

11th International Symposium on Parameterized and Exact Computation

IPEC'16, August 24–26, 2016, Aarhus, Denmark

Edited by

Jiong Guo
Danny Hermelin



Editors

Jiong Guo	Danny Hermelin
School of Computer Science and Technology	Department of Industrial Engineering and Management
Shandong University	Ben-Gurion University of the Negev
Jinan	Beer Sheva
China	Israel
jguo@sdu.edu.cn	hermelin@bgu.ac.il

ACM Classification 1998

F.1.3 Complexity Measures and Classes, F.2 Analysis of Algorithms and Problem Complexity, G.2 Discrete Mathematics

ISBN 978-3-95977-023-1

Published online and open access by

Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at <http://www.dagstuhl.de/dagpub/978-3-95977-023-1>.

Publication date
February, 2017

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 <http://dnb.d-nb.de>.

License

This work is licensed under a Creative Commons Attribution 3.0 Unported license (CC-BY 3.0): <http://creativecommons.org/licenses/by/3.0/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/LIPIcs.IPEC.2016.0

ISBN 978-3-95977-023-1

ISSN 1868-8969

<http://www.dagstuhl.de/lipics>

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

- Susanne Albers (TU München)
- Chris Hankin (Imperial College London)
- Deepak Kapur (University of New Mexico)
- Michael Mitzenmacher (Harvard University)
- Madhavan Mukund (Chennai Mathematical Institute)
- Catuscia Palamidessi (INRIA)
- Wolfgang Thomas (*Chair*, RWTH Aachen)
- Pascal Weil (CNRS and University Bordeaux)
- Reinhard Wilhelm (Saarland University)

ISSN 1868-8969

<http://www.dagstuhl.de/lipics>

Contents

Preface <i>Jiong Guo and Danny Hermelin</i>	0:vii
Invited Talk	
Determinant Sums for Hamiltonicity <i>Andreas Björklund</i>	1:1–1:1
Regular Papers	
Improved Algorithms and Combinatorial Bounds for Independent Feedback Vertex Set <i>Akanksha Agrawal, Sushmita Gupta, Saket Saurabh, and Roohani Sharma</i>	2:1–2:14
<i>H</i> -Free Graphs, Independent Sets, and Subexponential-Time Algorithms <i>Gábor Bacsó, Dániel Marx, and Zsolt Tuza</i>	3:1–3:12
Parallel Multivariate Meta-Theorems <i>Max Bannach and Till Tantau</i>	4:1–4:17
Finding Secluded Places of Special Interest in Graphs <i>René van Bevern, Till Fluschnik, George B. Mertzios, Hendrik Molter, Manuel Sorge, and Ondřej Suchý</i>	5:1–5:16
The Parameterized Complexity of Dependency Detection in Relational Databases <i>Thomas Bläsius, Tobias Friedrich, and Martin Schirneck</i>	6:1–6:13
A Faster Parameterized Algorithm for Pseudoforest Deletion <i>Hans L. Bodlaender, Hirotaka Ono, and Yota Otachi</i>	7:1–7:12
Optimal Dynamic Program for r -Domination Problems over Tree Decompositions <i>Glencora Borradaile and Hung Le</i>	8:1–8:23
Fine-Grained Dichotomies for the Tutte Plane and Boolean #CSP <i>Cornelius Brand, Holger Dell, and Marc Roth</i>	9:1–9:14
A Parameterized Algorithmics Framework for Degree Sequence Completion Problems in Directed Graphs <i>Robert Bredereck, Vincent Froese, Marcel Koseler, Marcelo Garlet Millani, André Nichterlein, and Rolf Niedermeier</i>	10:1–10:14
On the Parameterized Complexity of Biclique Cover and Partition <i>Sunil Chandran, Davis Issac, and Andreas Karrenbauer</i>	11:1–11:13
Exact Algorithms for List-Coloring of Intersecting Hypergraphs <i>Khaled Elbassioni</i>	12:1–12:15
Turbocharging Treewidth Heuristics <i>Serge Gaspers, Joachim Gudmundsson, Mitchell Jones, Julián Mestre, and Stefan Rümmele</i>	13:1–13:13

11th International Symposium on Parameterized and Exact Computation (IPEC 2016).

