



## Summary of Working Experience:

- 09/2004 – 12/2005 Research fellow, Dept. E & OR, FEB, Tilburg University, The Netherlands
- 05/2002 – 07/2004 Scientific researcher, Theoretic Informatics Group, FB 20, University Frankfurt/Main, Germany
- 04/2000 – 04/2002 Postdoc, SSOR, Dept. of Technical Mathematics and Informatics, TU Delft, The Netherlands
- 04/1999 – 04/2000 Scientific programmer, Dept. of Computer Science, Faculty of Mathematics and Informatics, Utrecht University, The Netherlands
- 04/1997 – 03/1999 Postdoc, SSOR, Faculty of Technical Mathematics, TU Delft, The Netherlands
- 1994 – 1996 Research Fellow, Research Institute for Applications of Computer Algebra (RIACA), CWI Amsterdam/TU Eindhoven, The Netherlands
- 1992 – 1994 PhD research student and part-time tutor, Department of Mathematics, University of Western Australia
- 1989 – 1992 Engineer, Laboratory of Discrete Mathematics, Institute for System Studies, Academy of Sciences of the USSR.
- 1982 – 1983 Software engineer, Computer Center of the 4th Main Department of Health Ministry of USSR.

**NANYANG TECHNOLOGICAL UNIVERSITY**  
**CV Form for Academic Staff (Part-II)**

**Name:** Dmitrii V. PASECHNIK **School:** SPMS

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## **A. TEACHING**

**(3) Development of teaching materials.** I developed sets of lecture notes for MAS212 (Calculus IV) and MAS794 (graduate seminar in pure mathematics). They are available online at <http://www.ntu.edu.sg/home/dima/teaching.htm>.

A partial set of lecture notes for MAS313 (Abstract Algebra I) has been written and is available on <http://equatorialmaths.wordpress.com/tags/MAS313/>.

**(4) Short courses.** In May 2006 I took part in teaching of a short course MAS331 designed to offer 1st year NTU students, as well as selected JC and Poly students, a bit of real research experience in combinatorics.

## **B. RESEARCH**

**(1) Awards.** In 1992 I won the Australian Overseas Postgraduate Research Scholarship (OPRS) and The University of Western Australia (UWA) Research Studentship that enabled me to enter the UWA PhD program. My PhD from UWA is “with distinction”, that is awarded to the top 3-5% of all the PhD theses there.

**(2) Citations.** According to the *Citation Database of Mathematical Reviews of the American Mathematical Society*, my publications are cited 115

times by 114 authors.

**(8) Service as external examiner for PhD thesis.** In Decemeber 2008 I examined the PhD of Richard Leroy, a PhD candidate at IRMAR, University Rennes I (France).

**(9) Invited presentations at scientific meetings/workshops.** Numerous, at high level international conferences such as International Symposium for Mathematical Programming (ISMP, twice), Symposium on Discrete Algorithms (SODA), Annual Joint Meeting of the American Mathematical Society / Mathematical Association of America (AMS/MAA), International Conference on Effective Methods in Algebraic Geoemtry (MEGA), International Symposium on Theoretical Aspects of Computer Science (STACS), several international conferences in world class research centers like MSRI (Berkeley, USA), BIRS (Banff, Canada), IMA (University of Minneapolis, USA), Oberwolfach, Schloss Dagstuhl (Germany), IHP (Paris, France),

**Present period:** Symposium on Discrete Algorithms (SODA), Workshop on Computational Social Choice (ComSoC).

**(10) Service as a reviewer.** It is very extensive; I review grant applications for MITACS-NCE (Canada).

I write referee reports on approximately 10 research papers per year, for the following journals and conferences: *Combinatorica*, *Journal of Algebraic Combinatorics*, *Journal of Combinatorial Theory*, *Discrete and Computational Geometry*, *Mathematical Programming*, *SIAM Journal on Optimization*, *Journal of Computational and Applied Mathematics*, *Graphs and Combinatorics*, *European Journal of Combinatorics*, *Applicable Algebra in Engineering, Communication and Computing*, *IEEE Trans. on Fuzzy Systems*, *Communications in Algebra*, *Discrete Mathematics*, *Discrete Applied Mathematics*, *Journal of Group Theory*, *Journal of Mathematical Analysis and Applications*, *ICALP* (International Colloquium on Algorithms, Language and Program-

ming), CSR (Computer Science in Russia).

