Curriculum Vitae of Ján Maňuch

Personal Details

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Education & Training

1992–1997	MSc, Dept. of Computer Science, Comenius University, Bratislava (1st rank)
June–September 1996	Summer Student Programme in CERN, Switzerland
1997–2002	PhD, Dept. of Mathematics, University of Turku & Turku Centre for Computer Science, Finland (rank: "laudatur")

Specialized Courses

October 28–30, 2004	Instructional Skills Workshop, Simon Fraser University
July 19–24, 2004	CBW Proteomics Workshop, University of Calgary
September 22–28, 2007	Minicourse in Quantitative Biology & Workshop on Deconstructing Biochemical Networks, CRM, University of Montreal

Work Experience

September 2002–August 2009	Postdoctoral Fellowship, School of Computing Science, Simon Fraser University (supported in part by PIMS and MITACS) — supervised by Arvind Gupta and Pavol Hell
September 2008–present	Adjunct Professor, Department of Mathematics, Simon Fraser University
September 2009–present	Research Associate, Department of Computing Science, University of British Columbia

Teaching Experience

Instructor:

Summer 2003	SFU, School of Comp. Sci.	Algorithms and data structures (CMPT 307)
Spring 2004	SFU, School of Comp. Sci.	Object-oriented design in C++ (CMPT 212)
Fall 2005	SFU, School of Comp. Sci.	Object-oriented design in C++ (CMPT 212)
Summer 2006	SFU, School of Comp. Sci.	Data structures and programming (CMPT 225)
Spring 2008	SFU, School of Comp. Sci.	Object-oriented design in C++ (CMPT 212)
Summer 2008	SFU, School of Comp. Sci.	Algorithms and data structures (CMPT 307)
Summer 2009	SFU, Dept. of Math.	Linear optimization (MATH 308)
Fall 2010	SFU, Dept. of Math.	Calculus for Social Sciences I (MATH 157)
Spring 2012	SFU, Dept. of Math.	Applied Linear Algebra (MATH 232)

Graduate students

Name	Years Supervised	Title of Project
Murray Patterson	Co-supervised 2006–2011	Generalizations of C1P problem (PhD, CS, UBC)
Christine Stoll	Co-supervised 2006–2009	Bounds on the tile complexity of shapes in self-assembly systems (MSc, Math, SFU)
Alireza Hadj Khodabakhshi	Co-supervised 2002–2008	Structure approximating inverse protein folding (PhD, CS, SFU)

Research Grants

- 2009: Co-applicant on 2-years **NSERC Collaborative Research and Development Grant** "Mapping the Human Kineome and Phosphoproteome"; $\$120,000$.
- 2010: Primary investigator on 5-years **NSERC Discovery Grant** "Combinatorial models and algorithms in bioinformatics"; $\$100,000$.
- 2012: Primary investigator on 8-months **MITACS Accelerate Grant** "Modeling Human Cell Phosphorylation Network"; $\$30,000$.

Publications[1]

Journal Publications

[1] Condon, A., Hu, A., Maňuch, J., Thachuk, C., Less haste, less waster: On recycling and its limits in strand displacement systems, *Interface Focus*, Royal Society, (to appear).

[2] Maňuch, J., Stacho, L., Stoll, C., Step-wise tile assembly with a constant number of tile types, *Nat. Comput.*, (to appear).

[3] Gupta, A., Maňuch, J., Stacho, L., Zhao, X., Algorithm for haplotype inference via galled-tree networks with simple galls, *J. Comp. Biol.*, (to appear).

[1] Computer science and theoretical bioinformatics papers list authors alphabetically representing equal intellectual contributions. Some bioinformatics publications traditionally list supervisors names last, while other contributors are listed in the order of the involvement in the work on the publication.

[4] Maňuch, J., Patterson, M., The complexity of the gapped consecutive-ones property problem for matrices of bounded maximum degree, *J. Comp. Biol.* **18**, No. 9, 1243–1253 (2011).

[5] Wittler, R., Maňuch, J., Patterson, M., Stoye, J., Consistency of sequence-based gene clusters, *J. Comp. Biol.* **18**, No. 9, 1023–1039 (2011).

