

Jakub Mareček: Curriculum Vitae

The University of Edinburgh
School of Mathematics
James Clerk Maxwell Building
Edinburgh EH9 3JZ, UK

+44 131 650 5044
jakub@marecek.cz
jakub.marecek@ed.ac.uk
www.maths.ed.ac.uk/~jmarecek

- RESEARCH INTERESTS ◇ The design, engineering, and analysis of practical algorithms, esp. the use of optimisation in scheduling and timetabling
- SKILLS ◇ Mathematical programming, i.e. the design, development, and use of solvers for optimisation problems
◇ Software development in C++ and Java, scripting and prototyping in Python and Matlab
◇ Design and use of relational databases (MySQL, Oracle) and mark-up languages (XML)
◇ Fluent in English and Czech, with passive German and Slovak, elementary French
- EDUCATION ◇ **The University of Nottingham** (Nottingham, UK)
November 2011: PhD in Computer Science. Thesis on *general-purpose integer linear programming solvers*, which exploit variable aggregations, graph colouring components, and precedence-constrained packing components, supervised by Prof. Edmund K. Burke and Dr. Andrew J. Parkes. Further work included the design of semidefinite programming relaxations for timetabling problems and linear programming relaxations for packing boxes into a larger box.
September 2006 – June 2007: Visiting postgraduate student in the Automated Scheduling, Optimisation, and Planning research group in the School of Computer Science.
◇ **Masaryk University** (Brno, the Czech Republic)
July 2009: Mgr. in Applied Informatics. Thesis on *integer programming approaches to course timetabling* supervised by Dr. Hana Rudová, Dr. Andrew J. Parkes, and Prof. Edmund K. Burke. Within the top percentile of students by GPA upon completion of 120/120 credits.
September 2006 – July 2009: Masters student of Theoretical Computer Science, supervised by Dr. Petr Hliněný. Studies terminated upon completion of 138/120 credits.
June 2006: Bc. in Applied Informatics with Databases and Natural Language Processing. Final year project with Dr. Petr Hliněný introduced a new *polylogarithmic algorithm for optimisation* of a linear function over an arbitrary discrete set in 3D.
September 2003 – June 2006: Undergraduate student of English Language and Literature with focus on Linguistics. Final year project redesigning *English or Czeenglish?*, the English usage textbook, supervised by Dr. Jarmila Fictumová.
- WORK EXPERIENCE ◇ **The University of Edinburgh** (Edinburgh, UK)
January 2012 – January 2014: Post-doc in the Edinburgh Research Group in Optimization, headed by Prof. Jacek Gondzio. Work on first-order methods for large-scale optimisation with Dr. Peter Richtárik. Co-developed distributed methods for the minimisation of composite functions, such as training sparse support vector machines (SVM), with strong bounds on the rate of convergence taking into account non-trivial scheduling. Used C++, boost, MPI, and OpenMP.