As well, I write reviews for Mathematical Reviews of the American Mathematical Society and Zentralblatt MATH.

**(12) External research funding.** I am in receipt of a MERLION grant for French-Singaporean collaboration in science, specifically with University of Rennes 1 group led by M.-F. Roy.

**(13) Research activities.** Currently I am in receipt of a 3-year Tier 1 grant, started April 2009. I was in receipt of a 2-year startup grant (extended into 2008) provided by SPMS. It covered travel costs related in particular to a joint project, with a French (M.-F. Roy, Rennes) and an American (Saugata Basu, Purdue) collaborators, on research on algorithms in real algebraic geometry, and related research. Most of the current Tier 1 grant will be directed into these topics, too.

Another activity, funded by the Tier 1 grant, is on investigating classical algebro-geometric approaches to the problem of representing nonnegative polynomials as sums of squares of rational functions.

The third major topic is applications of linear and semidefinite programming in combinatorics and engineering optimisation. The latter is a long-term ongoing project involving scientists from Netherlands (E. de Klerk, Tilburg), China (Y.-Q. Bai, Shanghai), UK (E. Elkind, Southampton), and others.

**Activities in the latest evaluation period (June 2008–June 2009).**

We have improved and published [4], describing a new and better semidefinite relaxation for the travelling salesman problem.

We have developed [1] and implemented a new numerical scheme for approximate block-diagonalisation of semidefinite program data.

We completed, published, and presented [3], which gives a first polynomial time approximation algorithm for finding the nucleolus of weighted voting games (and their vector versions).

We completed a paper on cost of stability in coalitional games [0].

We implemented a working prototype of GAP package for computing the centraliser ring of a permutation group. **Groups, Algorithms, and Programming (GAP)** is a very popular computer algebra system: <http://www.gap-system.org>.

## C. SERVICE

**(3) Other services to the University.** In the capacity of Deputy Chair of Teaching Committee, I serve as the MAS Division coordinator for the international student exchange programs run by NTU's IRO, such as INSTEP, GSS, etc, and the inter-Singapore exchange with NUS. This includes ranking applicants, supervising and approving subject matching for courses to be taken while away, etc.

I also am responsible for preparing undergraduate courses timetables (teaching as well as examination ones).

I oversee computing equipment and other IT-related purchases for the MAS Division. This includes evaluating division needs, comparing purchasing options, etc.

I am a representative of SPMS in NTU's BRC Sub-Committee "IT infrastructure for classroom of tomorrow".

## D. WORK LOAD

Workload for 2008/9 AY				
Course title	code	Lecture	Tutorial	Laboratory
Topology	MAS436	39	12	-
Linear Algebra II	MAS213	-	24	-
Mathematical Exposition	MAS216	-	24	-
Abstract Algebra I	MAS313	26	12	-
Advanced Investigations in Abstract Algebra I	MAS932	-	12	-

Further, I am supervising two PhD students, Nikolay Gravin and Svetlana Obraztsova, both recipients of A\*STAR SINGA scholarships.

## E. PUBLICATIONS:

Refereed journal papers : 44  
Refereed conference proceedings papers : 7  
Preprints (submitted for publication) : 2

### Journal papers

- [1] S. Basu, D.V. Pasechnik, and M.-F. Roy. Computing the Betti numbers of semi-algebraic sets defined by partly quadratic systems of polynomials. *Journal of Algebra*, 321:2206–2229, 2009.
- [2] S. Basu, D.V. Pasechnik, and M.-F. Roy. Bounding the Betti numbers and computing the Euler-Poincare characteristic of semi-algebraic sets defined by partly quadratic systems of polynomials. *Journal of European Mathematical Society*, to appear.