[6] Safaei, J., Maňuch, J., Gupta, A., Stacho, L., Pelech, S., Prediction of 492 human protein kinase substrate specificities, *Proteome Science* **9**(Suppl 1):S6 (2011).

[7] Maňuch, J., Thachuk, C., Stacho, L., Condon, A., NP-completeness of the energy barrier problem without pseudoknots and temporary arcs, *Nat. Comput.* **10**, No. 1, 391–405 (2011).

[8] Gupta, A., Karimi, M., Maňuch, J., Stacho, L., Zhao, X., Haplotype inference via galled-tree networks is NP-complete, *J. Comp. Biol.* **17**, No. 10, 1435–1449 (2010).

[9] Maňuch, J., Stacho, L., Stoll, C., Two lower bounds for self-assemblies at temperature 1, *J. Comp. Biol.* **17**, No. 6, 841–852 (2010).

[10] Adams, P., Ardal, H., Maňuch, J., Hòa, V.D., Rosenfeld, M., Stacho, L., Spanning cubic graph designs, *Discrete Math.* **309**, No. 18, 5781–5788 (2009).

[11] Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Gupta, A., Inverse protein folding in 3D hexagonal prism lattice under HPC model, *J. Comp. Biol.* **16**, No. 6, 769–802 (2009).

[12] Ardal, H., Maňuch, J., Rosenfeld, M., Shelah, S., Stacho, L., The odd-distance plane graph, *Discrete & Computational Geometry* **42**, No. 2, 132–141 (2009).

[13] Gupta, A., Maňuch, J., Stacho, L., Zhao, X., Haplotype inferring via galled-tree networks using a hypergraph covering problem for special genotype matrices, *Discrete Applied Mathematics* **157**, No. 10, 2310–2324 (2009).

[14] Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Gupta, A., Stable structure-approximating inverse protein folding in 2D Hydrophobic-Polar-Cysteine (HPC) model, *J. Comp. Biol.* **16**, No. 1, 19–30 (2009).

[15] Gupta, A., Heuvel, J., Maňuch, J., Stacho, L., Zhao, X., On the complexity of ordered colorings, *SIAM J. Discrete Math.* **22**, No. 2, 832–847 (2008).

[16] Maňuch, J., Gaur, D.R., Fitting protein chains to cubic lattice is NP-complete, *Journal of Bioinformatics and Computational Biology* **6**, No. 1, 93–106 (2008).

[17] Gupta, A., Maňuch, J., Stacho, L., Zhao, X., Characterization of the existence of galled-tree networks, *Journal of Bioinformatics and Computational Biology* **4**:6, 1309–1328 (2006).

[18] Gupta, A., Maňuch, J., Stacho, L., Fault tolerant forwarding and optical indexes: a design theory approach, *Journal of Combinatorial Designs* **14**, No. 1, 25–40 (2006).

[19] Gupta, A., Maňuch, J., Stacho, L., Structure-approximating inverse protein folding problem in 2D HP model, *J. Comp. Biol.* **12**, No. 10, 1328–1345 (2005).

[20] Berenbrink, P., Friedetzky, T., Maňuch, J., Stacho, L., (Quasi) spanners for mobile ad hoc networks, *Journal of Interconnection Networks* **6**, No. 2, 63–84 (2005).

[21] Maňuch, J., Stacho, L., On f-wise arc forwarding index and wavelength allocations in faulty all-optical hypercubes, *Theor. Inform. Appl.* **37**, No. 3, 255–270 (2003).

[22] Ďuriš, P., Maňuch, J., On the computational complexity of infinite words, *Theoret. Comput. Sci.* **295**, No. 1–3, 141–151 (2003).

[23] Karhumäki, J., Maňuch, J., Plandowski, W., A defect theorem for bi-infinite words, *Theoret. Comput. Sci.* **292**, No. 1, 237–243 (2003).

[24] Karhumäki, J., Maňuch, J., Multiple factorizations of words and defect effect, *Theoret. Comput. Sci.* **273**, No. 1–2, 81–97 (2002).

[25] Cassaigne, J., Karhumäki, J., Maňuch, J., On conjugacy of languages, *Theor. Inform. Appl.* **35**, no. 6, 535–550 (2001).

