LIPIcs – Leibniz International Proceedings in Informatics

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

Editorial Board
- Luca Aceto (Chair, Gran Sasso Science Institute and Reykjavik University)
- Christel Baier (TU Dresden)
- Mikolaj Bojanczyk (University of Warsaw)
- Roberto Di Cosmo (INRIA and University Paris Diderot)
- Javier Esparza (TU München)
- Meena Mahajan (Institute of Mathematical Sciences)
- Dieter van Melkebeek (University of Wisconsin-Madison)
- Anca Muscholl (University Bordeaux)
- Luke Ong (University of Oxford)
- Catuscia Palamidessi (INRIA)
- Thomas Schwentick (TU Dortmund)
- Raimund Seidel (Saarland University and Schloss Dagstuhl – Leibniz-Zentrum für Informatik)

ISSN 1868-8969

https://www.dagstuhl.de/lipics
Contents

Preface

Christophe Paul and Markus Bläser ............................................................ 0:ix–0:x

Conference organization ........................................................................... 0:xi–0:xii

Invited Talk

Statistical Physics and Algorithms

Dana Randall ................................................................. 1:1–1:6

Weisfeiler and Leman’s Unlikely Journey from Graph Isomorphism to Neural Networks

Martin Grohe ................................................................. 2:1–2:1

Computability, Complexity and Programming with Ordinary Differential Equations

Olivier Bournez ................................................................. 3:1–3:13

Tutorial

Graphical Models: Queries, Complexity, Algorithms

Martin C. Cooper, Simon de Givry, and Thomas Schiex ........................... 4:1–4:22

Regular Paper

Inapproximability Results for Scheduling with Interval and Resource Restrictions

Marten Maack and Klaus Jansen ............................................................ 5:1–5:18

An Automaton Group with PSPACE-Complete Word Problem

Jan Philipp Wächter and Armin Weiβ .................................................. 6:1–6:17

A Trichotomy for Regular Trail Queries

Wim Martens, Matthias Niewerth, and Tina Trautner ............................ 7:1–7:16

Descriptive Complexity on Non-Polish Spaces

Antonin Callard and Mathieu Hoyrup .................................................. 8:1–8:16

NP-Completeness, Proof Systems, and Disjoint NP-Pairs

Titus Dose and Christian Glaßer ............................................................ 9:1–9:18

String Indexing with Compressed Patterns

Philip Bille, Inge Li Gørtz, and Teresa Anna Steiner .............................. 10:1–10:13

An FPT Algorithm for Minimum Additive Spanner Problem

Yusuke Kobayashi .............................................................................. 11:1–11:16

New Bounds for Randomized List Update in the Paid Exchange Model

Susanne Albers and Maximilian Janke .................................................. 12:1–12:17
On Covering Segments with Unit Intervals

Decidability and Periodicity of Low Complexity Tilings
Jarkko Kari and Etienne Moutot ................................................................. 14:1–14:12

The Tandem Duplication Distance Is NP-Hard
Manuel Lafond, Binhai Zhu, and Peng Zou .............................................. 15:1–15:15

Existential Length Universality
Paweł Gawrychowski, Martin Lange, Narad Rampersad, Jeffrey Shallit, and
Marek Szykuła ........................................................................... 16:1–16:14

On the Termination of Flooding
Walter Hussak and Amitabh Trehan ...................................................... 17:1–17:13

Generalised Pattern Matching Revisited
Bartłomiej Dudek, Paweł Gawrychowski, and Tatiana Starikovskaya ............. 18:1–18:18

Parameterized Pre-Coloring Extension and List Coloring Problems
Gregory Gutin, Diptapriyo Majumdar, Sebastian Ordyniak, and Magnus Wahlström 19:1–19:18

Oracle Complexity Classes and Local Measurements on Physical Hamiltonians
Sevag Gharibian, Stephen Piddock, and Justin Yirka .................................. 20:1–20:37

Secret Key Agreement from Correlated Data, with No Prior Information
Marius Zimand .............................................................................. 21:1–21:12

Using Statistical Encoding to Achieve Tree Succinctness Never Seen Before
Michał Gańczorz .......................................................... 22:1–22:29

