



Parameterized Complexity News

Newsletter of the PC Community April 2011

Welcome

Frances Rosamond, Editor

Welcome to the Parameterized Complexity Newsletter. We are delighted to announce the IPEC 2010 winners of the Excellent Student Paper Awards. The meeting was expertly organized in Chennai. The 2011 IPEC will be held jointly with ESA in September. The CFP is in this newsletter. Please update the Table of Races and event information with your latest results at our community wiki at www.fpt.wikidot.com.

IPEC 2010 Chennai

Congratulations and a big *Thank You!* to all who helped with the 2010 *International Symposium on Parameterized and Exact Computation* held in December in Chennai. It was preceded by a highly successful parameterized complexity workshop (over 60 participants), and colocated with FSTTCS, the annual India theory meeting. There were 103 registrants from 15 countries. Winners of the Excellent Student Awards were M. Praveen: ‘Small Vertex Cover Makes Petri Net Coverability and Boundedness Easier’ and Jesper Nederlof and Johan M. M. van Rooij: ‘Inclusion/Exclusion Branching for Partial Dominating Set Set Splitting’.



Figure 1: M. Praveen receiving the Excellent Student Paper Award for “Small Vertex Cover Makes Petri Net Coverability and Boundedness Easier”.

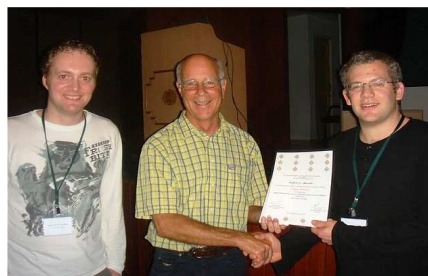


Figure 2: Jesper Nederlof and Johan M. M. van Rooij receiving the Excellent Student Paper Award for “Inclusion/Exclusion Branching for Partial Dominating Set and Set Splitting”.

IPEC 2011 Call for Papers

The 6th International Symposium on Parameterized and Exact Computation (<http://tcs.rwth-aachen.de/IPEC2011/>)

Important Dates:

Abstract registration: June 20, 17:00 GMT

Paper submission: June 23, 17:00 GMT

Notification of acceptance: July 15

Symposium: September 7-9

Final manuscript due: October 20

Invited Speaker: Martin Grohe.

Program co-chairs: Dániel Marx and Peter Rossmanith.

The 6th International Symposium on Parameterized and Exact Computation (IPEC 2011, formerly IWPEC) will be part of ALGO 2011, which also hosts ESA, WABI, WAOA, ATMOS, and ALGOSENSORS. ALGO 2011 will take place September 5-9, 2011 in Saarbrücken, Germany.

IPEC covers research in all aspects of parameterized and exact algorithms and complexity. Papers presenting original research in the area are sought, including but not limited to: new techniques for the design and analysis

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of parameterized and exact algorithms, fixed-parameter tractability results, parameterized complexity theory, relationship between parameterized complexity and traditional complexity classifications, applications of parameterized and exact computation, and implementation issues of parameterized and exact algorithms. In particular, studies on parameterized and exact computations for real-world applications and algorithmic engineering are especially encouraged.

Authors are invited to submit an extended abstract in English no longer than 12 pages using at least 11-point font, preferably in LNCS-style, describing original unpublished research. Simultaneous submission to other conferences with published proceedings is not permitted. A detailed description of the electronic submission process is available at the symposium website.

Accepted papers will be published in the symposium proceedings in the Springer series *Lecture Notes in Computer Science*. Accepted papers in final form will be due approximately 6 weeks after the symposium.

Excellent Student Paper Awards may be awarded by the Program Committee to one or more papers accepted to the symposium. A paper is eligible for the award if all authors are students at the time of submission, where a student is someone who has not been awarded a PhD.

WorKer 2011. Sept. in Vienna

WorKer 2011, the Third Workshop on Kernelization will take place on September 2-4, 2011, in Vienna, Austria (this is just before ALGO in Saarbrücken). The workshop is organized by Serge Gaspers, Sebastian Ordyniak, and Stefan Szeider.

Treewidth in May in Bergen

Bergen Treewidth Workshop May 19–20, 2011. The meeting begins May 19 (Thursday) at 09.00 and ends on May 20 (Friday) around 17.00. The format of the workshop will be several invited lectures on the recent advances in the area, short reports on new results, and slots for discussions and open problems.

Note that this workshop does not produce any proceedings and presentations here should not cause any problem for submitting the same material to a regular conference or journal.