[26] Maňuch, J., Defect effect of bi-infinite words in the two-element case, *Discrete Math. Theor. Comput. Sci.* **4**, No. 2, 273–290 (2001).

[27] Maňuch, J., Construction of very hard functions for multiparty communication complexity, *Theor. Inform. Appl.* **34**, No. 1, 61–75 (2000).

Conference publications[2]

Extended abstracts

[1] Safaei, J., Maňuch, J., Gupta, A., Stacho, L., Pelech, S., Evolutionary conservation of human phosphorylation sites, Proc. of *IEEE International Conference of Bioinformatics and Biomedicine* (BIBM, Atlanta, USA, 2011), IEEE Computer Society, (to appear).

[2] Condon, A., Hu, A., Maňuch, J., Thachuk, C., Less haste, less waster: On recycling and its limits in strand displacement systems, Proc. of *International Meeting on DNA Computing and Molecular Programming* (DNA, Pasadena, USA, 2011), LNCS **6937**, 84–99 (2011).

[3] Chauve, C., Maňuch, J., Patterson, M., Wittler, R., Tractability results for the consecutive-ones property with multiplicity, Proc. of *Combinatorial Pattern Matching* (CPM, Palermo, Italy, 2011), LNCS **6661**, 90–103 (2011).

[4] *Maňuch, J., Patterson, M., A. Gupta, Towards a characterisation of the generalised character compatibility problem for non-branching character trees, Proc. of *International Symposium on Bioinformatics Research and Applications* (ISBRA, Changsha, China, 2011), LNBI **6674**, 440–451 (2011).

[5] Safaei, J., Maňuch, J., Gupta, A., Stacho, L., Pelech, S., Prediction of human protein kinase substrate specificities, Proc. of *IEEE International Conference of Bioinformatics and Biomedicine* (BIBM, Hong Kong, 2010), IEEE Computer Society, 259–264 (2010).

[6] *Maňuch, J., Patterson, M., The complexity of the gapped consecutive-ones property problem for matrices of bounded maximum degree, Proc. of *Annual RECOMB Satellite Workshop on Comparative Genomics* (RECOMB-CG, Ottawa, Canada, 2010), LNBI **6398**, 278–289 (2010).

[2]The talks or posters presented by me are marked with *.

[7] Maňuch, J., Patterson, M., Poon S.-H., Thachuk, C., Complexity of finding non-planar rectilinear drawings of graphs, Proc. of *International Symposium on Graph Drawing* (GD, Konstanz, Germany, 2010), LNCS **6502**, 305–316 (2011).

[8] Thachuk, C., Maňuch, J., Rafiey, A., Mathieson, L-A., Stacho, L., Condon, A., An algorithm for the energy barrier problem without pseudoknots and temporary arcs, Proc. of *Pacific Symposium on Biocomputing* (PSB, Hawaii, USA, 2010), World Scientific Publishing, 108–119 (2010).

[9] *Maňuch, J., Stacho, L., Stoll, C., Step-assembly with a constant number of tile types, Proc. of *International Symposium on Algorithms and Computation* (ISAAC, Hawaii, USA, 2009), LNCS **5878**, 954–963 (2009).

[10] Chauve, C., Maňuch, J., Patterson, M., On the gapped consecutive-ones property, Proc. of *European Conference on Combinatorics, Graph Theory and Applications* (EUROCOMB, Bordeaux, France, 2009), ENDM **34**, 121–125 (2009).

[11] Maňuch, J., Thachuk, C., Stacho, L., Condon, A., NP-completeness of the direct energy barrier problem without pseudoknots, Proc. of *International Meeting on DNA Computing and Molecular Programming* (DNA, Fayetteville, USA, 2009), LNCS **5877**, 106–115 (2009).

[12] Maňuch, J., Patterson, M., Gupta, A., On the generalized character compatibility problem for non-branching character trees, Proc. of *Annual International Computing and Combinatorics Conference* (COCOON, Niagara Falls, USA, 2009), LNCS **5609**, 268–276 (2009).

[13] *Maňuch, J., Stacho, L., Stoll, C., Two lower bounds for self-assemblies at temperature 1, Proc. of *International Conference on Bioinformatics and Biomedical Engineering* (iCBBE, Beijing, China, 2009), 1–4 [DOI: 10.1109/ICBBE.2009.5163719] (2009).

