

## Founding Editors

Gerhard Goos

*Karlsruhe Institute of Technology, Karlsruhe, Germany*

Juris Hartmanis

*Cornell University, Ithaca, NY, USA*

## Editorial Board Members

Elisa Bertino

*Purdue University, West Lafayette, IN, USA*

Wen Gao

*Peking University, Beijing, China*

Bernhard Steffen 

*TU Dortmund University, Dortmund, Germany*

Moti Yung 

*Columbia University, New York, NY, USA*


More information about this series at <https://link.springer.com/bookseries/558>


Jesica de Armas · Helena Ramalhinho ·  
Stefan Voß (Eds.)

# Computational Logistics

13th International Conference, ICCL 2022  
Barcelona, Spain, September 21–23, 2022  
Proceedings

*Editors*

Jesica de Armas   
Universitat Pompeu Fabra  
Barcelona, Spain

Helena Ramalhinho   
Universitat Pompeu Fabra  
Barcelona, Spain

Stefan Voß   
Universität Hamburg  
Hamburg, Germany

ISSN 0302-9743

ISSN 1611-3349 (electronic)

Lecture Notes in Computer Science

ISBN 978-3-031-16578-8

ISBN 978-3-031-16579-5 (eBook)

<https://doi.org/10.1007/978-3-031-16579-5>

© The Editor(s) (if applicable) and The Author(s), under exclusive license  
to Springer Nature Switzerland AG 2022

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, expressed 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.

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

# Preface

The increasing availability of information, together with current complex logistics operations have led to the need of better optimization proposals. Recently, important efforts and initiatives from all sides of optimization have been undertaken to improve logistics operations with sophisticated algorithms and information systems. This resulted in advances in several logistics sectors, such as maritime shipping, urban logistics, warehousing, production and supply chain management. Computational logistics, as the driver between decision making and operations, has become a key component for economic and industrial growth.

Computational logistics covers the management of logistic activities and tasks by the combined use of computational technologies, advanced decision support and optimization techniques. It is applied in several areas such as the flow and storage of goods and services, as well as the flow of related information. In this context, modeling and algorithmic approaches are developed, verified, and applied for planning and execution complex logistics tasks, including identification of the most efficient routing plans and schedules to transport passengers or distribute goods. The models and algorithms are integrated with computing technologies, not only for getting satisfactory results in reasonable times, but also exploiting interactivity with the decision maker through visual interfaces, and for extracting knowledge from data to improve future decision making. This promotes the joint effort of practitioners and scholars for better understanding and solving the logistics problems at hand.

The International Conference on Computational Logistics (ICCL) is a forum where recent advances in the computational logistics research area are presented and discussed. This volume offers a selection of 32 peer-reviewed papers out of 64 contributions submitted to the 13th ICCL edition, held at the University Pompeu Fabra, Barcelona, Spain, during September 21–23, 2022. The papers show various directions of importance in computational logistics, classified into five topic areas reflecting the interest of researchers and practitioners in this field. The papers in this volume are grouped according to the following parts:

## 1. **Maritime and Port Logistics**

Maritime and port logistics are the backbone of global supply chains and international trade. The performance and functioning of its related activities are remarkably influenced by the quality of its planning and management. In ICCL 2022, the contributions that fall into this category relate to, among others, berth allocation, bulk logistics, crane scheduling, and various real-world maritime applications.

## 2. **Vehicle Routing and Urban Logistics**

Vehicle Routing is a well-known family of optimization problems that constitutes an important part of real-world transport and logistics activities. Due to the many specific real-world features, there is a strong necessity of modeling and developing efficient solution approaches that permit advancements in this area. Additionally, the progress in urban transport as well as the development of cities and other

regions require current systems to be adapted and updated to cope with changes that involve new transportation means, such as drones, integrated planning, and inter-modal transport. The papers in this category relate to a diverse range of topics, such as waste collection, school bus routing, green routing, drone-assisted delivery, long-haul transportation, and last mile delivery, among others.

### 3. **Warehousing and Location**

Warehousing is an important piece of the supply chain and logistics puzzle. Warehousing and inventory storage affect everything from sourcing raw materials and, efficiently managing inventory, to getting orders delivered to customers on time. Though the principles of warehousing have not changed much over the years, warehousing solutions have evolved. In the same vein, the location of warehouses impact on all other logistics operations. Contributions considering cross-docking, block stacking, palletizing, warehouse layouts, energy savings and facility location fall into this category.

### 4. **Supply Chain and Production Management**

The management of supply chains and production covers different relevant logistics operations. The works included in this category pursue the efficient organization and management of the diverse resources and operations involved. Thus, the papers that appear in this category relate to a range of topics concerning distribution, workforce management, lot sizing, production scheduling, risk tolerance, freight costs, information sharing and collaboration, and other supply chain-related topics.

