

24th Symposium on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems

ATMOS 2024, September 5–6, 2024, Royal Holloway, London,
United Kingdom

Edited by

Paul C. Bouman

Spyros C. Kontogiannis



Editors

Paul C. Bouman 

Erasmus University Rotterdam, The Netherlands
bouman@ese.eur.nl

Spyros C. Kontogiannis 

University of Patras, Greece
spyridon.kontogiannis@upatras.gr

ACM Classification 2012

Theory of computation → Design and analysis of algorithms; Mathematics of computing → Discrete mathematics; Mathematics of computing → Combinatorics; Theory of computation → Mathematical optimization; Mathematics of computing → Graph theory; Applied computing → Transportation

ISBN 978-3-95977-350-8

Published online and open access by

Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at <https://www.dagstuhl.de/dagpub/978-3-95977-350-8>.

Publication date

October, 2024

Bibliographic information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <https://portal.dnb.de>.

License

This work is licensed under a Creative Commons Attribution 4.0 International license (CC-BY 4.0):
<https://creativecommons.org/licenses/by/4.0/legalcode>.



In brief, this license authorizes each and everybody to share (to copy, distribute and transmit) the work under the following conditions, without impairing or restricting the authors' moral rights:

- Attribution: The work must be attributed to its authors.

The copyright is retained by the corresponding authors.

Digital Object Identifier: 10.4230/OASlcs.ATMOS.2024.0

ISBN 978-3-95977-350-8

ISSN 1868-8969

<https://www.dagstuhl.de/oasics>

OASlcs – OpenAccess Series in Informatics

OASlcs is a series of high-quality conference proceedings across all fields in informatics. OASlcs volumes are published according to the principle of Open Access, i.e., they are available online and free of charge.

Editorial Board

- Daniel Cremers (TU München, Germany)
- Barbara Hammer (Universität Bielefeld, Germany)
- Marc Langheinrich (Università della Svizzera Italiana – Lugano, Switzerland)
- Dorothea Wagner (*Editor-in-Chief*, Karlsruher Institut für Technologie, Germany)

ISSN 1868-8969

<https://www.dagstuhl.de/oasics>

■ Contents

Preface	
<i>Paul C. Bouman and Spyros C. Kontogiannis</i>	0:vii
Committees	
.....	0:ix
List of Authors	
.....	0:xi

Papers

Landmark Hub Labeling: Improved Bounds and Faster Query Answering	
<i>Justine Cauwi, Ruoying Li, and Sabine Storandt</i>	1:1–1:17
Indexing Graphs for Shortest Beer Path Queries	
<i>David Coudert, Andrea D’Ascenzo, and Mattia D’Emidio</i>	2:1–2:18
Pricing for the EVRPTW with Piecewise Linear Charging by a Bounding-Based Labeling Algorithm	
<i>Jenny Enerbäck, Lukas Eveborn, and Elina Rönnberg</i>	3:1–3:18
Periodic Event Scheduling with Flexible Infrastructure Assignment	
<i>Enrico Bortoletto, Rolf Nelson van Lieshout, Berenike Masing, and Niels Lindner</i>	4:1–4:18
Balanced Assignments of Periodic Tasks	
<i>Héloïse Gachet and Frédéric Meunier</i>	5:1–5:12
Two-Stage Weekly Shift Scheduling for Train Dispatchers	
<i>Tomas Lidén, Christiane Schmidt, and Rabii Zahir</i>	6:1–6:16
Improved Algorithms for the Capacitated Team Orienteering Problem	
<i>Gianlorenzo D’Angelo, Mattia D’Emidio, Esmail Delfaraz, and Gabriele Di Stefano</i>	7:1–7:17
New Bounds on the Performance of SBP for the Dial-a-Ride Problem with Revenues	
<i>Barbara M. Anthony, Christine Chung, Ananya Das, and David Yuen</i>	8:1–8:6
Online Vehicle Routing with Pickups and Deliveries Under Time-Dependent Travel-Time Constraints	
<i>Spyros Kontogiannis, Andreas Paraskevopoulos, and Christos Zaroliagis</i>	9:1–9:20
Periodic Timetabling: Travel Time vs. Regenerative Energy	
<i>Sven Jäger, Sarah Roth, and Anita Schöbel</i>	10:1–10:20
Solving the Electric Bus Scheduling Problem by an Integrated Flow and Set Partitioning Approach	
<i>Ralf Borndörfer, Andreas Löbel, Fabian Löbel, and Steffen Weider</i>	11:1–11:16