Confirmed invited speakers include:

Marek Cygan (Warsaw University, Poland),
 Fabian Hundertmark (Universität Hamburg, Germany),
 Daniel Lokshtanov (UCSD, USA)
 Dániel Marx (Humboldt University, Germany)
 Peter Rossmanith (RWTH Aachen, Germany)
 Saket Saurabh (IMS, Chennai, India)

Not-About-Graphs! August in Darwin

Parameterized Complexity: Not About Graphs!

(NAB) Please note the date change: 5-8 August 2011 for Workshop plus 9-13 August for Problem-Solving. The weekend workshop starts 6pm on Friday, August 5, and ends at noon on Monday, August 8 with scheduled talks. For those who wish to stay on after, following the workshop will be several days of problem-solving “Barbados-style,” on flip-charts out in the bush. This workshop will produce an informal proceedings published by CDU Press, and so presentations here should not cause any problem for submitting the same material to a regular conference or journal.

To date, much of the work in parameterized algorithmics has been focused in the area of graph algorithms. However, computational complexity is an issue that arises everywhere. The focus of the workshop is on reporting new advances regarding the parameterized computational complexity of problems in algebra, number theory, analysis, topology, game theory, geometry—anything that takes the field into new and unexplored directions of relevance. It is also focused on identifying and promoting the key unsolved problems in these new directions.

We expect the discussions and presentations at the workshop to be rich with possibilities for further development of entire research areas, and programmatic themes that can be developed into future research proposals. See www.cdu.edu.au/parameterized-nag or the FPT wiki at www.fpt.wikidot.com. Email Michael.Fellows@cdu.edu.au for more information.

Parameterized Complexity for Answer Set Programming

by Michael Morak, Nysret Musliu, Andreas Pfandler, Reinhard Pichler, Stefan Rümmele, Stefan Woltran

Answer set programming (ASP) is a declarative programming paradigm stemming from the area of nonmonotonic reasoning that allows for very elegant solutions to many combinatorial problems. The basic idea is to describe a problem by a logic program in such a way that the *stable models* [1] correspond to the solutions of the considered problem. For example, the answer sets of the following program together with facts of the form $node(v)$ and $edge(v, w)$ correspond to valid 3-colorings of the encoded graph.

$$\begin{aligned} & red(x) \vee blue(x) \vee green(x) \leftarrow node(x). \\ & \perp \leftarrow edge(x, y), red(x), red(y). \\ & \perp \leftarrow edge(x, y), blue(x), blue(y). \\ & \perp \leftarrow edge(x, y), green(x), green(y). \end{aligned}$$

Deciding whether a given logic program has a solution is computationally hard. This holds even for ground

programs, i.e. programs without variables [2].

In order to cope with the intractability of this problem the underlying graph structure is considered. One such structure, called the incidence graph of the program, leads to an FPT result when treewidth is used as parameter. To test whether this tractability result leads to an efficient solver for logic programs the *dynASP* system was developed.

This system is based on a purpose-built framework that provides ready-to-use heuristics for obtaining tree decompositions of arbitrary graphs and interfaces for implementing treewidth-based algorithms. Essentially it performs the following operations: After parsing and preprocessing the input program, a tree decomposition of the logic program is generated. Each of its (labeled) nodes then represents a sub-program of the original logic program for which (partial) solutions can be computed using a dynamic-programming approach: At each node the respective sub-program is evaluated using the partial solutions of the child nodes (if any) and for each of those an exhaustive search inside the current node is performed. Because of the properties of tree decompositions, this search step is now exponential only in the size of the node (i.e. the treewidth). The sub-program represented by the root node is the whole logic program, thus the partial solutions calculated at the root node represent the stable models of the given program. For specifics, see [3] and the project website <http://dbai.tuwien.ac.at/proj/dynasp>.

The following chart shows first benchmark results for instances of treewidth 5 when compared to the DLV system [4]. The vertical axis represents the time in seconds to solve the problem and the horizontal axis the size of the benchmark instance.

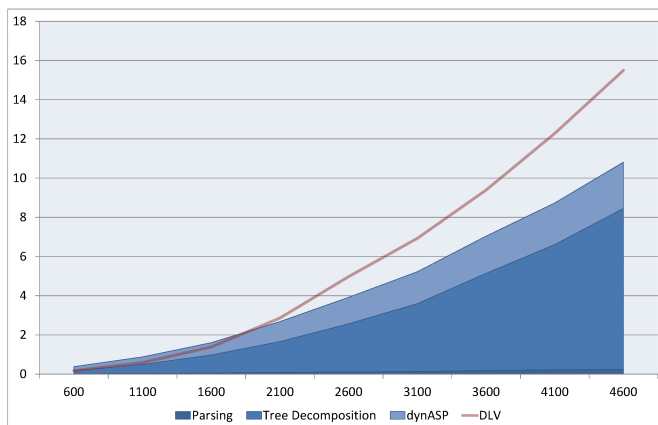


Figure 3: Benchmarks: Treewidth 5, average runtime

As seen in the figure above, using treewidth as parameter already yields competitive algorithms for logic programs of low treewidth. In a next step, further graph and non graph-based parameters will be considered. Resulting algorithms could be combined into a kind of an FPT portfolio ASP-solver which would remain compet-

itive on a broader range of instances than the current *dynASP* implementation. A challenge for future work is a generalization of the presented work to non-ground logic programs, where a wide range of further parameters immediately comes into play.

