

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

Gerhard Woeginger 

RWTH Aachen, Aachen, Germany

Moti Yung


Columbia University, New York, NY, USA

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

Henning Fernau (Ed.)

Computer Science – Theory and Applications

15th International Computer Science Symposium in Russia, CSR 2020
Yekaterinburg, Russia, June 29 – July 3, 2020
Proceedings

Editor
Henning Fernau 
University of Trier
Trier, Germany

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-50025-2 ISBN 978-3-030-50026-9 (eBook)
<https://doi.org/10.1007/978-3-030-50026-9>

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer Nature Switzerland AG 2020

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.

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 15th International Computer Science Symposium in Russia (CSR 2020) was supposed to be held in Ekaterinburg, Russia. It was organized by the Ural Federal University, Russia. This was the 15th edition of the annual series of meetings, previous editions were held in St. Petersburg (2006), Ekaterinburg (2007), Moscow (2008), Novosibirsk (2009), Kazan (2010), St. Petersburg (2011), Nizhny Novgorod (2012), Ekaterinburg (2013), Moscow (2014), Listvyanka (2015), St. Petersburg (2016), Kazan (2017), Moscow (2018), and Novosibirsk (2019). The symposium covers a broad range of topics in Theoretical Computer Science, ranging from fundamental to application-related.

This year, CSR was planned to be organized as a part of the centennial celebrations of the Ural Federal University. Unfortunately, the corona crisis made it impossible to organize this event in a usual format. At the time of writing this preface, we were investigating the different ways of hosting the conference online.

The distinguished CSR keynote lecture was supposed to be given by Béla Bollobás. The six other CSR invited plenary speakers were, in alphabetical order, Farid Ablaei (Kazan Federal University, Russia), Ulrik Brandes (ETH Zürich, Switzerland), Piotr Faliszewski (AGH University of Science and Technology, Poland), Mateus de Oliveira Oliveira (University of Bergen, Norway), Meirav Zehavi (Ben-Gurion University, Israel), and Binhai Zhu (Montana State University, USA). The Program Committee (PC) included 30 scientists from 14 countries and was chaired by Henning Fernau (University of Trier, Germany). These 30 names included Jérôme Monnot from Dauphine University in Paris, France, who sadly enough passed away in December, 2019.

This volume contains extended abstracts both of the invited lectures and of the accepted papers. We received 49 submissions in total. Each paper was reviewed by at least three PC members on average. As a result, the PC selected 25 papers for presentation on the symposium and publication in these proceedings. The reviewing process was smoothly run using the EasyChair conference system.

The PC also selected two papers to receive awards sponsored by Springer. The awardees are:

- Best Paper Award: Fedor V. Fomin and Vijayaragunathan Ramamoorthi: “On the Parameterized Complexity of the Expected Coverage Problem”
- Best Student Paper Award: Onur Çağırıcı: “On Embeddability of Unit Disk Graphs onto Straight Lines”

We would like to thank all invited speakers for accepting to give a talk at the conference, PC members for giving their time and energy, 19 external reviewers for their expertise, and the publishers Springer and MDPI who provided financial support

for this event. We also acknowledge support by the Ural Mathematical Center under agreement No. 075-02-2020-1537/1 with the Ministry of Science and Higher Education of the Russian Federation.

April 2020

Henning Fernau

Organization

Program Committee

Eric Allender	Rutgers University, USA
Sergey Bereg	The University of Texas at Dallas, USA
Davide Bilò	University of Sassari, Italy
Karl Bringmann	Max Planck Institute for Informatics, Germany
Tin-Chih Toly Chen	National Chiao Tung University, Taiwan
Henning Fernau	Universität Trier, Germany
Alexander Grigoriev	Maastricht University, The Netherlands
Yo-Sub Han	Yonsei University, South Korea
Kun He	Huazhong University of Science and Technology, China
Dominik Kempa	University of California, Berkeley, USA
Michael Khachay	Krasovsky Institute of Mathematics and Mechanics, Russia
Margarita Korovina	A. P. Ershov Institute of Informatics Systems, Russia
Dmitry Kosolobov	Ural Federal University, Russia
Andrei Krokhin	University of Durham, UK
Giuseppe Lancia	University of Udine, Italy
Meena Mahajan	The Institute of Mathematical Sciences, HBNI, India
David Manlove	University of Glasgow, UK
Neeldhara Misra	Indian Institute of Science, India
Jerome Monnot	CNRS-LAMSADE, Université Paris-Dauphine, France
Sergio Rajsbaum	UNAM, Mexico
Jörg Rothe	Heinrich-Heine-Universität Düsseldorf, Germany
Markus L. Schmid	Humboldt Universität Berlin, Germany
Vladimir Shenmaier	Sobolev Institute of Mathematics, Russia
Arseny Shur	Ural Federal University, Russia
Ulrike Stege	University of Victoria, Canada
Sergey Verlan	LACL, Université Paris-Est Créteil, France
Mikhail Volkov	Ural Federal University, Russia
Yaokun Wu	Shanghai Jiao Tong University, China
Tomoyuki Yamakami	University of Fukui, Japan
Ryo Yoshinaka	Tohoku University, Japan