- ◇ **Research Software Engineer**, IBM T. J. Watson Research Center (Nov 2011 – Jan 2012)
Work on question generation and answering using semantic role labelling generated by an integer linear program in the group of Dr. Jan Kleindienst. Legally, a consulting software engineer at IBM's Prague office.
 - ◇ **Researcher**, The University of Toronto (Jul–Sept 2011)
Invited participant in a Summer Thematic Program on the Mathematics of Constraint Satisfaction at Fields Institute for Research in Mathematical Sciences, organised by Profs. Guruswami, Hell, Valeriote, and Willard.
 - ◇ **Logistics of Small Things Fellowship**, The University of Nottingham (Feb–Apr 2011)
Work on stochastic control in a scanning probe microscope under development in Nottingham Nanotechnology and Nanoscience Centre in the School of Physics and Astronomy. Supervised by Dr. Richard Woolley and Dr. Andrew J. Parkes.
 - ◇ **Industrial Mathematics Internship**, ARM Ltd. (Oct 2009 – Apr 2010)
Developed a scheduler for an embedded multi-core fine-grained multi-threading processor compliant with OpenCL (*ARM Mali*). Established EXP-Hardness of some of the problems involved. Developed heuristics for decoding signal in wireless communications with multiple antennas (MIMO over QAM in LTE, LTE Advanced, and WiFi N).
 - ◇ **Research Associate (Part-time)**, The University of Nottingham (Mar–Jul 2007)
Developed tools in Python and Java facilitating research in corpus linguistics. Helped set up the SRIF *Corpus Lab* in the School of English and led tutorials on the use of corpora.
 - ◇ **Software Developer and Co-founder**, Aponia Software s. r. o. (until Oct 2003)
Developed *Pocket Translator 2004*, an award-winning and very well selling dictionary interface for Microsoft Windows Mobile (Pocket PC) using Microsoft Embedded Visual C++. Engaged in a number of other roles, as well, in what had eventually become one of the largest vendors of in-car sat-nav in Central Europe, before TomTom bought TeleAtlas and Nokia bought Naviteq.
 - ◇ **Translator**, Grada Publishing a. s. (May–Jul 2002)
Updated, translated into Czech and set in type *Learning Python* by Lutz and Ascher, the first Python textbook to be published in the Czech language.
 - ◇ **Programmer**, BrnoCity s. r. o. (May 2000 – Feb 2001)
Developed several web-based applications, including a web-based email client and a message handling module for a CRM system, in a team of five. Used Perl, PHP and Java with Oracle 8i and MySQL.
- ACADEMIC ACTIVITIES
- ◇ **Refereeing**, Submissions referee for IEEE Transactions on Parallel and Distributed Systems (2011), Computers & Operations Research (2009, 2010, 2011, 2012), and the European Journal of Operational Research (2009)
 - ◇ **Subrefereeing**, European Conference on Artificial Intelligence (2008), International Symposium on Computer Architecture (2010), International Symposium on Wireless Communications Systems (2010)
 - ◇ **Reviews**, Book reviews for The Computer Journal, Interfaces, and SIGACT Newsletter
 - ◇ **Contests**, Minor involvement in the organisation of the 2nd International Timetabling Competition (ITC 2007, Track 3); Member of jury for a number of programming contests organised by Ministerstvo školství, mládeže a tělovýchovy in Brno, the Czech Republic (2001–2005)
 - ◇ **Conferences**, Assistant to Dr. Hana Rudová organising the 6th International Conference on Practice and Theory of Automated Timetabling in Brno, the Czech Republic (2006)

PAPERS &
WORK IN
PROGRESS

- ◇ **A Distributed Coordinate Descent Method for Composite Function Minimisation with Applications in Training Sparse Support Vector Machines**, joint work with Peter Richtárik and Martin Takáč, available on request
- ◇ **A Cutting Surface Method for Integer Least Squares with Application in MIMO Signal Decoding**, available on request
- ◇ **A Semidefinite Programming Relaxation of Integer Least Squares with Applications in MIMO Signal Decoding**, joint work with Florian Jarre, available on request
- ◇ **A Programming Language for Optimisation with Semi-Automated Reformulations**, joint work with Edmund K. Burke and Andrew J. Parkes, in preparation
- ◇ **Space-Indexed Formulations of Packing Boxes into a Larger Box**, joint work with Sam D. Allen and Edmund K. Burke, *Operations Research Letters* (2012) 40(1): 20–24
- ◇ **Fully Dynamic Data Structures for Taskgraph Scheduling Policies with Applications in OpenCL Accelerators**, joint work with a number of co-authors, *Multidisciplinary International Scheduling Conference 2011*, an extended version invited and submitted to a special issue of the *Journal of Scheduling*, and available on-line
- ◇ **Semidefinite Programming Relaxations in Timetabling**, joint work with Edmund K. Burke and Andrew J. Parkes, Part I: Relaxations, *Practice and Theory of Timetabling 2010*, Part II: Algorithms, *Practice and Theory of Timetabling 2012*, an extended version on-line
- ◇ **Some Probabilistic Results on Width Measures of Graphs**, *Graph Classes, Optimization, and Width Parameters 2009*, an extended version on-line
- ◇ **A Primal Heuristic for Integer Linear Programming with Automated Aggregations**, *International Symposium on Mathematical Programming 2009*, extended into a chapter in my dissertation
- ◇ **A Branch-and-Cut Procedure for the Udine Course Timetabling Problem**, joint work with Edmund K. Burke, Hana Rudová, and Andrew J. Parkes, *Practice and Theory of Automated Timetabling 2008*, an extended version in *Annals of Operations Research* (2012) 194(1): 71–87.
- ◇ **A Supernodal Formulation of Vertex Colouring with Applications in Course Timetabling**, joint work with Edmund K. Burke, Hana Rudová, and Andrew J. Parkes, *Annals of Operations Research* (2010) 179(1): 105–130
- ◇ **Decomposition, Reformulation, and Diving in University Course Timetabling**, joint work with Edmund K. Burke, Hana Rudová, and Andrew J. Parkes, *Computers and Operations Research* (2010) 37(3): 582–597
- ◇ **Penalising Patterns in Timetables: Novel Integer Programming Formulations**, joint work with Edmund K. Burke, Hana Rudová, and Andrew J. Parkes, in *Operations Research Proceedings 2007*, ed. Stefan Nickel and Jörg Kalcsics: 409–414. Springer, 2008