Towards an Optimization Pipeline for the Design of Train Control Systems with Hybrid Train Detection <i>Stefan Engels and Robert Wille</i>	12:1–12:6
A Bayesian Rolling Horizon Approach for Rolling Stock Rotation Planning with Predictive Maintenance <i>Felix Prause and Ralf Borndörfer</i>	13:1–13:19
The Line-Based Dial-a-Ride Problem <i>Kendra Reiter, Marie Schmidt, and Michael Stiglmayr</i>	14:1–14:20
A Bi-Objective Optimization Model for Fare Structure Design in Public Transport <i>Philine Schiewe, Anita Schöbel, and Reena Urban</i>	15:1–15:19
Modeling Subway Networks and Passenger Flows <i>Antoine Thébault, Loïc Hérouët, and Kenza Saïah</i>	16:1–16:20
Computing User Equilibria for Schedule-Based Transit Networks with Hard Vehicle Capacities <i>Tobias Harks, Sven Jäger, Michael Markl, and Philine Schiewe</i>	17:1–17:17
Dynamic Traffic Assignment for Public Transport with Vehicle Capacities <i>Julian Patzner and Matthias Müller-Hannemann</i>	18:1–18:20

■ Preface

In the ongoing desire to improve, adapt and understand transportation systems, algorithmic theory and mathematical techniques are essential to develop and solve new models and optimization problems. Scientific advancements come from various disciplines, including mathematical optimization, theoretical computer science, algorithmics, and operations research. Since the 2000's, the *Algorithmic Approaches for Transportation Modelling, Optimization and Systems* (ATMOS) symposia represent a well-established series of meetings that brings together researchers and practitioners who are interested in all aspects of algorithmic methods and models for transportation optimization, providing a forum for the exchange and dissemination of new ideas and techniques to handle all modes of transportation.

The 24th edition of the *Symposium on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems* (ATMOS 2024) was held on September 5-6 2024, as part of ALGO 2024, the major annual European event for researchers, students and practitioners in algorithms, which was hosted by the Royal Holloway, University of London in Egham, United Kingdom. All optimization problems, models and algorithmic techniques which are related to transportation systems were regarded as topics of interest for ATMOS 2024, including but not limited to: charging schemes; electromobility; fairness in schedules; fare structure design; infrastructure assignment and maintenance; passenger flows; resource-constrained shortest paths; route planning; (rolling-stock, shift, vehicle, periodic-event) scheduling; time-dependent travel-times; traffic-assignment; equilibria with side-constraints; vehicle routing and dial-a-ride problems. Of particular interest were the following techniques which were used by the papers in this year's edition of ATMOS: (exact, approximate, heuristic, local-search) algorithms for transport optimization; algorithmic engineering; algorithmic game theory; Bayesian inference; labelling and indexing schemes; learning and prediction techniques; mathematical programming; multi-objective optimization; stochastic simulation.

We received a total of thirty-two submissions from all over the world, twenty-eight of them being regular papers, and the other four being short papers. All manuscripts were reviewed by at least three PC members and were evaluated on originality, technical quality, and relevance to the topics of the symposium. Based on the reviews, the program committee selected eighteen submissions (sixteen regular papers and two short papers) to be presented at the symposium. Altogether, they quite remarkably demonstrate the wide applicability of algorithmic optimization on transportation problems. In addition, Eduardo Uchoa (Universidade Federal Fluminense, Niteroi, Brazil) kindly agreed to complement the program with an invited talk “*Exact Algorithms for Vehicle Routing: advances, challenges, and perspectives*”, that was presented as one of the keynote talks of ALGO 2024.

We would like to thank: the Steering Committee of ATMOS for giving us the opportunity to serve as Program Chairs of ATMOS 2024; all the authors who submitted their papers; the members of the ATMOS 2024 Program Committee and the sub-reviewers for their valuable work in evaluating all the submissions and selecting the papers appearing in this volume; Eduardo Uchoa for accepting our invitation to present an invited talk; Argyrios Deligkas and Eduard Eiben (co-chairs of the ALGO 2024 Organizing Committee) and their team at the Royal Holloway, University of London for hosting the symposium as part of ALGO 2024. We would also like to acknowledge the use of the EasyChair system for the great help in managing the submission and review processes, and Schloss Dagstuhl for publishing the proceedings of ATMOS 2024 in its OASICS series.