Quantum Distributed Algorithm for Triangle Finding in the CONGEST Model
Taisuke Izumi, François Le Gall, and Frédéric Magniez ................................ 23:1–23:13

Lower Bounds for Arithmetic Circuits via the Hankel Matrix
Nathanaël Fijalkow, Guillaume Lagarde, Pierre Ohlmann, and Olivier Serre ........ 24:1–24:16

Solving Vertex Cover in Polynomial Time on Hyperbolic Random Graphs
Thomas Bläsius, Philipp Fischbeck, Tobias Friedrich, and Maximilian Katzmann .... 25:1–25:14

Domino Problem Under Horizontal Constraints
Nathalie Aubrun, Julien Esnay, and Mathieu Sablik .................................... 26:1–26:15

Computing Maximum Matchings in Temporal Graphs
George B. Mertzios, Hendrik Molter, Rolf Niedermeier, Viktor Zamarov, and
Philipp Zschoche ....................................................................... 27:1–27:14

Tight Bounds for the Cover Times of Random Walks with Heterogeneous Step
Lengths
Brieuc Guinard and Amos Korman ......................................................... 28:1–28:14

Solving Connectivity Problems Parameterized by Treedepth in Single-Exponential
Time and Polynomial Space
Falko Hegerfeld and Stefan Kratsch ...................................................... 29:1–29:16

Non-Rectangular Convolutions and (Sub-)Cadences with Three Elements
Mitsuru Funakoshi and Julian Pape-Lange ........................................... 30:1–30:16
<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Matchings in Geometric Intersection Graphs</td>
<td>Édouard Bonnet, Sergio Cabello, and Wolfgang Mulzer</td>
<td>31:1–31:17</td>
</tr>
<tr>
<td>Unambiguous Separators for Tropical Tree Automata</td>
<td>Thomas Colcombet and Sylvain Lombardy</td>
<td>32:1–32:13</td>
</tr>
<tr>
<td>Streaming Complexity of Spanning Tree Computation</td>
<td>Yi-Jun Chang, Martín Farach-Colton, Tsan-Sheng Hsu, and Meng-Tsung Tsai</td>
<td>34:1–34:19</td>
</tr>
<tr>
<td>Elimination Distances, Blocking Sets, and Kernels for Vertex Cover</td>
<td>Eva-Maria C. Hols, Stefan Kratsch, and Astrid Pieterse</td>
<td>36:1–36:14</td>
</tr>
<tr>
<td>Relational Width of First-Order Expansions of Homogeneous Graphs with Bounded Strict Width</td>
<td>Michał Wrona</td>
<td>39:1–39:16</td>
</tr>
<tr>
<td>A Sub-Quadartic Algorithm for the Longest Common Increasing Subsequence Problem</td>
<td>Lech Duraj</td>
<td>41:1–41:18</td>
</tr>
<tr>
<td>Identifiability of Graphs with Small Color Classes by the Weisfeiler-Leman Algorithm</td>
<td>Frank Fuhlbrück, Johannes Köbler, and Oleg Verbitsky</td>
<td>43:1–43:18</td>
</tr>
<tr>
<td>Better Approximations for General Caching and UFP-Cover Under Resource Augmentation</td>
<td>Andrés Cristi and Andreas Wiese</td>
<td>44:1–44:14</td>
</tr>
<tr>
<td>Improved Bounds on Fourier Entropy and Min-Entropy</td>
<td>Srinivasan Arunachalam, Soarav Chakraborty, Michal Koucký, Nitin Saurabh, and Ronald de Wolf</td>
<td>45:1–45:19</td>
</tr>
<tr>
<td>Information Distance Revisited</td>
<td>Bruno Bauwens</td>
<td>46:1–46:14</td>
</tr>
<tr>
<td>On Computing Multilinear Polynomials Using Multi-r-ic Depth Four Circuits</td>
<td>Suryajith Chillara</td>
<td>47:1–47:16</td>
</tr>
</tbody>
</table>
Observation and Distinction. Representing Information in Infinite Games
   Dietmar Berwanger and Laurent Doyen .......................... 48:1–48:17