- [3] E. De Klerk, D.V. Pasechnik, and R. Sotirov. On semidefinite programming relaxations of the traveling salesman problem. *SIAM Journal on Optimization*, 19:1559–1573, 2008.
- [4] E. De Klerk, M.W. Newman, D.V. Pasechnik, and R. Sotirov. On the Lovász theta-number of almost regular graphs with application to Erdős-Rényi graphs. *European Journal of Combinatorics*, 30:879–888, 2009.
- [5] Y.-Q. Bai, E. De Klerk, D.V. Pasechnik, and R. Sotirov. Exploiting group symmetry in truss topology optimization. *Optimization and Engineering*, to appear.
- [6] E. de Klerk and D. V Pasechnik. A note on the stability number of an orthogonality graph. *European Journal of Combinatorics*, 28:1971–1979, 2007.
- [7] E. de Klerk and D. V Pasechnik. A linear programming reformulation of the standard quadratic optimization problem. *Journal of Global Optimization*, 37:75–84, 2007.
- [8] E. de Klerk, D. V. Pasechnik, J. Maharry, B. Richter, and G. Salazar. Improved bounds for the crossing numbers of  $K_{m,n}$  and  $K_n$ . *SIAM J. Discr. Math.*, 20:189–202, 2006.
- [9] Etienne de Klerk, Dmitrii V. Pasechnik, and Alexander Schrijver. Reduction of symmetric semidefinite programs using the regular \*-representation. *Math. Prog. B*, 109:613–624, 2007.
- [10] M. Filaseta, A. Kumchev, and D. V. Pasechnik. On the irreducibility of a truncated binomial expansion. *Rocky Mountains J. Math.*, 37:455–464, 2007.
- [11] S. Busygin and D. V. Pasechnik. On NP-hardness of the clique partition – Independence number gap recognition and related problems. *Discr. Math.*, 306:460–463, 2006.
- [12] D. Grigoriev and D. V. Pasechnik. Polynomial-time computing over quadratic maps I. sampling in real algebraic sets. *Computational Complexity*, 14:20–52, 2005.



- [13] A. Deza, B. Goldengorin, and D. V. Pasechnik. The isometries of the cut, metric and hypermetric cones. *J. Algebraic Combinatorics*, 23:197–203, 2006.
- [14] E. de Klerk, D. V. Pasechnik, and J. P. Warners. On approximate graph colouring and MAX- $k$ -CUT algorithms based on the  $\vartheta$ -function. *J. Comb. Optim.*, 8(3):267–294, 2004.
- [15] Etienne de Klerk and Dmitrii V. Pasechnik. Products of positive forms, linear matrix inequalities, and Hilbert 17th problem for ternary forms. *European J. Oper. Res.*, 157(1):39–45, 2004.
- [16] A. A. Ivanov and D. V. Pasechnik. Minimal representations of locally projective amalgams. *J. London Math. Soc. (2)*, 70(1):142–164, 2004.
- [17] A. A. Ivanov and D. V. Pasechnik.  $c$ -extensions of the  $F_4(2)$ -building. *Discrete Math.*, 264(1-3):91–110, 2003.
- [18] Dima Grigoriev, Edward A. Hirsch, and Dmitrii V. Pasechnik. Complexity of semialgebraic proofs. *Mosc. Math. J.*, 2(4):647–679, 805, 2002.
- [19] E. de Klerk and D. V. Pasechnik. Approximation of the stability number of a graph via copositive programming. *SIAM J. Optim.*, 12(4):875–892 (electronic), 2002.
- [20] Michel Deza and Dmitrii V. Pasechnik. On equicut graphs. *Mult.-Valued Log.*, 7(5-6):363–377, 2001.
- [21] Dmitrii V. Pasechnik. On computing Hilbert bases via the Elliot-MacMahon algorithm. *Theoret. Comput. Sci.*, 263(1-2):37–46, 2001.
- [22] Philippe Cara, Serge Lehman, and Dimitrii V. Pasechnik. On the number of inductively minimal geometries. *Theoret. Comput. Sci.*, 263(1-2):31–35, 2001.
- [23] A. A. Ivanov, D. V. Pasechnik, and S. V. Shpectorov. Extended  $F_4$ -buildings and the Baby Monster. *Invent. Math.*, 144(2):399–433, 2001.
- [24] B. Baumeister, A. A. Ivanov, and D. V. Pasechnik. A characterization of the Petersen-type geometry of the McLaughlin group. *Math. Proc. Cambridge Philos. Soc.*, 128(1):21–44, 2000.