VIEWS &
REVIEWS

- ◇ **Review of “Theoretical Aspects of Local Search”**, *ACM SIGACT News* (2009) 40(2): 27–30.
- ◇ **Review of “Handbook of Approximation Algorithms and Metaheuristics”**, *The Computer Journal* (2010) 53(8): 1338–1339.
- ◇ **Review of “Production Planning Using Mixed Integer Programming”**, *The Computer Journal* (2009) 52(6): 724–725.
- ◇ **Review of “The Traveling Salesman Problem: A Computational Study”**, *Interfaces* (2008) 38(4): 344–344.

- SELECTED TALKS
- ◇ **The Many Approaches to Integer Programming**,
ERGO (Edinburgh Research Group in Optimization) Seminar, School of Mathematics, The University of Edinburgh, March 21, 2012
 - ◇ **Optimisation in Natural Language Processing**,
IBM T. J. Watson Research Center, Prague, the Czech Republic, November 30, 2011, and a half-day workshop at the same location, December 23rd, 2010 (invited)
 - ◇ **Recent Trends in Convex Programming, with Applications**,
Working Seminar on Formal Models, Discrete Structures, and Algorithms, Brno, the Czech Republic, November 15, 2011 (invited); Automated Scheduling, Optimisation and Planning Seminar, Nottingham, November 15, 2011; IBM T. J. Watson Research Center, Prague, the Czech Republic, December 2, 2011 (invited)
 - ◇ **Semidefinite Programming Relaxations in Timetabling (and Matrix-Free Implementations of Augmented Lagrangian Methods for Solving them)**,
Part I: Relaxations: Automated Scheduling, Optimisation and Planning Seminar, Nottingham, May 25, 2010; International Conference on the Practice and Theory of Automated Timetabling, PATAT 2010, Belfast, August 10–13, 2010; *Part II: Algorithms*: Applied Mathematics, SINTEF, Oslo, NO, February 11th, 2011 (invited); Optimisation and Linear Algebra Seminar, School of Mathematics, University of Birmingham, Birmingham, UK, February 17th, 2011 (invited); School of Mathematics, University of Edinburgh, Edinburgh, UK, April 7th, 2011 (invited); LANCS Workshop on Modelling and Solving Complex Optimisation Problems, Lancaster, UK, April 11–13, 2011; School of Mathematics, University of Southampton, Southampton, UK, July 13th, 2011 (invited); *Both Parts*: International Symposium of Mathematical Programming, ISMP 2012, Berlin, August 19–24, 2012
 - ◇ **Signal Decoding in Multi-Antenna Systems Using Second-Order Cone Programming**,
Research and Development, ARM Ltd., April 8, 2010 (invited); European Conference on Operational Research, EURO XXIV, Lisbon, July 11–14, 2010 (invited); Mixed Integer Programming Workshop, MIP 2010, GeorgiaTech, July 26–29, 2010 (poster); Nonlinear Methods in Combinatorial Optimization, EURO Summer Institute 2010, Klagenfurt, AT, August 30, 2010
 - ◇ **OpenCL Scheduling**,
Media Processing Group, ARM Ltd., November 17, 2009 (invited); Research and Development, ARM Ltd., April 8, 2010 (invited); Multidisciplinary International Scheduling Conference, MISTA 2011, Phoenix, Arizona, August 9–12, 2011
 - ◇ **Some Probabilistic Results on Width Measures of Graphs**,
Workshop on Graph Classes, Optimization, and Width Parameters, GROW 4, Bergen, Norway, October 15, 2009; Student Conference on Operational Research, SCOR 2010, Nottingham, April 9–11th, 2010
 - ◇ **A Primal Heuristic for Integer Linear Programming with Automated Aggregations**,
International Symposium of Mathematical Programming, ISMP 2009, Chicago, August 23–28, 2009
 - ◇ **Graph Colouring with Theta via the Spectral Bundle Method of Helmberg**,
Student Conference on Operations Research, SCOR 2009, Lancaster University Management School, March 27–29, 2009
 - ◇ **A Branch-and-Cut Procedure for the Udine Course Timetabling Problem**,
International Conference on the Practice and Theory of Automated Timetabling, PATAT 2008, Université de Montréal, August 18–22, 2008
 - ◇ **Four Easy Pieces**,
Mixed Integer Programming Workshop, MIP 2008, Columbia University, New York, August 4–7, 2008 (poster)