[14] Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Gupta, A., Inverse protein folding in 3D hexagonal prism lattice under HP model, Proc. of *International Conference on Bioinformatics & Computational Biology* (BIOCOMP, Las Vegas USA, 2008), CSREA Press, 619–625 (2008).

[15] Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Gupta, A., A robust class of stable proteins in the 2D HPC model, Proc. of *Bioinformatics Research and Development* (BIRD, Vienna, Austria, 2008), Communications in Computer and Information Science **13**, 180-192 (2008).

[16] *Gupta, A., Maňuch, J., Stacho, L., Zhao, X., Haplotype inferring via galled-tree networks is NP-complete, Proc. of *Annual International Computing and Combinatorics Conference* (COCOON, Dalian, China, 2008), LNCS **5092**, 287–298 (2008).

[17] Condon, A., Maňuch, J., Thachuk, C., Complexity of a collision-aware string partition problem and its relation to oligo design for gene synthesis, Proc. of *Annual International Computing and Combinatorics Conference* (COCOON, Dalian, China, 2008), LNCS **5092**, 265–275 (2008).

[18] *Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Gupta, A., Structure-approximating design of stable proteins in 2D HP model fortified by cysteine monomers, Proc. of *Asia Pacific Bioinformatics Conference* (APBC, Kyoto, Japan, 2008), Advances in Bioinformatics and Computational Biology **6**, 49–58 (2008).

[19] *Gupta, A., Karimi, M., Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Design of artificial protein structures in 3D hexagonal prism lattice under HP model, Proc. of *International Conference on Bioinformatics & Computational Biology* (BIOCOMP, Las Vegas USA, 2007), CSREA Press, 362–369 (2007).

[20] *Gupta, A., Maňuch, J., Stacho, L., Zhao, X., Algorithm for haplotype inferring via galled-tree networks with simple galls (extended abstract), Proc. of *International Symposium on Bioinformatics Research and Applications* (ISBRA, Atlanta, USA, 2007), LNBI **4463**, 121–132 (2007).

[21] *Gaur, D. R., Maňuch, J., Fitting protein chains to cubic lattice is NP-complete, Proc. of *Asia Pacific Bioinformatics Conference* (APBC, Hong Kong, 2007), Advances in Bioinformatics and Computational Biology **5**, 153–164 (2007).

[22] Kavanagh, J., Mitchell, D., Ternovska, E., Maňuch, J., Zhao, X., Gupta, A., Constructing Camin-Sokal phylogenies via answer set programming, Proc. of *Logic for Programming, Artificial Intelligence, and Reasoning* (LPAR, Phnom Penh, Cambodia, 2006), LNCS **4246**, 452–466 (2006).

[23] *Gaur, D. R., Krishnamurti, R., Maňuch, J., Improved approximation algorithm for scheduling tasks with a choice of start times, Proc. of *Algorithms and Complexity in Durham* (ACiD, Durham, UK 2006), Texts in Algorithmics **7**, 85–94 (2006).

[24] *Maňuch, J., Zhao, X., Stacho, L., Gupta, A., Characterization of the existence of galled-tree networks (extended abstract), Proc. of *Asia Pacific Bioinformatics Conference* (APBC, Taipei, Taiwan, 2006), Imperial College Press, 297–306 (2006).

[25] Brown, T., Maňuch, J., A simple proof of Lerch's formula, Proc. of *Fibonacci Numbers and Their Applications* (Braunschweig, Germany, 2004), Applications of Fibonacci Numbers **10**, Kluwer Academic Publishers (to appear).

[26] *Gupta, A., Maňuch, J., Stacho, L., Inverse protein folding in 2D HP model (extended abstract), Proc. of *Computational Systems Bioinformatics* (CSB, Stanford, USA, 2004), IEEE Computer Society, 311–318 (2004).

[27] *Gupta, A., Maňuch, J., Stacho, L., Zhu, C., Small phylogeny problem: Character evolution trees, Proc. of *Combinatorial Pattern Matching* (CPM, Istanbul, Turkey, 2004), LNCS **3109**, 230–243 (2004).