Finally, we are pleased to announce that, based on the Program Committee’s reviews and decisions, the authors Justine Cauvi, Ruoying Li and Sabine Storandt have been awarded this year’s “Best Paper Award of ATMOS 2024” for their paper “*Landmark Hub Labeling: Improved Bounds and Faster Query Answering*”.

August 2024

Paul Bouman and Spyros Kontogiannis

■ Committees

Program committee chairs

- Paul Bouman (co-chair), Erasmus University Rotterdam, Netherlands
- Spyros Kontogiannis (co-chair), University of Patras, Greece

Program committee members

- David Coudert, INRIA and Université Côte d'Azur, France
- Mattia D'Emidio, University of L'Aquila, Italy
- Julian Dibbelt, Apple, USA
- Twan Dollevoet, Erasmus University Rotterdam, The Netherlands
- Daniele Frigioni, University of Aquila, Italy
- Loukas Georgiadis, University of Ioannina, Greece
- Marc Goerigk, University of Passau, Germany
- Andrew Goldberg, Amazon, USA
- Vera Grafe, University of Kaiserslautern-Landau, Germany
- Irene Heinrich, TU Darmstadt, Germany
- Jesper Larsen, Technical University of Denmark, Denmark
- Niels Lindner, Zuse Institute Berlin, Germany
- Philine Schiewe, Aalto University, Finland
- Sabine Storandt, University of Konstanz, Germany
- Rolf van Lieshout, Eindhoven University of Technology, The Netherlands

Steering committee

- Alberto Marchetti-Spaccamela, Sapienza Università di Roma, Italy
- Marie Schmidt, Universität Würzburg, Germany
- Anita Schöbel, University of Kaiserslautern-Landau, Germany
- Christos Zaroliagis, University of Patras, Greece (Chair)

Organizing committee

- Karen Burnett, Royal Holloway, University of London
- Argyrios Deligkas, Royal Holloway, University of London (co-chair)
- Eduard Eiben, Royal Holloway, University of London (co-chair)
- Francisco Ferreira Ruiz, Royal Holloway, University of London
- Tiger-Lily Goldsmith, Royal Holloway, University of London
- Matthew Hague, Royal Holloway, University of London
- Reuben Rowe, Royal Holloway, University of London
- Magnus Wahlström, Royal Holloway, University of London

24th Symposium on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems (ATMOS 2024).

Editors: Paul C. Bouman and Spyros C. Kontogiannis



OpenAccess Series in Informatics
OASICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

List of subreviewers


- Oliver Bachtler
- Sofia Brenner
- Serafino Cicerone
- Andrea D'Ascenzo
- Esmail Delfaraz
- Christoph Hertrich
- Eda Kaja
- Stefano Leucci
- Ruoying Li
- Berenike Masing
- Georg Schindling
- Lena Volk


■ List of Authors

Barbara M. Anthony  (8)
Southwestern University, Georgetown, TX, USA

Ralf Borndörfer  (11, 13)
Zuse Institute Berlin, Germany

Enrico Bortoletto  (4)
Zuse Institute Berlin, Germany

Justine Cauvi  (1)
École Normale Supérieure de Lyon, France;
Department of Computer and Information
Science, University of Konstanz, Germany

Christine Chung  (8)
Connecticut College, New London, CT, USA


David Coudert  (2)
Université Côte d'Azur, Inria, I3S, CNRS,
Sophia Antipolis, France


Gianlorenzo D'Angelo  (7)
Gran Sasso Science Institute, L'Aquila, Italy

Andrea D'Ascenzo  (2)
Luiss University, Rome, Italy


Mattia D'Emidio  (2, 7)
University of L'Aquila, Italy


Ananya Das  (8)
Middlebury College, VT, USA

Esmail Delfaraz  (7)
Dept. of Information Engineering, Computer
Science and Mathematics, University of
L'Aquila, L'Aquila, Italy

Gabriele Di Stefano  (7)
Dept. of Information Engineering, Computer
Science and Mathematics, University of
L'Aquila, L'Aquila, Italy