- ◇ **Zykov Revisited: Engineering an Exact Solver for Graph Colouring**, International Symposium on Combinatorial Optimization, CO 2008, University of Warwick, March 18, 2008
- ◇ **A Clique-Based Integer Programming Formulation of Graph Colouring and Applications**, Automated Scheduling, Optimisation and Planning Seminar, Nottingham, October 18, 2007; International Symposium on Combinatorial Optimization, CO 2008, University of Warwick, March 18, 2008; Seminar of the Centre for Discrete Mathematics and its Applications, University of Warwick, June 10, 2008 (invited)
- ◇ **Penalising Patterns in Timetables: Strengthened Integer Programming Formulations**, Annual Conference of the German Operations Research Society, OR 2007, Saarbrücken, September 5–7, 2007
- ◇ **Uses and Abuses of MIP in Course Timetabling**, Mixed Integer Programming Workshop, MIP 2007, Montreal, July 30–August 2, 2007 (poster)
- ◇ **Variability of Integer Programming Models of Course Timetabling**, Automated Scheduling, Optimisation and Planning Seminar, Nottingham, February 15, 2007; European Conference on Operational Research, EURO XXII, Prague, July 8–11, 2007

TEACHING
AND SERVICE

- ◇ **Exhibit(or)**, National Museum of Scotland
- ◇ Volunteer for “Museum Late: A Night in Wonderland” on behalf of The University of Edinburgh School of Mathematics, explaining graph colouring to kids.
- ◇ **Lecturer**, The University of Edinburgh
 - Spring 2012: Mathematical Computation and Communication Skills, Maple stream (compulsory 3rd-year course on Maple programming and algorithm design, 56 students)
- ◇ **Supervisor of Operational Research MSc Dissertations**, The University of Edinburgh
 - TBA (2012): Portfolio Management with Side-Information (w/ Martin Lotz)
 - TBA (2012): Reconciling the Output of Multiple Classifiers Subject to Global Rules (w/ Arthur Kantor at IBM Research)
 - TBA (2012): Integer Linear Programming Formulations Integrating Semantic Role Labelling and Question Generation (w/ Arthur Kantor at IBM Research)
 - Thibaud Du Pouget De Nadaillac (2011): Load Planning for Civilian Passenger Aircraft, A Mixed Integer Linear Programming Approach (w/ Paul Keating at Air New Zealand)
 - Yin Wang (2011): Forecasting Methods in Sales (w/ Ian Walker at Cisco)
- ◇ **Teaching Assistant**, The University of Nottingham
 - Spring 2010: G53COM Computability (26 students)
 - Autumn 2008: G52ADS Algorithms and Data Structures (212 students)
 - Spring 2007: Q34180 Text, Talk and Corpus Analysis (9 students)
- ◇ **Tutor of English**, Masaryk University (Jan 2004 – Jul 2006)
 - Taught English to MU’s Deaf students. Developed an intensive course using Moodle, custom-compiled corpora, tools in Python, and XSL transformations. Responsible for teaching English to the Deaf funded by the European Social Fund (EUR 500K).
- ◇ **Various roles**, DDM Junior (Sept 1999 – Jul 2007)
 - Taught C++ programming to gifted high-school students. Member of jury of speed coding competitions organised by Czech Republic’s Dept. of Education.