- [25] Dmitrii V. Pasechnik and Cheryl E. Praeger. On transitive permutation groups with primitive subconstituents. *Bull. London Math. Soc.*, 31(3):257–268, 1999.
- [26] Barbara Baumeister and Dmitrii V. Pasechnik. The universal covers of certain semiplanes. *European J. Combin.*, 18(5):491–496, 1997.
- [27] Alberto Del Fra, Dmitrii V. Pasechnik, and Antonio Pasini. A new family of extended generalized quadrangles. *European J. Combin.*, 18(2):155–169, 1997.
- [28] Dmitrii V. Pasechnik. The extensions of the generalized quadrangle of order  $(3, 9)$ . *European J. Combin.*, 17(8):751–755, 1996.
- [29] Barbara Baumeister and Dmitrii V. Pasechnik. The universal covers of the sporadic semiplanes. *European J. Combin.*, 17(7):595–604, 1996.
- [30] Hans Cuyper, Anna Kasikova, and Dmitrii V. Pasechnik. Multiple extensions of generalized hexagons related to the simple groups  $\text{McL}$  and  $\text{Co}_3$ . *J. London Math. Soc. (2)*, 54(1):16–24, 1996.
- [31] Leonid Brailovsky, Dmitrii V. Pasechnik, and Cheryl E. Praeger. Classification of 2-quasi-invariant subsets. *Ars Combin.*, 42:65–76, 1996.
- [32] Alexander A. Ivanov, Dmitrii V. Pasechnik, and Sergey V. Shpectorov. Non-abelian representations of some sporadic geometries. *J. Algebra*, 181(2):523–557, 1996.
- [33] Dmitrii V. Pasechnik. The triangular extensions of a generalized quadrangle of order  $(3, 3)$ . *Bull. Belg. Math. Soc. Simon Stevin*, 2(5):509–518, 1995.
- [34] Dmitrii V. Pasechnik. Extending polar spaces of rank at least 3. *J. Combin. Theory Ser. A*, 72(2):232–242, 1995.
- [35] Dmitrii V. Pasechnik. Extended generalized octagons and the group  $\text{He}$ . *Geom. Dedicata*, 56(1):85–101, 1995.
- [36] Leonid Brailovsky, Dmitrii V. Pasechnik, and Cheryl E. Praeger. Subsets close to invariant subsets for group actions. *Proc. Amer. Math. Soc.*, 123(8):2283–2295, 1995.