The ICCL 2022 was the 13th edition of this conference series, following the earlier ones held in Shanghai, China (2010, 2012), Hamburg, Germany (2011), Copenhagen Denmark (2013), Valparaíso, Chile (2014), Delft, The Netherlands (2015), Lisbon, Portugal (2016), Southampton, UK (2017), Salerno, Italy (2018), Barranquilla, Colombia (2019) and Enschede, The Netherlands (2020, 2021). The editors thank all the authors for their contributions as well as the program committee and reviewers for their invaluable support and feedback. We trust that the present volume supports the continued advances within computational logistics and inspires all participants and readers to its fullest extent.

November 2022

Jesica de Armas  
Helena Ramalhinho  
Stefan Voß

# Organization

## Program Committee

Tolga Bektas	University of Liverpool, UK
Francesco Carrabs	University of Salerno, Italy
Raffaele Cerulli	University of Salerno, Italy
Alysson M. Costa	University of Melbourne, Australia
Joachim R. Daduna	Berlin School of Economics and Law, Germany
Adriana Daza	Universidad del Norte, Colombia
Jesica de Armas (Chair)	Universitat Pompeu Fabra, Spain
René De Koster	Erasmus University Rotterdam, Germany
Elena Fernández	Universitat Politècnica de Catalunya, Spain
Jian Gang Jin	Shanghai Jiao Tong University, China
Maria Isabel Gomes	Universidade Nova de Lisboa, Portugal
Rosa Gonzalez Ramirez	Universidad de Los Andes, Chile
Hans-Dietrich Haasis	University of Bremen, Germany
Alessandro Hill	California Polytechnic State University, USA
Patrick Hirsch	BOKU, Vienna
Raka Jovanovic	Qatar Environment and Energy Research Institute, Qatar
Ioannis Lagoudis	University of Piraeus, Greece
Manuel Laguna	University of Colorado Boulder, USA
Eduardo Lalla-Ruiz	University of Twente, The Netherlands
Janny Leung	University of Macau, China
Pedro Martins	Polytechnic Institute of Coimbra, Portugal
Frank Meisel	University of Kiel, Germany
Gonzalo Mejía	Universidad de La Sabana, Colombia
Martijn Mes	University of Twente, The Netherlands
Dario Pacino	Technical University of Denmark, Denmark
Julia Pahl	University of Southern Denmark, Denmark
Luciana Pessoa	PUC-Rio, Brazil
Carlos Quintero	Universidad de La Sabana, Colombia
Markus Rabe	TU Dortmund, Germany
Helena Ramalhinho (Chair)	Universitat Pompeu Fabra, Spain
Rosephine Rakotonirainy	University of Cape Town, South Africa
Daniel Riera	Universitat Oberta de Catalunya, Spain
Jessica Rodriguez-Pereira	Universitat Pompeu Fabra, Spain
Dirk Sackmann	HS Merseburg, Germany
Juan J. Salazar González	Universidad de La Laguna, Spain

Frederik Schulte  
Douglas Smith  
Anand Subramanian  
Shunji Tanaka  
Kevin Tierney  
Stefan Voß (Chair)

Delft University of Technology, The Netherlands  
University of Missouri - St. Louis, USA  
Universidade Federal da Paraíba, Brazil  
Kyoto University, Japan  
Bielefeld University, Germany  
University of Hamburg, Germany

## **Additional Reviewers**

Alan Dávila de León  
Ping He  
Fabio Luiz Usberti  
Xiaohuan Lyu  
José Eduardo Pécora Jr.  
Orivalde Soares da Silva Junior  
Xinyu Tang  
Bruno Vieira

# Contents

## Maritime and Port Logistics

Hybrid Berth Allocation for Bulk Ports with Unavailability and Stock Level Constraints .....	3
<i>Xiaohuan Lyu and Frederik Schulte</i>	
A Self-adaptive Hybrid Search Technique with Its Application to the Quadratic Semi-assignment and Berth Allocation Problems .....	16
<i>Mehrdad Amirghasemi, Marcella Bernardo Papini, and Stefan Voß</i>	
The Multi-port Continuous Berth Allocation Problem with Speed Optimization .....	31
<i>Bernardo Martin-Iradi, Dario Pacino, and Stefan Ropke</i>	
Optimization of a Ship-Based Logistics System for Carbon Capture and Storage .....	44
<i>Anders Bønnæs, Martin Skogset, Tormod Svorkdal, Kjetil Fagerholt, Lisa Herlicka, Frank Meisel, and Wilfried Rickels</i>	
A Linear Time Algorithm for Optimal Quay Crane Scheduling .....	60
<i>Mathias Offerlin Herup, Gustav Christian Wichmann Thiesgaard, Jaikje van Twiller, and Rune Møller Jensen</i>	
Impact of Rubber-Tired Gantry Crane Dimension on Container Terminal Productivity .....	74
<i>Marvin Kastner and Carlos Jahn</i>	