Jenny Enerbäck (3)
Department of Mathematics,
Linköping University, Sweden;
Scania CV AB, Södertälje, Sweden


Stefan Engels  (12)
Chair for Design Automation,
Technical University of Munich, Germany


Lukas Eveborn  (3)
Department of Mathematics,
Linköping University, Sweden


Héloïse Gachet (5)
École nationale des ponts et chaussées,
Champs-sur-Marne, France;
SNCF, DTIPG, Saint-Denis, France


Tobias Harks  (17)
University of Passau, Germany

Loïc Héluët  (16)
Univ. Rennes, IRISA, CNRS & INRIA,
Rennes, France

Sven Jäger  (10, 17)
RPTU Kaiserslautern-Landau, Germany

Spyros Kontogiannis  (9)
Computer Engineering and Informatics
Department, University of Patras, Greece;
Computer Technology Institute and Press
"Diophantus", Patras, Greece

Ruoying Li  (1)
Department of Computer and Information
Science, University of Konstanz, Germany

Tomas Lidén  (6)
Department of Science and Technology (ITN),
Linköping University, Sweden


Niels Lindner  (4)
Zuse Institute Berlin, Germany


Andreas Löbel (11)
IVU Traffic Technologies AG, Berlin, Germany

Fabian Löbel  (11)
Zuse Institute Berlin, Germany

Michael Markl  (17)
University of Passau, Germany

Berenike Masing  (4)
Zuse Institute Berlin, Germany

Frédéric Meunier  (5)
École nationale des ponts et chaussées,
Champs-sur-Marne, France

Matthias Müller-Hannemann  (18)
Martin-Luther-Universität Halle-Wittenberg,
Germany

Andreas Paraskevopoulos (9)
Computer Technology Institute and Press
"Diophantus", Greece

24th Symposium on Algorithmic Approaches for Transportation Modelling, Optimization, and Systems (ATMOS 2024).

Editors: Paul C. Bouman and Spyros C. Kontogiannis



OpenAccess Series in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

- Julian Patzner  (18)
Martin-Luther-Universität Halle-Wittenberg,
Germany
- Felix Prause  (13)
Zuse Institute Berlin, Germany
- Kendra Reiter  (14)
Department of Computer Science,
University of Würzburg, Germany
- Sarah Roth  (10)
RPTU Kaiserslautern-Landau, Germany
- Elina Rönnerberg  (3)
Department of Mathematics,
Linköping University, Sweden
- Kenza Saiah (16)
Alstom Transport, Saint-Ouen, France
- Philine Schiewe  (15, 17)
Department of Mathematics and Systems
Analysis, Aalto University, Finland
- Christiane Schmidt  (6)
Department of Science and Technology (ITN),
Linköping University, Sweden
- Marie Schmidt  (14)
Department of Computer Science,
University of Würzburg, Germany
- Anita Schöbel  (10, 15)
RPTU Kaiserslautern-Landau, Germany;
Fraunhofer Institute for Industrial Mathematics,
Kaiserslautern, Germany
- Michael Stiglmayr  (14)
Department of Mathematics and Informatics,
University of Wuppertal, Germany
- Sabine Storandt  (1)
Department of Computer and Information
Science, University of Konstanz, Germany
- Antoine Thébault  (16)
Univ. Rennes, IRISA, CNRS & INRIA,
Rennes, France;
Alstom Transport, Saint-Ouen, France
- Reena Urban  (15)
Department of Mathematics, University of
Kaiserslautern-Landau (RPTU), Germany
- Rolf Nelson van Lieshout  (4)
Eindhoven University of Technology,
The Netherlands
- Steffen Weider (11)
IVU Traffic Technologies AG, Berlin, Germany
- Robert Wille  (12)
Chair for Design Automation,
Technical University of Munich, Germany;
Software Competence Center Hagenberg GmbH
(SCCH), Austria
- David Yuen  (8)
Independent Researcher, Kapolei, HI, USA
- Rabii Zahir  (6)
Department of Science and Technology (ITN),
Linköping University, Sweden
- Christos Zaroliagis  (9)
Computer Engineering and Informatics
Department, University of Patras, Greece;
Computer Technology Institute and Press
“Diophantus”, Patras, Greece