How Fast Can You Escape a Compact Polytope?
   Julian D’Costa, Engel Lefaucheur, Joël Ouaknine, and James Worrell ....... 49:1–49:11

The SDP Value for Random Two-Eigenvalue CSPs
   Sidhanth Mohanty, Ryan O’Donnell, and Pedro Paredes ..................... 50:1–50:45

Asymptotic Divergences and Strong Dichotomy
   Xiang Huang, Jack H. Lutz, Elvira Mayordomo, and Donald M. Stull ........ 51:1–51:15

Perfect Resolution of Conflict-Free Colouring of Interval Hypergraphs
   S. M. Dhannya and N. S. Narayanaswamy .................................. 52:1–52:16

Constant-Time Dynamic $(\Delta + 1)$-Coloring
   Monika Henzinger and Pan Peng ........................................ 53:1–53:18

Cryptocurrency Mining Games with Economic Discount and Decreasing Rewards
   Marcelo Arenas, Juan Reutter, Étienne Toussaint, Martín Ugarte,
   Francisco Vial, and Domagoj Vrgoč ........................................ 54:1–54:16

Randomness and Initial Segment Complexity for Probability Measures
   André Nies and Frank Stephan ........................................ 55:1–55:14

Computing Shrub-Depth Decompositions
   Jakub Gajarský and Stephan Kreutzer .................................. 56:1–56:17

Typical Sequences Revisited – Computing Width Parameters of Graphs
   Hans L. Bodlaender, Lars Jaffke, and Jan Arne Telle ................ 57:1–57:16

Grundy Coloring & Friends, Half-Graphs, Bicliques
   Pierre Aboulker, Édouard Bonnet, Eun Jung Kim, and Florian Sikora .......... 58:1–58:18

Lower Bounds Against Sparse Symmetric Functions of ACC Circuits: Expanding
   the Reach of #SAT Algorithms
   Nikhil Vyas and R. Ryan Williams ........................................ 59:1–59:17

Reversible Pebble Games and the Relation Between Tree-Like and General
   Resolution Space
   Jacobo Torán and Florian Wörz ........................................ 60:1–60:18
The International Symposium on Theoretical Aspects of Computer Science (STACS) conference series is an internationally leading forum for original research on theoretical aspects of computer science. Typical areas are:

- algorithms and data structures, including: design of parallel, distributed, approximation, parameterized and randomized algorithms; analysis of algorithms and combinatorics of data structures; computational geometry, cryptography, algorithmic learning theory, algorithmic game theory;
- automata and formal languages, including: algebraic and categorical methods, coding theory; complexity and computability, including: computational and structural complexity theory, parameterized complexity, randomness in computation;
- logic in computer science, including: finite model theory, database theory, semantics, specification verification, rewriting and deduction;
- current challenges, for example: natural computing, quantum computing, mobile and net computing, computational social choice.


The interest in STACS has remained at a very high level over the past years. The STACS 2020 call for papers led to 242 submissions with authors from 43 countries. Each paper was assigned to three program committee members who, at their discretion, asked external reviewers for reports. For the sixth time within the STACS conference series, there was also a rebuttal period during which authors could submit remarks to the PC concerning the reviews of their papers. The committee selected 56 papers during a three-week electronic meeting held in November/December 2019. This means an acceptance rate of only 23%. As co-chairs of the program committee, we would like to sincerely thank all its members and the 448 external reviewers for their valuable work. In particular, there were intense and interesting discussions inside the PC committee. The overall very high quality of the submissions made the selection an extremely difficult task.

We would like to express our thanks to the three invited speakers: Dana Randal (Georgia Technical Institute, Atlanta, USA), Olivier Bournez (LIX, École Polytechnique, Palaiseau, France), and Martin Grohe (RWTH Aachen University, Germany). Since 2011, the conference program includes tutorials. This year, we are pleased to invite Thomas Schiex (INRAE, Toulouse, France) and Stéphan Thomassé (LIP, ENS Lyon, France) to the tutorial session.

Special thanks go to the local organizing committee for continuous help throughout the conference organization. In particular, we wish to thank the colleagues and student from the ALGCO, ECO and ESCAPE research groups for their help as well as Mégane Miquel and Virginie Fèche from LIRMM laboratory staff for her permanent organisation support.