Editors: Jiong Guo and Danny Hermelin



Leibniz International Proceedings in Informatics

Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

On Satisfiability Problems with a Linear Structure <i>Serge Gaspers, Christos H. Papadimitriou, Sigve Hortemo Sæther, and Jan Arne Telle</i>	14:1–14:14
Cutwidth: Obstructions and Algorithmic Aspects <i>Archontia C. Giannopoulou, Michał Pilipczuk, Jean-Florent Raymond, Dimitrios M. Thilikos, and Marcin Wrochna</i>	15:1–15:13
Computing Graph Distances Parameterized by Treewidth and Diameter <i>Thore Husfeldt</i>	16:1–16:11
Lower Bounds for Protrusion Replacement by Counting Equivalence Classes <i>Bart M. P. Jansen and Jules J. H. M. Wulms</i>	17:1–17:12
Treedepth Parameterized by Vertex Cover Number <i>Yasuaki Kobayashi and Hisao Tamaki</i>	18:1–18:11
Dynamic Parameterized Problems <i>R. Krithika, Abhishek Sahu, and Prafullkumar Tale</i>	19:1–19:14
A $2\ell k$ Kernel for ℓ -Component Order Connectivity <i>Mithilesh Kumar and Daniel Lokshtanov</i>	20:1–20:14
Structural Parameterizations of Feedback Vertex Set <i>Diptapriyo Majumdar</i>	21:1–21:16
Randomised Enumeration of Small Witnesses Using a Decision Oracle <i>Kitty Meeks</i>	22:1–22:12
Backdoors for Linear Temporal Logic <i>Arne Meier, Sebastian Ordyniak, Ramanujan Sridharan, and Irena Schindler</i>	23:1–23:17
Improved Bounds for Minimal Feedback Vertex Sets in Tournaments <i>Matthias Mnich and Eva-Lotta Teutrine</i>	24:1–24:10
Ground Reachability and Joinability in Linear Term Rewriting Systems are Fixed Parameter Tractable with Respect to Depth <i>Mateus de Oliveira Oliveira</i>	25:1–25:12
Edge Bipartization Faster Than 2^k <i>Marcin Pilipczuk, Michał Pilipczuk, and Marcin Wrochna</i>	26:1–26:13
Cut and Count and Representative Sets on Branch Decompositions <i>Willem J. A. Pino, Hans L. Bodlaender, and Johan M. M. van Rooij</i>	27:1–27:12
A Fast Parameterized Algorithm for Co-Path Set <i>Blair D. Sullivan and Andrew van der Poel</i>	28:1–28:13
Clifford Algebras Meet Tree Decompositions <i>Michał Włodarczyk</i>	29:1–29:18
The First Parameterized Algorithms and Computational Experiments Challenge <i>Holger Dell, Thore Husfeldt, Bart M. P. Jansen, Petteri Kaski, Christian Komusiewicz, and Frances A. Rosamond</i>	30:1–30:9

Preface

This volume contains the papers presented at IPEC 2016: the 11th International Symposium on Parameterized and Exact Computation held during August 24–26, 2016, in Aarhus, Denmark. IPEC was held together with seven other algorithms conferences as part of the annual ALGO congress.

The International Symposium on Parameterized and Exact Computation (IPEC, formerly IWPEC) is a series of international symposia covering research in all aspects of parameterized and exact algorithms and complexity. Started in 2004 as a biennial workshop, it became an annual event in 2009.

In response to the call of papers, 48 papers were submitted. Each submission was reviewed by at least 3 reviewers. The reviews came from the 14 members of the program committee, and from 84 external reviewers contributing 107 external reviews. The program committee held electronic meetings through the EasyChair.

Previous IPECs	
2004	Bergen, Norway
2006	Zürich, Switzerland
2008	Victoria, Canada
2009	Copenhagen, Denmark
2010	Chennai, India
2011	Saarbrücken, Germany
2012	Ljubljana, Slovenia
2013	Sophia Antipolis, France
2014	Wrocław, Poland
2015	Patras, Greece

The program committee felt that the median submission quality was very high, and in the end selected 28 of the submissions for presentation at the symposium and for inclusion in the proceedings volume. The program committee presented the IPEC 2016 Best Paper Awards to Michał Włodarczyk for the paper *Clifford Algebras Meet Tree Decompositions*, Kitty Meeks for the paper *Randomised Enumeration of Small Witnesses Using a Decision Oracle*, and Archontia Giannopoulou, Michał Pilipczuk, Jean-Florent Raymond, Dimitrios Thilikos, and Marcin Wrochna for the paper *Cutwidth: Obstructions and Algorithmic Aspects*. The program committee also presented the IPEC 2016 Excellent Student Paper Awards to Michał Włodarczyk for the paper *Clifford Algebras Meet Tree Decompositions* and R. Krithika, Abhishek Sahu, and Prafullkumar Tale for the paper *Dynamic Parameterized Problems*.

IPEC invited one plenary speaker to the ALGO meeting, Andreas Björklund, as part of the award ceremony for the 2016 EATCS-IPEC Nerode Prize for outstanding papers in the area of multivariate algorithmics. The award was given by a committee consisting of Jan Arne Telle, David Eppstein, and Dániel Marx to Andreas Björklund for his paper *Determinant Sums for Undirected Hamiltonicity* [SIAM J. Comput., 43(1), 2014]. We thank Andreas for accepting our invitation and for contributing an excellent talk to IPEC 2016.

We would like to thank the program committee, together with the external reviewers for their commitment in the whole paper reviewing process. We also thank all authors who submitted their work for consideration. Finally, we are grateful to the local organizers of ALGO, chaired by Gerth Stølting Brodal, for the efforts, which made chairing IPEC an enjoyable experience.