Additional Reviewers

Bevern, René Van
de Rezende, Susanna F.
Haghpanah, Mohammadreza
Kerkmann, Anna Maria
Klein, Shmuel Tomi
Kobylkin, Konstantin
Li, Sizhe
Liu, Guodong
Melnikov, Alexander
Mittal, Harshil

Neveling, Marc
Ogorodnikov, Yuri
Puppis, Gabriele
Scheder, Dominik
Sethia, Aditi
Shapira, Dana
Villagra, Marcos
Wang, Xinmao
Weishaupt, Robin

Contents

Invited Papers

Quantum Hashing and Fingerprinting for Quantum Cryptography and Computations	1
<i>Farid Ablayev, Marat Ablayev, and Alexander Vasiliev</i>	
Parameterized Analysis of Art Gallery and Terrain Guarding	16
<i>Akanksha Agrawal and Meirav Zehavi</i>	
Central Positions in Social Networks	30
<i>Ulrik Brandes</i>	
Second-Order Finite Automata	46
<i>Alexsander Andrade de Melo and Mateus de Oliveira Oliveira</i>	
Isomorphic Distances Among Elections	64
<i>Piotr Faliszewski, Piotr Skowron, Arkadii Slinko, Stanisław Szufa, and Nimrod Talmon</i>	
Tandem Duplications, Segmental Duplications and Deletions, and Their Applications.	79
<i>Binhai Zhu</i>	

Contributed Papers

Faster 2-Disjoint-Shortest-Paths Algorithm	103
<i>Maxim Akhmedov</i>	
An Improvement to Chvátal and Thomassen's Upper Bound for Oriented Diameter	117
<i>Jasine Babu, Deepu Benson, Deepak Rajendraprasad, and Sai Nishant Vaka</i>	
The Normalized Algorithmic Information Distance Can Not Be Approximated	130
<i>Bruno Bauwens and Ilya Blinnikov</i>	
Definable Subsets of Polynomial-Time Algebraic Structures	142
<i>Nikolay Bazhenov</i>	
Families of Monotonic Trees: Combinatorial Enumeration and Asymptotics	155
<i>Olivier Bodini, Antoine Genitrini, Mehdi Naima, and Alexandros Singh</i>	

Nested Regular Expressions Can Be Compiled to Small Deterministic Nested Word Automata	169
<i>Iovka Boneva, Joachim Niehren, and Momar Sakho</i>	
On Embeddability of Unit Disk Graphs onto Straight Lines	184
<i>Onur Çağırıcı</i>	
On the Decision Tree Complexity of Threshold Functions	198
<i>Anastasiya Chistopolskaya and Vladimir V. Podolskii</i>	
Randomized and Symmetric Catalytic Computation.	211
<i>Samir Datta, Chetan Gupta, Rahul Jain, Vimal Raj Sharma, and Raghunath Tewari</i>	
On the Parameterized Complexity of the Expected Coverage Problem	224
<i>Fedor V. Fomin and Vijayaragunathan Ramamoorthi</i>	
Computational Hardness of Multidimensional Subtraction Games	237
<i>Vladimir Gurvich and Mikhail Vyalyi</i>	
Parameterized Complexity of Fair Feedback Vertex Set Problem.	250
<i>Lawqueen Kanesh, Soumen Maity, Komal Muluk, and Saket Saurabh</i>	
The Power of Leibniz-Like Functions as Oracles.	263
<i>Jaeyoon Kim, Ilya Volkovich, and Nelson Xuzhi Zhang</i>	
Optimal Skeleton Huffman Trees Revisited	276
<i>Dmitry Kosolobov and Oleg Merkurev</i>	
The Subtrace Order and Counting First-Order Logic	289
<i>Dietrich Kuske</i>	
Speedable Left-c.e. Numbers	303
<i>Wolfgang Merkle and Ivan Titov</i>	
The Complexity of Controlling Condorcet, Fallback, and k -Veto Elections by Replacing Candidates or Voters	314
<i>Marc Neveling, Jörg Rothe, and Roman Zorn</i>	
On the Transformation of $LL(k)$ -linear Grammars to $LL(1)$ -linear	328
<i>Alexander Okhotin and Ilya Olkhovsky</i>	
On Computing the Hamiltonian Index of Graphs.	341
<i>Geevarghese Philip, M. R. Rani, and R. Subashini</i>	
A Lower Bound for the Query Phase of Contraction Hierarchies and Hub Labels	354
<i>Tobias Rupp and Stefan Funke</i>	

Kernelization of ARC DISJOINT CYCLE PACKING in α -Bounded Digraphs	367
<i>Abhishek Sahu and Saket Saurabh</i>	
On Subquadratic Derivational Complexity of Semi-Thue Systems	379
<i>Alexey Talambutsa</i>	
The Untold Story of SBP	393
<i>Ilya Volkovich</i>	
Weighted Rooted Trees: Fat or Tall?	406
<i>Yaokun Wu and Yinfeng Zhu</i>	
Groupoid Action and Rearrangement Problem of Bicolor Arrays by Prefix Reversals	419
<i>Akihiro Yamamura, Riki Kase, and Tatiana B. Jajcayová</i>	
Author Index	433