Moreover, we thank Michael Wagner from the Dagstuhl/LIPIcs team for assisting us in the publication process and the final production of the proceedings. These proceedings
Preface

contain extended abstracts of the accepted contributions and abstracts of the invited talks and the tutorials. The authors retain their rights and make their work available under a Creative Commons license. The proceedings are published electronically by Schloss Dagstuhl – Leibniz-Center for Informatics within their LIPIcs series. Finally we would like to thank our sponsors for their financial supports: Occitanie Region District, Institut des Sciences de l’Information et leurs Interaction (INS2I) of CNRS; the University of Montpellier and the I-Site MUSE project; the LabEx NUMEV and the LIRMM Laboratory.

Montpellier and Saarbrücken, March 2020
Christophe Paul and Markus Bläser
Conference organization

Program committee

Spyros Angelopoulos  CNRS, Sorbonne Université, Paris, France
V. Arvind  The Institute of Mathematical Sciences (HBNI), Chennai, India
Sayan Bhattacharya  University of Warwick, United Kingdom
Laurent Bienvenu  CNRS, Université de Bordeaux, France
Markus Bläser  Saarland University, Saarbrücken, Germany, co-chair
Manuel Bodirsky  Technische Universität Dresden, Germany
Jop Briët  CWI, Amsterdam, Netherlands
Wojciech Czerwiński  University of Warsaw, Poland
Holger Dell  IT University of Copenhagen, Denmark
Faith Ellen  University of Toronto, Canada
Petr Golovach  Bergen University, Norway
John Hitchcock  University of Wyoming, USA
Christian Ikenmeyer  University of Liverpool, United Kingdom
Shunsuke Inenaga  Kyushu University, Fukuoka, Japan
Christian Konrad  University of Bristol, United Kingdom
Kasper Green Larsen  Aarhus University, Denmark
Ranko Lazic  University of Warwick, United Kingdom
Meena Mahajan  The Institute of Mathematical Sciences (HBNI), Chennai, India
Ulrich Meyer  Goethe Universität, Frankfurt am Main, Germany
Benjamin Monmege  Aix-Marseille Université, France
Christophe Paul  CNRS, Université de Montpellier, France, co-chair
Marcin Pilipczuk  University of Warsaw, Poland
Eva Rothenberg  Technical University of Denmark, Lingby, Denmark
Pierre Senellart  École normale supérieure, Université PSL, France
Till Tantau  Universität zu Lübeck, Germany
Lidia Tendera  Uniwersytet Opolski, Poland
Corentin Travers  Université de Bordeaux, France
Alfredo Viola  Universidad de la República de Uruguay, Uruguay
Georg Zetzsche  The Max Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany
Thomas Zeume  Technische Universität Dortmund, Germany
Martin Ziegler  KAIST, Daejeon, Republic of Korea
Standa Zivny  University of Oxford, United Kingdom
Steering committee

Thomas Colcombet  CNRS, Université Paris Diderot, France
Martin Dietzfelbinger  Technische Universität Ilmenau, Germany
Arnaud Durand  Université Paris Diderot, France
Christoph Dürr  CNRS, Sorbonne Université, co-chair, France
Henning Fernau  Universität Trier, Germany
Dietrich Kuske  Technische Universität Ilmenau, Germany
Arne Meier  Leibniz Universität Hannover, Germany
Rolf Niedermeier  Technische Universität Berlin, Germany
Natacha Portier  ENS Lyon, France
Gilles Schaeffer  CNRS, École Polytechnique, Palaiseau, France
Thomas Schwentick  Technische Universität Dortmund, co-chair, Germany
Ioan Todinca  Université d’Orléans, France

Local organizing committee (LIRMM, Université de Montpellier, CNRS)

Marin Bougeret  Fabien Jacques  Andrei Romashchenko
Virginie Fèche  Hoang La  Ignasi Sau Valls
Daniel Goncalves  Romain Lebreton  Alexander Shen
Bruno Grenet  Mégane Miquel  Ilaria Zappatore
Emirhan Gürpinar  Christophe Paul (Chair)
Lucas Isenmann  Alexandre Pinlou

Sponsors