risk management	2

## 9 Other Faculty Activities

### 9.1 Editorial Activities

- Immanuel M. Bomze
- European Journal of Operational Research (Editor)
  - Central European Journal of Operations Research (Associate Editor)
  - Journal of Global Optimization (Member of Editorial Board)
  - Advances in Data Analysis and Classification (Member of Editorial Board)
  - Optimization Letters (Member of Editorial Board)
  - TOP (Member of Editorial Board)
- Andreas Futschik
- Journal on Mathematics, Statistics and Operations Research (Associate Editor)
  - Open Journal of Genetics (Associate Editor)
  - International Journal of Information and Management Sciences (Associate Editor)
- Walter J. Gutjahr
- Advances in Operations Research (Member of Editorial Board)
  - Central European Journal of Operations Research (Associate Editor)
  - Swarm Intelligence (Member of Editorial Board)
- Karl Doerner, Walter J. Gutjahr, Luk Van Wassenhove
- Special Issue of *OR Spectrum* on “Optimization in Disaster Relief”
- Georg C. Pflug
- Statistics and Risk Modeling (Editor in Chief)
  - Computational Optimization and Applications (Associate Editor)
  - Computational Management Science (Associate Editor)
  - Central European Journal of Operations Research (Associate Editor)
  - Austrian Journal of Statistics (Associate Editor)
  - Energy Systems: Optimization, Modeling, Simulation and Economic Aspects, Operations Research (Associate Editor)
  - Journal of Stochastic Analysis (Associate Editor)
  - Financial Mathematics and Applications (Associate Editor)
- Benedikt M. Pötscher
- Econometric Theory (Co-Editor)
  - Journal of Econometrics (Associate Editor)

## 9.2 Refereeing<sup>1</sup>

- Immanuel M. Bomze
- Games
  - Linear Algebra and Its Applications
  - European Journal of Operational Research
  - Mathematical Programming
- Andreas Futschik
- Test (1)
  - Heredity (1)
  - Metrika (1)
  - Nucleic Acids Research (1)
  - Open Journal of Genetics (1)
  - Journal of Evolutionary Biology (1)
  - Genetics (1)
  - Molecular Ecology (1)
- Stefan Gollowitzer
- Central European Journal of Operations Research (1)
  - European Journal of Operational Research (2)
  - Journal of Optimization Theory and Applications (1)
  - Journal of Combinatorial Optimization (1)
- Walter J. Gutjahr
- Applied Soft Computing (1)
  - Central European Journal of Operations Research (1)
  - Discrete Applied Mathematics (1)
  - Engineering Optimization (1)
  - European Journal of Operational Research (1)
  - IEEE Transactions on Evolutionary Computation (2)
  - IIE Transactions (1)
  - International Journal of Human Resources Development and Management (1)
  - Journal of Multi-Criteria Decision Analysis (1)
  - OR Spectrum (1)
  - Swarm Intelligence (1)
  - National Fund for Scientific & Technological Development, Chile (1)
  - Swiss National Science Fund (1)
- Irene Klein
- Mathematical Finance (1)
  - European Journal of Operational Research (1)
- Hannes Leeb
- Annals of Statistics (1)
  - Biometrics (1)
  - Canadian Journal of Statistics (1)
  - Econometric Theory (1)
  - Electronic Journal of Statistics (3)
  - Journal of Econometrics (1)
  - Netherlands Organisation for Scientific Research (NWO) (1)

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<sup>1</sup> incomplete list



- Raimund Kovacevic
- Advances in Operations Research (1)
  - Central European Journal of Operations Research (1)
  - European Journal of Operational Research (1)
  - Quantitative Finance (1)
- Ivana Ljubic
- Annals of Operations Research (1)
  - Discrete Applied Mathematics (1)
  - European Journal of Operational Research (1)
  - INFORMS Journal on Computing (2)
  - Journal of Global Optimization (1)
  - Mathematical Programming (1)
  - Optimization Letters (1)
  - Operations Research (1)
  - 19<sup>th</sup> Annual European Symposium on Algorithms (ESA) 2011 (Subreferee)
  - The 38<sup>th</sup> International Colloquium on Automata, Languages and Programming (ICALP) 2011 (Subreferee)
- Alois Pichler
- Quantitative Finance (1)
  - Statistics and Decisions (1)
  - European Journal of Operational Research (3)
- Benedikt M. Pötscher
- Annals of Statistics
  - Biometrika
  - Econometrica
  - Mathematical Methods of Statistics
  - Pakistani Journal of Statistics

### 9.3 Other Professional Activities

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|----------------------|--|
| Immanuel M. Bomze    | <ul style="list-style-type: none"><li>• EJOR Editor's meeting, London, UK</li><li>• Meeting of the Scientific Advisory Board, CMA – Nova University of Lisbon, Portugal</li><li>• Elsevier Editor's meeting, Amsterdam, The Netherlands</li></ul>  |
| Andreas Futschik     | <ul style="list-style-type: none"><li>• Member of Program Committee, MASAMB 2011 Conference, Vienna, Austria</li><li>• Member of Organizing Committee, ISCB (35<sup>th</sup> Annual Conference of the International Society for Clinical Biostatistics), Vienna 2014, Austria</li><li>• Member of Executive Board, ÖSG</li></ul>   |
| Stefan Gollowitzer   | <ul style="list-style-type: none"><li>• Member of Austrian Society of OR (ÖGOR)</li></ul>  |
| Walter J. Gutjahr    | <ul style="list-style-type: none"><li>• Member of Program Committee, EvoCOP 2011</li><li>• Member of Program Committee, GECCO 2011</li><li>• Member of Program Committee, ICARIS 2011</li><li>• Member of Program Committee, ICSI 2011</li><li>• Member of Program Committee, MIC 2011</li><li>• Member of Program Committee, SBST 2011</li><li>• Member of Program Committee, LION 2012</li><li>• Deputy Director of Studies Programme Business, Economics and Statistics</li></ul> |
| Ivana Ljubic         | <ul style="list-style-type: none"><li>• Member of Program Committee, INOC 2011, Hamburg, Germany</li><li>• Member of Program Committee, 11<sup>th</sup> INFORMS Telecommunication Conference 2012, Boca Raton, FL, USA</li><li>• Member of Council of the INFORMS Technical Section on Telecommunications</li></ul>  |
| Georg C. Pflug       | <ul style="list-style-type: none"><li>• Member of Central Research Committee of the University of Bozen, Italy</li><li>• Stream organizer for Stochastic Programming, Stochastic Modelling &amp; Simulation at the OR2011, Zurich, Switzerland</li></ul>   |
| Benedikt M. Pötscher | <ul style="list-style-type: none"><li>• Member of ASA</li><li>• Member of IMS</li><li>• Member of Verein für Socialpolitik (Ausschuss für Oekonometrie)</li><li>• Member of Program Committee, EMS 2013 (29<sup>th</sup> European Meeting of Statisticians), Budapest, Hungary</li><li>• Co-Organizer of Workshop “Statistical Inference in Complex/High-dimensional Problems”</li><li>• Head of Department</li></ul>  |
| Werner Schachinger   | <ul style="list-style-type: none"><li>• Deputy Head of Department</li></ul>  |