[28] *Gupta, A., Maňuch, J., Stacho, L., Fault tolerant forwarding and optical indexes: A design theory approach, Proc. of *Colloquium on Structural Information and Communication Complexity* (SIROCCO, Smolenice Castle, Slovak Republic, 2004), LNCS **3104**, 197–208 (2004).

[29] *Ďuriš, P., Maňuch, J., On the computational complexity of infinite words, Proc. of *Math. Foundations of Comp. Sci.* (MFCS, Mariánske Lázne, Czech Republic, 2001), LNCS **2136**, 328–337 (2001).

[30] *Maňuch, J., Characterization of a word by its subwords, in: Rozenberg, Grzegorz (ed.) et al., Proc. of *Developments in language theory: Foundations, applications, and perspectives* (DLT, Aachen, Germany, 1999), World Scientific, 210–219 (2000).

[31] Maňuch, J., Stacho, L., Fault-tolerant wavelength allocations in all-optical hypercubes, Proc. of *Colloquium on Structural Information and Communication Complexity* (SIROCCO, Lacanau-Ocean, France, 1999), Carleton Scientific, 219–222 (1999).

[32] *Maňuch, J., Multiparty communication complexity: Very hard functions, Proc. of *Math. Foundations of Comp. Sci.* (MFCS, Szklarszka Poreba, Poland, 1999), LNCS **1672**, 160–169 (1999).

[33] *Karhumäki, J., Maňuch, J., Plandowski, W., On defect effect of bi-infinite words, Proc. of *Math. Foundations of Comp. Sci.* (MFCS, Brno, Czech Republic, 1998), LNCS **1450**, 674–682 (1998).

Short abstracts

[34] Maňuch, Stacho, L., Stoll, C., Two lower bounds for self-assemblies at temperature 1 (poster abstract), Proc. of *Annual ACM Symposium on Applied Computing (Bioinformatics Track)* (ACM SAC BIO, Honolulu, USA, 2009), 808–809 (2009).

[35] Heuvel, J., Gupta, A., Maňuch, J., Stacho, L., Zhao, X., On the complexity of ordered colorings (short abstract), Proc. of *Algorithms and Complexity in Durham* (ACiD, Durham, UK, 2006), Texts in Algorithmics **7**, 156 (2006).

[36] Mead, C.R., Maňuch, J., Huang, X., Bhattacharyya, B., Stacho, L., Gupta, A., Investigating lattice structure for inverse protein folding (poster abstract), Proc. of *FEBS Congrese & IUBM Conference: The Protein World* (Budapest, Hungary, 2005), *FEBS Journal* **272** (s1), 4739_1_380 (2005).

Without proceedings

[37] *Khodabakhshi, A.H., Maňuch, J., Rafiey, A., Stacho, L., Gupta, A., Protein designs in HP models, *Foundations of Nanoscience: Self-Assembled Architectures and Devices* (FNANO, Snowbird, USA, 2008).

[38] Thomas D., Maňuch, J., Gaur, D., Experiments on fitting protein chains to lattices (poster), *Asia Pacific Bioinformatics Conference* (APBC, Taipei, Taiwan, 2007).

[39] *Maňuch, J., Gaur, D. R., Huang, X., Benkoczi, R., Fitting protein chains to lattices, *SIAM Conference on Discrete Mathematics* (Victoria, Canada, 2006).

[40] Gupta, A., Maňuch, J., Stacho, L., Zhao, X., On intractability of haplotype inferring via galled-tree networks, *Workshop on Networks in Computational Biology* (Ankara, Turkey, 2006).

[41] *Maňuch, J., Mead, C.R., Huang, X., Bhattacharyya, B., Stacho, L., Gupta, A., On design of stable proteins in 3D HP Model (poster), *Metalloprotein and Protein Design Conference* (Chicago, USA, 2005).

[42] *Cassaigne, J., Karhumäki, J., Maňuch, J., Conjugation of languages, *WORDS* (Palermo, Italy, 2001).

[43] *Karhumäki, J., Maňuch, J., Multiple factorizations of words and defect effect, *WORDS* (Rouen, France, 1999).

[44] Verdier, A., Maňuch, J., Computation on fixed points in a circular machine, *Particle Accelerator Conference* (Vancouver, Canada, 1997).

