

*Commenced Publication in 1973*

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

## Editorial Board

David Hutchison

*Lancaster University, Lancaster, UK*

Takeo Kanade

*Carnegie Mellon University, Pittsburgh, PA, USA*

Josef Kittler

*University of Surrey, Guildford, UK*

Jon M. Kleinberg

*Cornell University, Ithaca, NY, USA*

Friedemann Mattern

*ETH Zurich, Zurich, Switzerland*

John C. Mitchell

*Stanford University, Stanford, CA, USA*

Moni Naor

*Weizmann Institute of Science, Rehovot, Israel*

C. Pandu Rangan

*Indian Institute of Technology, Madras, India*

Bernhard Steffen

*TU Dortmund University, Dortmund, Germany*

Demetri Terzopoulos

*University of California, Los Angeles, CA, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Gerhard Weikum

*Max Planck Institute for Informatics, Saarbrücken, Germany*

More information about this series at <http://www.springer.com/series/7407>

Tolga Bektaş · Stefano Coniglio  
Antonio Martinez-Sykora · Stefan Voß (Eds.)


# Computational Logistics


8th International Conference, ICCL 2017  
Southampton, UK, October 18–20, 2017  
Proceedings

*Editors*

Tolga Bektaş   
University of Southampton  
Southampton  
UK

Stefano Coniglio  
University of Southampton  
Southampton  
UK

Antonio Martinez-Sykora   
University of Southampton  
Southampton  
UK

Stefan Voß   
University of Hamburg  
Hamburg  
Germany

ISSN 0302-9743                      ISSN 1611-3349 (electronic)  
Lecture Notes in Computer Science  
ISBN 978-3-319-68495-6              ISBN 978-3-319-68496-3 (eBook)  
<https://doi.org/10.1007/978-3-319-68496-3>

Library of Congress Control Number: 2017954978

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer International Publishing AG 2017

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature  
The registered company is Springer International Publishing AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

Logistics is central to world trade. It encompasses a wide range of activities, including the production, handling, storage, and distribution of goods, as well as the use of communication technologies needed for the flow of information to meet consumer demand. In order for these activities to be run in an efficient manner, good, or optimal, decisions are to be taken in relation to various aspects of a logistics system, including the design of the physical and the digital infrastructure on which the logistics network will operate, the interaction between various entities in the network, and the flow of products and information. The breadth and the range of tasks involved in logistics make the management and coordination of the activities complex and challenging, and require advanced methods for the design, planning, and control of the system. This is where computational tools are of competitive advantage, offering ways to capture, store, visualize, and share information to solve complex problems employing optimization techniques, to evaluate systems and policies using simulation, and to enable collaborative schemes through the use of algorithmic mechanisms. The use of computational technology facilitates addressing these challenges within reasonable amounts of computational time and supports decision-making.

The International Conference on Computational Logistics (ICCL) is a forum where recent advances on the topic are presented and discussed. This volume offers a selection of 38 peer-reviewed papers submitted to the 8th International Conference on Computational Logistics (ICCL 2017), held in Southampton during October 18–20, 2017. The papers are indicative of the recent work that is being undertaken in computational logistics, categorized in what emerged as four sufficiently distinct but interrelated areas within computational logistics, and which appear as four sections in the volume:

1. **Vehicle Routing and Scheduling:** The papers in this area address planning problems arising in road transportation, and, in particular, various extensions of the vehicle routing problem describing algorithmic advances as well as applications in route planning for truck drivers, disaster logistics, snow plowing, offshore petroleum wells, and collaborative logistics.
2. **Maritime Logistics:** As a recurring and a popular theme within computational logistics, the papers that fall in this area relate to fleet deployment, routing, scheduling, and inventory problems arising in maritime shipping and in offshore wind farms. This section also presents two survey papers, one in the area of autonomous surface vessels structured in two parts, and the other in the use of fuzzy techniques in maritime shipping operations.
3. **Synchromodal Transportation:** Being an emerging area of research, synchromodal transportation has its unique advantages and challenges. One of the papers that appear in this section presents a framework to classify the problems in this area, whereas another paper reviews the particular aspects of synchromodal

transportation when used within global cold chains. The third paper in this section presents computational tools to solve a scheduling problem arising in the same area.

4. Transportation, Logistics, and Supply Chain Planning: The papers that appear in this section relate to a range of topics concerning various planning problems in transportation, warehouse operations, perishable goods, bike-sharing systems, construction projects, road traffic, container packing, and airport emissions. The section also includes a paper with a tutorial flavor on the use of stochastic programming in supply chains.

ICCL 2017 was the eighth edition of this conference series, following those held in Shanghai (2010, 2012), Hamburg (2011), Copenhagen (2013), Valparaiso (2014), Delft (2015), and Lisbon (2016).