Jiong Guo and Danny Hermelin
Jinan and Beer-Sheva, October 2016

■ Program Committee

Cristina Bazgan
LAMSADE, Universite Paris-Dauphine

Yixin Cao
Hong Kong Polytechnic University

Jiong Guo (chair)
Shandong University

Danny Hermelin (chair)
Ben-Gurion University of the Negev

Bart M. P. Jansen
Eindhoven University of Technology

Eun-Jun Kim
CNRS-Paris Dauphine

Christian Komusiewicz
Friedrich-Schiller-Universität Jena

Geevarghese Philip
Max-Planck-Institut für Informatik

Hadas Shachnai
The Technion

Stefan Szeider
TU Wien

Jan Arne Telle
University of Bergen

Meirav Zehavi
The Technion



■ External Reviewers

Faisal Abu-Khzam	Euiwoong Lee
Julien Baste	Wenjun Li
René van Bevern	Mathieu Liedloff
Hans L. Bodlaender	Hong Liu
Robert Bredereck	Yang Liu
Hubie Chen	Daniel Lokshtanov
Marek Cygan	Amaldev Manuel
Holger Dell	Pranabendu Misra
Eduard Eiben	Valia Mitsou
Moran Feldman	Matthias Mnich
Qilong Feng	Hendrik Molter
Henning Fernau	Amer Mouawad
Till Fluschnik	Haiko Müller
Fedor Formin	Martin Mundhenk
Martin Fürer	N. S. Narayanaswamy
Serge Gaspers	Jesper Nederlof
Petr Golovach	André Nichterlein
Alexander Grigoriev	Rolf Niedermeier
Gregory Gutin	Sebastian Ordyniak
Thore Husfeldt	Fahad Panolan
Davis Issac	Marcin Pilipczuk
Dušan Knop	Michał Pilipczuk
Mikko Koivisto	M. Praveen
Sudeshna Kolay	Ashutosh Rai
Stavros Kolliopoulos	Venkatesh Raman
Lukasz Kowalik	M. S. Ramanujan
Dieter Kratsch	Jean-Florent Raymond
Stefan Kratsch	Felix Reidl
R. Krithika	Noy Rotbart
O-Joung Kwon	Stefan Rümmele
Michael Lampis	Michalis Samaris

0:xii External Reviewers

Ignasi Sau
Saket Saurabh
Roy Schwartz
Yash Raj Shrestha
Friedrich Slivovsky
Manuel Sorge
A. V. Sreejith
Yann Strozecki
Ondřej Suchý
Peng Sun
Prafullkumar Tale
Nimrod Talmon
Thomas C. Van Dijk
Johan M. M. Van Rooij
Stéphane Vialette
Fernando Sánchez Villaamil
Magnus Waldström
Justin Ward
Oren Weimann
Andreas Wiese
Marcin Wrochna
Yongjie Yang

List of Authors

Akanksha Agrawal	Daniel Lokshtanov
Gábor Bacsó	Diptapriyo Majumdar
Max Bannach	Dániel Marx
René van Bevern	Kitty Meeks
Thomas Bläsius	Arne Meier
Hans L. Bodlaender	George B. Mertzios
Glencora Borradaile	Julián Mestre
Cornelius Brand	Marcelo Garlet Millani
Robert Bredereck	Matthias Mnich
Sunil Chandran	Hendrik Molter
Holger Dell	André Nichterlein
Khaled Elbassioni	Rolf Niedermeier
Till Fluschnik	Mateus de Oliveira Oliveira
Tobias Friedrich	Hirotaka Ono
Vincent Froese	Sebastian Ordyniak
Serge Gaspers	Yota Otachi
Archontia Giannopoulou	Christos Papadimitriou
Joachim Gudmundsson	Marcin Pilipczuk
Sushmita Gupta	Michał Pilipczuk
Thore Husfeldt	Willem Pino
Davis Issac	M. S. Ramanujan
Bart M. P. Jansen	Jean-Florent Raymond
Mitchell Jones	Frances A. Rosamond
Andreas Karrenbauer	Marc Roth
Petteri Kaski	Stefan Rümmele
Yasuaki Kobayashi	Sigve Hortemo Sæther
Christian Komusiewicz	Abhishek Sahu
Marcel Koseler	Saket Saurabh
R. Krithika	Irena Schindler
Mithilesh Kumar	Martin Schirneck
Hung Le	Roohani Sharma

Manuel Sorge
Ondřej Suchý
Blair D. Sullivan
Prafullkumar Tale
Hisao Tamaki
Till Tantau
Jan Arne Telle
Eva-Lotta Teutrine
Dimitrios Thilikos
Zsolt Tuza
Andrew van der Poel
Johan M. M. van Rooij
Michał Włodarczyk
Marcin Wrochna
Jules J. H. M. Wulms