- [1] M. Gelfond and V. Lifschitz. Classical negation in logic programs and disjunctive databases. *New Generation Comput.*, 9(3/4):365–386, 1991.
- [2] T. Eiter and G. Gottlob. On the computational cost of disjunctive logic programming: Propositional case. *Ann. Math. Artif. Intell.*, 15(3-4):289–323, 1995.
- [3] M. Morak, R. Pichler, S. Rümmele, and S. Woltran. A dynamic-programming based ASP-solver. In T. Janhunen and I. Niemelä, editors, Proc. of *JELIA*, volume 6341 of *LNCS*, pages 369–372. Springer, 2010.
- [4] N. Leone, G. Pfeifer, W. Faber, T. Eiter, G. Gottlob, S. Perri, and F. Scarcello. The DLV system for knowledge representation and reasoning. *ACM Trans. Comput. Log.*, 7(3):499–562, 2006.

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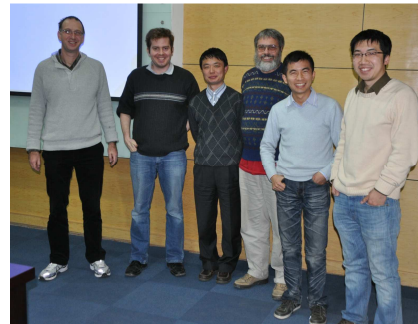


Figure 4: Inaugural Workshop of the Shanghai ACM SIGACT Chapter: (from left) Uri Zwick, David Woodruff, Zhang Guochuan, Rudolf Fleischer, Lu Pinyan, and Yin Yitong.

News from Shanghai

by Rudolf Fleischer, Fudan University, Shanghai

Theoretical Computer Science (TCS) is one of the areas of computer science where China has been catching up rapidly in recent years. Chinese scientists are now able to publish regularly in top-tier conferences like STOC, FOCS, CCC, SODA, LICS, ICALP, and even win best paper awards in these conference, for example FOCS 2006 (Xi Chen), ICALP 2007 (Pinyan Lu), ICALP 2008 (Shengyu Zhang), ICALP 2010 (Yijia Chen), and STOC 2010 (Zhengfeng Ji). This was completely unimaginable ten years ago.

Another sign of the growing importance of TCS in China has been the emergence in recent years of several theory conferences that originated in China but quickly reached out to

become truly international conferences (e.g., AAIM, FAW, TAMC). The recent efforts of colocating some of these conferences to create a really strong Chinese TCS conference seem to indicate that the formerly fragmented theory community in China is maturing into a strong united force.

To further support this growth process and provide the TCS researchers with a platform to share their ideas and ideals, we recently founded the Shanghai ACM SIGACT Chapter with founding chair Rudolf Fleischer, vice-chair Guochuan Zhang, and treasurer Pinyan Lu. The chapter was approved by ACM on January 12, and we celebrated this event with an Inaugural Workshop at Fudan University on January 11 with David Woodruff, Yin Yitong, and Uri Zwick as speakers and 36 participants.

This theory workshop has become a regular monthly event for our local TCS community, we had already four more seminars in Shanghai, Hangzhou, and Nanjing. We have research groups at Shanghai Jiatong University (Chen Yijia) and Fudan University (Rudolf Fleischer) working on FPT algorithms, and we would like to encourage all our colleagues planning a trip to China also to visit Shanghai. Please contact us at sigact.sh@gmail.com, maybe we can arrange you to speak in our seminar series. We may also be able to accommodate you in Shanghai. Please visit our local chapter home page at <http://sigact-shanghai.acm.org> (it will very soon be filled with real content, we are working on it).

WorKer Kernelization Workshop 2010

The WorKer Workshop on Kernelization was held from 8–12 Nov 2010 at the Lorentz Center in Leiden. Organizers were Fedor Fomin, Hans Bodlaender, and Saket Saurabh, with websupport from Neeldhara Misra. The following is taken from the Scientific Report on the Lorentz Center website:

An important step when solving combinatorially hard problems (for many applications) is to first preprocess the data, i.e., transform the input to a smaller sized but otherwise equivalent input, and use a slow exact solving method on the result. In this workshop, we look at a mathematical analysis of such preprocessing algorithms, termed kernelization algorithms. Lectures presented the most important recent developments in kernelizations, including new techniques to obtain lower bounds for kernels, including the very new technique of *cross composition*, *meta-results*, i.e., techniques that allow to obtain kernelization algorithms for not one, but entire classes of problems (the notion of *protrusion* plays an important role here), kernelization for problems from logic and data clustering, the use of nonstandard parameters, and notions related to kernelization. Two lectures were held on the multi-cut problem. In addition, there were discussion sessions on the definition of kernelization, publicity, and open problems.