The editors thank all the authors for their contributions and the reviewers for their invaluable support and feedback. We hope that the present volume will help to continue the dialogue within computational logistics and inspire further developments in this exciting area of research.

October 2017

Tolga Bektaş  
Stefano Coniglio  
Antonio Martinez-Sykora  
Stefan Voß

# Organization

The 8th International Conference on Computational Logistics 2017 (ICCL 2017) was organized by the Centre for Operational Research, Management Sciences and Information Systems (CORMSIS) spanning the Southampton Business School and Department of Mathematical Sciences at the University of Southampton, in association with the Universität Hamburg.

## Organizing Committee

### Program Committee

Tolga Bektas	University of Southampton, UK
Stefano Coniglio	University of Southampton, UK
Antonio Martinez-Sykora	University of Southampton, UK
Stefan Voß	University of Hamburg, Germany

### Local Committee

Silvia Gonzato	University of Southampton, UK
Rahimeh Neamatian-Monemi	University of Southampton, UK
Chris Potts	University of Southampton, UK

## Scientific Committee

Panagiotis Angeloudis	Imperial College London, UK
Khalid Bichou	Imperial College, UK
Miguel Ayala Botto	Instituto Superior Técnico, Portugal
Jürgen W. Böse	TU Hamburg-Harburg, Germany
Buyang Cao	Tongji University, China and ESRI, USA
Rafael Carmona	Universidad Anahuac Mexico Norte, Mexico
José Ceroni	Católica de Valparaíso, Chile
Marielle Christiansen	Norwegian University of Science and Technology, Norway
Francesco Corman	Delft University of Technology, The Netherlands
Joachim Daduna	University of Economics and Law, Germany
Rommert Dekker	Erasmus University, The Netherlands
Karl F. Doerner	Johannes Kepler University, Austria
Wolfgang Domschke	TU Darmstadt, Germany
Roberto Domínguez Cañizares	Universidad de Sevilla, Spain
Kjetil Fagerholt	Norwegian University of Science and Technology, Norway
Enzo Frazzon	Universidade Federal de Santa Catarina, Brazil
Monica Gentili	University of Salerno, Italy

Rosa González	Universidad de los Andes, Chile
Luis Gouveia	University of Lisbon, Portugal
Peter Greistorfer	Karl-Franzens-Universität Graz, Austria
Hans-Otto Guenther	TU Berlin, Germany
Richard Hartl	University of Vienna, Austria
Geir Hasle	SINTEF, Norway
Leonard Heilig	University of Hamburg, Germany
Sin Ho	Aarhus University, Denmark
Patrick Jaillet	Massachusetts Institute of Technology, USA
Rune Møller Jensen	IT University, Denmark
Carlos Ocampo-Martinez	Technical University of Catalonia, Spain
André Ludwig	University of Leipzig, Germany
Herbert Kopfer	University of Bremen, Germany
René de Koster	Erasmus University, The Netherlands
Ioannis Lagoudis	Malaysia Institute for Supply Chain Innovation, Malaysia
Jasmine Siu Lee Lam	Nanyang Technological University, Singapore
Gilbert Laporte	HEC Montreal and CIRRELT, Canada
Janny Leung	The Chinese University of Hong Kong, SAR China
Shijie Li	Delft University of Technology, The Netherlands
José Maestre	University of Seville, Spain
Vittorio Maniezzo	University of Bologna, Italy
João Nabais	Escola Superior de Tecnologia de Setúbal, Portugal
Rudy R. Negenborn	Delft University of Technology, The Netherlands
Dario Pacino	Technical University of Denmark, Denmark
Ana Paias	University of Lisbon, Portugal
Margarida Pato	University of Lisbon, Portugal
Julia Pahl	University of Southern Denmark, Denmark
Guenther Raidl	Vienna University of Technology, Austria
Jana Ries	Portsmouth University, UK
Mario Ruthmair	University of Vienna, Austria
Simona Sacone	University of Genoa, Italy
Juan Jose Salazar González	University of La Laguna, Spain
Frederik Schulte	University of Hamburg, Germany
Xiaoning Shi	University of Hamburg, Germany
L. Douglas Smith	University of Missouri, USA
Lori Tavasszy	Delft University of Technology, The Netherlands
Kevin Tierney	Paderborn University, Germany
David Woodruff	University of California Davis, USA
Jianbin Xin	Delft University of Technology, The Netherlands
Tsz Leung Yip	Hong Kong Polytechnic University, SAR China
Shiyuan Zheng	Shanghai Maritime University, China