AWARDS &
FUNDING

- ◇ Invitation and funding to attend the summer thematic program on the Mathematics of Constraint Satisfaction at the Fields Institute at the University of Toronto (2011)
- ◇ Logistics of Small Things Fellowship at Nottingham Nanotechnology and Nanoscience Centre funded by EPSRC (2011)
- ◇ The University of Nottingham PhD Studentship (2007–2011)

- ◇ Industrial Mathematics Knowledge Transfer Network Industrial Mathematics Internship Award co-funded by EPSRC (2009–2010)
- ◇ Travel funding from EPSRC via The University of Nottingham (2006–2010), EPSRC via Newton Institute (2011), NSERC via MITACS (2008), London Mathematical Society (2009, 2011), IBM Corp. and others via Georgia Institute of Technology (2010), and others
- ◇ Masaryk U. Scholarship for Excellent Students (“na podporu vynikajících studentů”; 2008) for overall GPA within the top percentile of graduates of the programme
- ◇ Erasmus/Socrates Scholarship and Komerční Banka (Société Générale Group) Premium funding my stay at the University of Nottingham School of Computer Science in 2006/7
- ◇ Masaryk U. Faculty of Informatics Extraordinary Scholarship (“zvláštní stipendium”; 2006)
- ◇ Several “top-product” awards for Pocket Translator, the Windows Mobile dictionary interface I have developed while at Aponia Software (2003)

GRADUATE COURSES

- ◇ NAIS Workshop on Advances in Large-Scale Optimization, Edinburgh, UK, UK, May 24–25, 2012 with *Yurii Nesterov*
- ◇ OpenMP Course, EPCC, Edinburgh, UK, May 21–22, 2012
- ◇ NAIS Workshop on GPUs for Scientific Computing, Edinburgh, UK, January 9–10, 2012 with *Mike Giles*
- ◇ Inverse Problems in Science and Engineering, Newton Institute, Cambridge, UK, December 12–16, 2011 with *Bill Symes*
- ◇ Approximability of Constraint Satisfaction Problems, Fields Institute, Toronto, Canada, August 12–16, 2011 with *Johan Hastad, Prasad Raghavendra*
- ◇ Algebra and Constraint Satisfaction Problems, Fields Institute, Toronto, Canada, August 2–6, 2011 with *Andrei Bulatov*
- ◇ Foundations of Computational Mathematics, Budapest, Hungary, July 4–10, 2011
- ◇ Signal Processing with Adaptive Sparse Structured Representations, Edinburgh, UK, June 27–30, 2011 with *David L. Donoho, Stephen J. Wright*
- ◇ Compressed Sensing, LMS Invited Lectures 2011, Cambridge, UK, March 21–25 2011 with *Emmanuel Candès*
- ◇ Nonlinear Methods in Combinatorial Optimization, EURO Summer Institute 2010, Klagenfurt, AT, August 28 – September 4, 2010 with *Florian Jarre, Franz Rendl*
- ◇ Summer School on Column Generation 2010, Darmstadt, DE, August 23–27, 2010 with *Guy Desaulniers, Jacques Desrosiers, Marco Lübbecke*
- ◇ Sparse Structures: Statistical Theory and Practice, Bristol, UK, June 16–18, 2010
- ◇ New Topics at the Interface Between Probability and Communications, Newton Institute, Cambridge, UK, January 11–15, 2010 with *Ayalovadi Ganesh, Andrea Montanari, John Tsitsiklis*
- ◇ Combinatorial Optimization at Work, Berlin, DE, September 21 – October 9, 2009 with *Bob Bixby, Ralf Borndörfer, Martin Grötschel, Martin Puterman*
- ◇ LMS-EPSRC Short Course on Probabilistic Combinatorics, Cambridge, UK, July 13–17, 2009 with *Béla Bollobás, Tim Gowers, Assaf Naor*
- ◇ National Taught Course in Operational Research: Stochastic Modelling, Lancaster University, UK, March 23–27, 2009 with *Jeff Griffiths, Kevin Glazebrook, Tony Lewins*
- ◇ Structural Graph Theory (MA052), Brno, CZ, Spring 2009 with *Petr Hliněný*
- ◇ Database System Implementation (PA152), Brno, CZ, Autumn 2008 with *Pavel Rychlý*
- ◇ Interior Point Methods, Politecnico di Torino, Torino, IT, October 20–28, 2008 with *Jacek Gondzio*