Publications in preparation

- Gupta, A., Maňuch, J., Stacho, L., Zhao, X., *Polynomial algorithm for coloring random graphs by small posets*, manuscript.
- Gupta, A., Maňuch, J., Stacho, L., *Tree minors with prescribed leaf labeling and their variations*, manuscript.
- Gaur, D., Krishnamurti, R., Maňuch, J., *Improved analysis of approximation algorithms for scheduling with a choice of start times*, manuscript.
- Khodabakhshi, A., Maňuch, J., Mirzazadeh, M., Rafiey, A., Thachuk, C., *Algorithms for different variations of codon selection problem*, in preparation.
- Benkoczi, R., Gupta, A., Huang, X., Maňuch, J., *Optimal fitting protein chains to lattices using integer programming*, in preparation.
- Maňuch, J., Thachuk, C., *String partitioning problems*, in preparation.
- Dobrev, S., Kranakis, E., Krizanc, D., Maňuch, J., Morales-Ponce, O., Stacho, L., *An upper bound on the angle of rotating directional antennae continuously covering the plane*, in preparation.
- Goussiatiner, A., Maňuch, J., *Prority retrieval from stack*, in preparation.

Research interests

- *Computational Biology and Bioinformatics:* Phylogenetic Networks and Haplotyping, Genome Rearrangement Models, RNA Secondary Structures, Molecular Self-assembly, Kinase Cell Signaling Pathways, Forward and Inverse Protein Folding, String Matching
- *Discrete Mathematics and Graph Theory:* Coloring Problems, Probability Theory, Combinatorics on Words, Formal Language and Automata Theory
- *Networks algorithms:* Communication Complexity, Mobile Networks, Fault-tolerant Routings, Social Networks

PhD Dissertation

Title:	Defect theorems and infinite words
Supervisor:	Juhani Karhumäki, Turku University, Finland
Examiner:	Christian Choffrut, University Denis Diderot – Paris VII, LIAFA, France
Reviewers:	Wojciech Rytter, Liverpool University, UK Lila Kari, University of Western Ontario, Canada
Short abstract:	The thesis attacks different problems of Combinatorics on Words. Several defect-type theorems are developed for bi-infinite words. The problem of conjugacy of languages is considered and solved in two-element case. In the last chapter two open problems in the theory of computational complexity of infinite words are studied.

Master's thesis

Title:	Nondeterministic communication complexity on the multiparty model
Supervisor:	Pavol Ďuriš, Comenius University, Slovakia
Reviewer:	Dana Pardubská, Comenius University, Slovakia
Short abstract:	Functions with the worst possible nondeterministic communication complexity are constructed. It is also proved that almost all functions have complexity at least $M-n-2$, where M is the maximum complexity and n is the number of parties.

Other research activities

- MITACS Accelerate Lead Associate Research Review Committee (ARRC) member (2009 – present).
- Research collaboration with Kinexus Bioinformatics Corporation (September, 2005 – February 2006; and January, 2008 – present). Co-investigator on the NSERC Collaborative Research and Development (CRD) Grant "Mapping the Human Kineome and Phosphoproteome" (PI: Dr. Ladislav Stacho, duration: September 2009 – August 2011).
- Committee work: Member of examining committee for MSc student Vivija You (Math., SFU, 2009) supervised by Dr. Cedric Chauve.
- Co-organizer of the BIRS workshop "The Biology-Combinatorics Interface: Addressing New Challenges in Computational Biology" (July, 2008).
- Organizer of the MITACS Bioinformatics Series seminar 2007/2008 (`http://www.pims.math.ca/~manuch/MBS/`).
- Co-organizer of the BIRS workshop "Inverse Protein Folding" (September, 2006).
- Reviewer for conferences: MFCS, SIROCCO, DLT, ADHOC-NOW, CNSR, WG; and journals: Discrete Applied Mathematics, Theoretical Computer Science, Graphs and Combinatorics, Information Sciences, Opuscula Mathematica, Discrete Mathematics, J. Math. Biol-

ogy, Nucleic Acids Research, Information Processing Letters, Mathematica Slovaca, J. Graph Theory.

References

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