- [37] Dmitrii V. Pasechnik. Geometric characterization of the sporadic groups  $\text{Fi}_{22}$ ,  $\text{Fi}_{23}$ , and  $\text{Fi}_{24}$ . *J. Combin. Theory Ser. A*, 68(1):100–114, 1994.
- [38] Dmitrii V. Pasechnik. Geometric characterization of graphs from the Suzuki chain. *European J. Combin.*, 14(5):491–499, 1993.
- [39] A. Munemasa, D. V. Pasechnik, and S. V. Shpectorov. The automorphism group and the convex subgraphs of the quadratic forms graph in characteristic 2. *J. Algebraic Combin.*, 2(4):411–419, 1993.
- [40] Dmitrii V. Pasechnik. New examples of finite  $\tilde{C}_2$ -geometries. *Geom. Dedicata*, 46(2):161–164, 1993.
- [41] Dmitrii V. Pasechnik. Skew-symmetric association schemes with two classes and strongly regular graphs of type  $L_{2n-1}(4n-1)$ . *Acta Appl. Math.*, 29(1-2):129–138, 1992. Interactions between algebra and combinatorics.
- [42] Dmitrii V. Pasechnik. Affine extensions of the Petersen graph and 2-arc-transitive graphs of girth 5. *European J. Combin.*, 13(4):279–290, 1992.
- [43] Dmitrii V. Pasechnik. Dual linear extensions of generalised quadrangles. *European J. Combin.*, 12(6):541–548, 1991.
- [44] Irene V. Chuvaeva and Dmitrii V. Pasechnik. Distance-transitive graphs of type  $q \cdot K_{q,q}$  and projective planes. *European J. Combin.*, 11(4):341–346, 1990.

### Conference papers (refereed)

- [45] E. Elkind and D.V. Pasechnik. Computing the nucleolus of weighted voting games. In Claire Mathieu, editor, *Proceedings of ACM-SIAM Symposium on Discrete Algorithms (SODA'09)*, pages 327–335. SIAM, New York, 2009.
- [46] Dima Grigoriev, Edward A. Hirsch, and Dmitrii Pasechnik. Exponential lower bound for static semi-algebraic proofs. In *Automata, languages and programming*, volume 2380 of *Lecture Notes in Comput. Sci.*, pages 257–268. Springer, Berlin, 2002.

- [47] Dima Grigoriev, Edward A. Hirsch, and Dmitrii V. Pasechnik. Complexity of semi-algebraic proofs. In *STACS 2002*, volume 2285 of *Lecture Notes in Comput. Sci.*, pages 419–430. Springer, Berlin, 2002.
- [48] Antoine Deza, Komei Fukuda, Dmitrii Pasechnik, and Masanori Sato. On the skeleton of the metric polytope. In *Discrete and computational geometry (Tokyo, 2000)*, volume 2098 of *Lecture Notes in Comput. Sci.*, pages 125–136. Springer, Berlin, 2001.
- [49] Dmitrii V. Pasechnik. Bipartite sandwiches: semidefinite relaxations for maximum biclique. In *6th Twente Workshop on Graphs and Combinatorial Optimization (Enschede, 1999)*, volume 3 of *Electron. Notes Discrete Math.*, page 5 pp. (electronic). Elsevier, Amsterdam, 1999.
- [50] D. V. Pasechnik. On some locally 3-transposition graphs. In *Finite geometry and combinatorics (Deinze, 1992)*, volume 191 of *London Math. Soc. Lecture Note Ser.*, pages 319–325. Cambridge Univ. Press, Cambridge, 1993.
- [51] A. Munemasa, D. V. Pasechnik, and S. V. Shpectorov. A local characterization of the graphs of alternating forms and the graphs of quadratic forms over  $\text{GF}(2)$ . In *Finite geometry and combinatorics (Deinze, 1992)*, volume 191 of *London Math. Soc. Lecture Note Ser.*, pages 303–317. Cambridge Univ. Press, Cambridge, 1993.

### **Preprints (submitted)**

- [52] Y. Bachrach, E. Elkind, R. Meir, D. Pasechnik, M. Zuckerman, J. Rothe, and J. S. Rosenschein. The cost of stability and its application to weighted voting games, 2009. submitted to Symposium on Algorithmic Game Theory.
- [53] E. De Klerk, C. Dobre, and D.V. Pasechnik. Numerical block diagonalization of matrix \*-algebras with application to semidefinite programming. *Mathematical Programming B*, submitted. Preprint 2009-02-2244 at Optimization online.