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- ◇ Fall School of Logic and Complexity with Emphasis on Proof Complexity, Prague, CZ, September 21–27, 2008 with *Steve Cook, Jan Krajíček, Pavel Pudlák*
- ◇ National Taught Course in Operational Research: Combinatorial Optimization, University of Southampton, UK, September 15 – June 19, 2008 with *Adam Letchford, Laurence Wolsey*
- ◇ National Taught Course in Operational Research: Convex Optimization, Brunel University, UK, June 16 – June 20, 2008 with *Shabbir Ahmed, Jacek Gondzio*
- ◇ Integer Programming and Combinatorial Optimization Summer School, Bertinoro, IT, May 28–30, 2008 with *Michele Conforti, Franz Rendl, Martin Skutella*
- ◇ National Taught Course in Operational Research: Heuristics and Approximation Algorithms, University of Nottingham, UK, March 31 – April 4, 2008 with *Erwin Pesch, Chris Potts*
- ◇ Complexity (IA012), Brno, CZ, Spring 2008 with *Ivana Černá*
- ◇ ADONET-CIRM School on Graphs and Algorithms, Levico Terme, IT, October 21–27, 2007 with *Maria Chudnovsky, Jim Geelen, Michel Goemans, Bertrand Guenin, Satoru Iwata, Carsten Thomassen*
- ◇ Artificial Intelligence Methods (G5BAIM), Nottingham, UK, Spring 2007 with *Andrew Parkes*
- ◇ Computer Aided Formal Reasoning (G5BCFR), Nottingham, UK, Autumn 2006 with *Thorsten Altenkirch, Conor McBride*
- ◇ Operations Research I and II (N13305/N13309), Nottingham, UK, 2006–2007 with *Luc Muyl-dermans*
- ◇ Scheduling (PA167), Brno, CZ, Spring 2006 with *Hana Rudová*
- ◇ Graphs on Surfaces (MA051), Brno, CZ, Spring 2006 with *Petr Hliněný*
- ◇ Linear and Integer Optimization (IA102), Brno, CZ, Autumn 2005 with *Petr Hliněný*

OTHER
ACTIVITIES

- ◇ **Sport Trekking** in the Dolomites (2007, 2010), Monte Negro (2003, 2008), Garhwal Himal (2009), Karakoram (2010), Picos de Europa (2011), and elsewhere. Running in 88-hour adventure races: Octoginta Octo 2006 (1st), Octoginta Octo 2008 (2nd), Terra Incognita 2010 (1st). Shorter races: Vrah 2011 (2nd), Pražský Maraton 2011 (3:20), Edinburgh Rock'n'Roll Half Marathon 2012 (1:29).
- ◇ **Scouting**, Member of Brno's 2nd group of troops within the Association of Scouts and Guides of the Czech Republic since 1992. Recent service: chair of the board of audit (2007–2010), member of the board of audit (2010–2013).
- ◇ **Experiential Learning**, Participation in a year-long course for instructors of experiential learning, resembling Outward Bound leader qualification (IS Kurz 2005/2006).