## Additional Reviewers

Douglas Alem	Ola Jabali	Jakob Puchinger
Henrik Andersson	Angel Juan	Günther Raidl
Panagiotis Angeloudis	Jörg Kalcsics	Jana Ries
Christopher Bayliss	Herbert Kopfer	Ruben Ruiz
Marton Benedek	Eduardo Lalla-Ruiz	Mario Ruthmair
Julia Bennell	Gilbert Laporte	Frederik Schulte
Patrick Beullens	Philip Le	Frank Schwartz
Marta Cabo	Fabien Lehuédé	L. Douglas Smith
Bülent Çatay	Janny Leung	Sven Spieckermann
Karl Doerner	Martijn Mes	Magnus Stålhane
Jan Fabian Ehmke	Rahimeh Neamatian	Kevin Tierney
Kjetil Fagerholt	Monemi	Juan G. Villegas R.
Juan José	Tri-Dung Ngyuen	Stein W. Wallace
Salazar González	Julia Pahl	Tony Wauters
Stefano Gualandi	Ana Paias	Bart Wiegman
Richard F. Hartl	Dimitris Paraskevopoulos	David Woodruff
Leonard Heilig	Meltem Peker	Yuan Zhang
Sin C. Ho	Edgar Possani	Shiyuan Zheng

## Sponsoring Institutions

Southampton Marine and Maritime Institute

# Contents

## Vehicle Routing and Scheduling

An Effective Large Neighborhood Search for the Team Orienteering Problem with Time Windows . . . . .	3
<i>Verena Schmid and Jan Fabian Ehmke</i>	
Hybrid Heuristic for the Clustered Orienteering Problem . . . . .	19
<i>Ala-Eddine Yahiaoui, Aziz Moukrim, and Mehdi Serairi</i>	
An Adaptive Large Neighborhood Search for the Periodic Vehicle Routing Problem . . . . .	34
<i>Sandra Zajac</i>	
The Vehicle Routing Problem with Dynamic Occasional Drivers . . . . .	49
<i>Lars Dahle, Henrik Andersson, and Marielle Christiansen</i>	
Maximizing the Number of Served Requests in an Online Shared Transport System by Solving a Dynamic DARP . . . . .	64
<i>Sven Vallée, Ammar Oulamara, and Wahiba Ramdane Cherif-Khettaf</i>	
A Polyhedral Study of the Elementary Shortest Path Problem with Resource Constraints . . . . .	79
<i>Jiarui Da, Lanbo Zheng, and Xin Tang</i>	
Vehicle Routing with a Heterogeneous Fleet of Combustion and Battery-Powered Electric Vehicles Under Energy Minimization. . . . .	94
<i>Herbert Kopfer, Benedikt Vornhusen, and Jan Dethloff</i>	
Time-Dependent Route Planning for Truck Drivers . . . . .	110
<i>Alexander Kleff, Christian Bräuer, Frank Schulz, Valentin Buchhold, Moritz Baum, and Dorothea Wagner</i>	
A Combinatorial Auction for Transportation Matching Service: Formulation and Adaptive Large Neighborhood Search Heuristic . . . . .	127
<i>Baoxiang Li and Hoong Chuin Lau</i>	
Metaheuristic Framework for a Disaster Logistics Problem with Time-Dependent Demands . . . . .	143
<i>Jorge F. Victoria, H. Murat Afsar, and Christian Prins</i>	
Planning of an Offshore Well Plugging Campaign: A Vehicle Routing Approach . . . . .	158
<i>Steffen Bakker, Mats Aarlott, Asgeir Tomasgard, and Kjetil Midthun</i>	

Arc Routing with Precedence Constraints: An Application to Snow Plowing Operations . . . . .	174
<i>Anders H. Gundersen, Magnus Johansen, Benjamin S. Kjær, Henrik Andersson, and Magnus Stålhane</i>	
Analysis of the Partner Selection Problem in Horizontal Collaboration Among Shippers . . . . .	189
<i>Hanan Ouhader and Malika El Kyal</i>	
A Simple Mechanism for the Disaster Emergency Unit Scheduling Problem . . . . .	205
<i>P.J. Araya-Córdova and Óscar C. Vásquez</i>	
<b>Maritime Logistics</b>	
Survey on Autonomous Surface Vessels: Part I - A New Detailed Definition of Autonomy Levels . . . . .	219
<i>Matteo Schiaretta, Linying Chen, and Rudy R. Negenborn</i>	
Survey on Autonomous Surface Vessels: Part II - Categorization of 60 Prototypes and Future Applications . . . . .	234
<i>Matteo Schiaretta, Linying Chen, and Rudy R. Negenborn</i>	
Review of Fuzzy Techniques in Maritime Shipping Operations . . . . .	253
<i>Jana Ries, Rosa G. González-Ramírez, and Stefan Voß</i>	
A Relax-and-Fix Algorithm for a Maritime Inventory Routing Problem . . . . .	270
<i>Marcelo W. Friske and Luciana S. Buriol</i>	
Strategic Optimization of Offshore Wind Farm Installation . . . . .	285
<i>Stian Backe and Dag Haugland</i>	
Maritime Load Dependent Lead Times - An Analysis . . . . .	300
<i>Julia Pahl and Stefan Voß</i>	
Integrating Fleet Deployment into the Liner Shipping Cargo Allocation Problem . . . . .	306
<i>Daniel Müller, Stefan Guericke, and Kevin Tierney</i>	
A New Formulation for the Combined Maritime Fleet Deployment and Inventory Management Problem . . . . .	321
<i>Bo Dong, Tolga Bektaş, Saurabh Chandra, Marielle Christiansen, and Kjetil Fagerholt</i>	
The Liner Shipping Routing and Scheduling Problem under Environmental Considerations: The Case of Emission Control Areas . . . . .	336
<i>Philip Dithmer, Line Reinhardt, and Christos A. Kontovas</i>	