## Vehicle Routing and Urban Logistics

Fleet Size Control in First-Mile Ride-Sharing Problems .....	91
<i>Jinwen Ye, Giovanni Pantuso, and David Pisinger</i>	
ILS-RVND Algorithm for Multi-trip Pickup and Delivery Problem, with Split Loads, Profits and Multiple Time Windows .....	105
<i>Wahiba Ramdane Cherif-Khettaf, Atef Jaballah, and Fernando Ferri</i>	
The Biobjective Consistent Traveling Salesman Problem .....	120
<i>Daniel Díaz-Ríos and Juan-José Salazar-González</i>	
Optimized Dispatch of Fire and Rescue Resources .....	132
<i>Tobias Andersson Granberg</i>	

<b>Industrial Waste Collection Optimization: A Real-World Case Study in Northern Italy</b> .....	147
<i>Andrea Chiussi, Gabriel de Paula Felix, Manuel Iori, and André Gustavo dos Santos</i>	
<b>Solving a School Bus Routing Problem in Rural Areas: An Application in Brazil</b> .....	162
<i>Letícia Caldas, Rafael Martinelli, and Bruno Rosa</i>	
<b>Hinterland Intermodal Transport Routing as an Added Value Tool for Port Community Systems: A Colombian Case Study</b> .....	177
<i>Adriana Moros-Daza, René Amaya-Mier, Guisselle García, and Stefan Voß</i>	
<b>Integrated Path Planning and Task Assignment Model for On-Demand Last-Mile UAV-Based Delivery</b> .....	198
<i>Jose Escribano, Huan Chang, and Panagiotis Angeloudis</i>	
<b>Dynamic Time Slot Pricing Using Delivery Costs Approximations</b> .....	214
<i>Fabian Akkerman, Martijn Mes, and Eduardo Lalla-Ruiz</i>	
<b>The Green Sequencing and Routing Problem</b> .....	231
<i>Giacomo Lanza, Mauro Passacantando, and Maria Grazia Scutellà</i>	
<b>The Long-Haul Transportation Problem with Refueling Deviations and Time-Dependent Travel Time</b> .....	245
<i>Silvia Anna Cordieri, Francesca Fumero, Ola Jabali, and Federico Malucelli</i>	
<b>The Dynamic Drone Scheduling Delivery Problem</b> .....	260
<i>Giovanni Campuzano, Eduardo Lalla-Ruiz, and Martijn Mes</i>	
<b>Integrating Clustering Methodologies and Routing Optimization Algorithms for Last-Mile Parcel Delivery</b> .....	275
<i>Angie Ramírez-Villamil, Jairo R. Montoya-Torres, Anicia Jaegler, Juan M. Cuevas-Torres, David L. Cortés-Murcia, and William J. Guerrero</i>	
<b>Warehousing and Location</b>	
<b>SLAPStack: A Simulation Framework and a Large-Scale Benchmark Use Case for Autonomous Block Stacking Warehouses</b> .....	291
<i>Jakob Pfrommer, Alexandru Rinciog, Sohaib Zahid, Michael Morrissey, and Anne Meyer</i>	

Locating Hydrogen Production in Norway Under Uncertainty .....	306
<i>Šárka Štádlerová, Trygve Magnus Aglen, Andreas Hofstad, and Peter Schütz</i>	
Oblivious Stacking and MAX $k$ -CUT for Circle Graphs .....	322
<i>Martin Olsen</i>	
How Can a Refrigerated Warehouse Be Used to Store Energy? .....	336
<i>Marco Repke, Ann-Kathrin Lange, and Carsten Eckert</i>	
CrossLog: Automatic Mixed-Palletizing for Cross-Docking Logistics Centers .....	351
<i>Pedro Rocha, António G. Ramos, and Elsa Silva</i>	
<b>Supply Chain and Production Management</b>	
A Framework on Centralised to Decentralised Logistics Control Structures Applied in Two Case Studies .....	369
<i>Meike Hopman, Ruben Franssen, Jaco van Meijeren, and Irene Zubin</i>	
Risk-Aware Procurement Optimization in a Global Technology Supply Chain .....	382
<i>Jonathan Chase, Jingfeng Yang, and Hoong Chuin Lau</i>	
Freight Costs Versus Service Level: Optimizing the Distribution of a Materials Trader .....	397
<i>Thomas Bömer and Anne Meyer</i>	
Reference Model for Data-Driven Supply Chain Collaboration .....	412
<i>Anna-Maria Nitsche, Christian-Andreas Schumann, and Bogdan Franczyk</i>	
Heuristics for the Single-Item Dynamic Lot-Sizing Problem with Rework of Internal Returns .....	425
<i>Steffen Rudert and Udo Buscher</i>	
A Carbon-Aware Planning Framework for Production Scheduling in Mining ...	441
<i>Nurul Asyikeen Binte Azhar, Aldy Gunawan, Shih-Fen Cheng, and Erwin Leonardi</i>	
Multi-shift Worker Assignment Problem with a Heterogeneous Workforce in Semi-automated Electronics Production .....	457
<i>Nadine Schiebold</i>	
<b>Author Index</b> .....	473