Over fifty participants from many different countries and continents gathered for the workshop. Most of the world experts from the field came to the workshop. The excellent facilities and the helpful staff were very beneficial to make the workshop a big success.

The Alpha-Crown Problem. During the WorKer Problem Posing Session, cash prizes were offered for various open problems. Mike Fellows offered 100 AUD for a polynomial al-

gorithm that would find an alpha-crown or else determine that one did not exist (or, for a proof that there was no such algorithm). Alpha-crowns are a generalisation of crowns - rather than requiring that the Crown is larger or equal to the size of the Head, we require that the Crown is larger than or equal to alpha times the size of the Head, where alpha is some number between 0 and 1. Marek Cygan, Mark Jones and Michal Pilipczuk showed that that if such an algorithm exists, the Unique Games Conjecture fails. This is the opposite of the result Mike was hoping for, but he awarded the prize anyway, at the IPEC symposium.

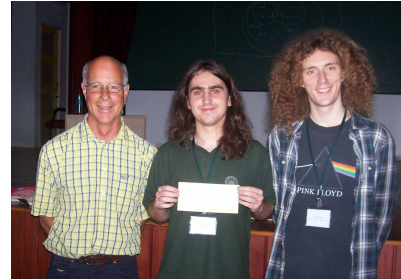


Figure 5: Mark Jones and Michal Pilipczuk receiving the prize for from Mike Fellows at the IPEC Symposium in Chennai. Missing is co-author Marek Cygan.

CONGRATULATIONS ON POSITIONS.

Stephan Kreutzer has left Oxford to take over the Chair for Logic and Semantics at the Technical University Berlin. Stephan's new email address is stephan.kreutzer@tu-berlin.de.

Tobias Friedrick has accepted a position in the Cluster of Excellence "Multimodal Computing and Interaction" Research Group at Saarland University.

CONGRATULATIONS New PhDs

Nadia Betzler, *A Multivariate Complexity Analysis of Voting Problems*, Friedrich-Schiller-Universität Jena, 2010. A hard copy version can be found at Verlag Dr. Hut. Advisor: Rolf Niedermeier. Dr. Betzler moved to TU Berlin in January, and currently is a postdoc at the University of Auckland, NZ with a DAAD Fellowship. Congratulations, Dr. Betzler.

Ondra Suchy, *Parameterized Complexity: Nonstandard Parameterizations of Graph Problems*, Department of Applied Mathematics, Charles University, Prague, Czech Republic. Advisor: Jan Kratochvil. Ondra has joined Jiong Guo in the Cluster of Excellence "Multimodal Computing and Interaction" at the University of Saarbrücken. Congratulations, Dr. Suchy.

Positions Available

Please refer to position postings on THEORYNT and also DMANet. There are postings for Bergen, and for Berlin.

PhD position in Algorithms at the University of Bergen.

Write to Prof. Fedor Fomin at fomin@ii.uib.no and send an application before May 20, 2011. The working environment will be the Algorithms Research Group at the Department of Informatics working with Prof. Fomin on the “Rigorous Theory of Preprocessing” project funded by the European Research Council (ERC) via the Advanced Investigator Grant scheme. The goal of the project is the study of heuristic algorithms, mainly in the realm of Parameterized Complexity. The research areas are Algorithms and Complexity, in particular, fixed parameter tractability, parameterized complexity, and kernelization. Financing is for 4 years. Preferred starting date: August-September 2011.

PhD positions available in Berlin.

Write to Prof. Martin Grohe. Several scholarships for Ph.D. studies starting July 1st, 2011 or later, are funded by the German Science Foundation (DFG) at the three Berlin Universities. See The Research Training Group, METHODS FOR DISCRETE STRUCTURES, <http://www.math.tu-berlin.de/MDS/>. The MDS program covers topics at the interface between algorithms, combinatorics, geometry, probability, and optimization. The lively Berlin discrete mathematics context also includes the DFG Research Center MATHEON (<http://www.matheon.de>).

The RTG “Methods for Discrete Structures” is also a registered unit for the “Phase II” part of BERLIN MATHEMATICAL SCHOOL (<http://www.math-berlin.de>), the joint international graduate program of the three major Berlin universities - which has a lot to offer!