A Shortest Path Heuristic for evaluating the Quality of Stowage Plans in Roll-On Roll-Off Liner Shipping. . . . .	351
<i>Jone R. Hansen, Kjetil Fagerholt, and Magnus Stålhane</i>	

Optimising and Recognising 2-Stage Delivery Chains with Time Windows. . . . .	366
<i>Frank Phillipson, Max Ortega del Vecchio, Bart van Ginkel, Dylan Huizing, and Alex Sangers</i>	

## **Synchromodal Transportation**

Framework of Synchromodal Transportation Problems. . . . .	383
<i>M.A.M. De Juncker, Dylan Huizing, Max Ortega del Vecchio, Frank Phillipson, and Alex Sangers</i>	

Scheduling Drayage Operations in Synchromodal Transport. . . . .	404
<i>Arturo E. Pérez Rivera and Martijn R.K. Mes</i>	

Survey on Characteristics and Challenges of Synchromodal Transportation in Global Cold Chains. . . . .	420
<i>Wenjing Guo, Wouter Beelaerts van Blokland, and Gabriel Lodewijks</i>	

## **Transportation, Logistics and Supply Chain Planning**

Stochastic Programming for Global Supply Chain Planning Under Uncertainty: An Outline. . . . .	437
<i>Yingjie Fan, Frank Schwartz, Stefan Voß, and David L. Woodruff</i>	

Towards the Physical Internet Paradigm: A Model for Transportation Planning in Complex Road Networks with Empty Return Optimization. . . . .	452
<i>Claudia Caballini, Massimo Paolucci, Simona Sacone, and Evrim Ursavas</i>	

Simulating Storage Policies for an Automated Grid-Based Warehouse System. . . . .	468
<i>Michaela Beckschäfer, Simon Malberg, Kevin Tierney, and Christoph Weskamp</i>	

Quality-Aware Modeling and Optimal Scheduling for Perishable Good Distribution Networks: The Case of Banana Logistics. . . . .	483
<i>Xiao Lin, Rudy R. Negenborn, Mark B. Duinkerken, and Gabriel Lodewijks</i>	

Cost-Efficient Allocation of Bikes to Stations in Bike Sharing Systems. . . . .	498
<i>Patrick Vogel, Jan Fabian Ehmke, and Dirk Christian Mattfeld</i>	

A Dynamic Network Flow Model for Interdependent Infrastructure and Supply Chain Networks with Uncertain Asset Operability . . . . .	513
<i>Nils Goldbeck, Panagiotis Angeloudis, and Washington Y. Ochieng</i>	
Establishing Outsourcing and Supply Chain Plans for Prefabricated Construction Projects Under Uncertain Productivity. . . . .	529
<i>Pei-Yuan Hsu, Marco Aurisicchio, and Panagiotis Angeloudis</i>	
Agent-Based Simulation to Assess the Performance of Intersections with Pre-signals: Comparison with Roundabouts . . . . .	544
<i>António A.C. Vieira, Luís M.S. Dias, Guilherme A.B. Pereira, and José A. Oliveira</i>	
Efficient Local Search Heuristics for Packing Irregular Shapes in Two-Dimensional Heterogeneous Bins. . . . .	557
<i>Ranga P. Abeysooriya, Julia A. Bennell, and Antonio Martinez-Sykora</i>	
Reducing Airport Emissions with Coordinated Pushback Processes: A Case Study . . . . .	572
<i>Branko Bubalo, Frederik Schulte, and Stefan Voß</i>	
<b>Author Index . . . . .</b>	<b>587</b>