
Marcus Schaefer

Professor

DePaul University
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Areas Graph theory, Graph drawing, Computational Complexity.

Academic **DePaul University**

Career Professor, 2014.

Associate Professor, 2005.

Assistant Professor, 1999.

University of Chicago

Ph.D., June 1999 (“Completeness and Incompleteness”; advisor: Stuart Kurtz);

Master of Science, March 1998;

joined graduate program in summer 1995.

University of Southern Maine

Research Assistant to Prof. Stephen Fenner from July 1996 to March 1997.

Universität Karlsruhe

Diplom-Mathematiker (graduate degree in mathematics), December 1994;

Diplom-Informatiker (graduate degree in computer science), May 1994.

Award **Conference on Computational Complexity**

Ron Book Best Student Paper Award, May 1999.

Marcus Schaefer

Teaching Experience

DePaul University

- CSC 202: Mathematics for Computer Science (S 2006/7, W 2006/7, F 2006/7).
- CSC 202: Mathematics for Computer Science (S 2006/7, W 2006/7, F 2006/7).
- CSC 233: Codes and Ciphers (S 2010/11, W 2010/11, W 2008/9, W 2007/8, W 2005/6, W 2003/4).
- CSC 241: Introduction to Computer Science I (F 2015/16, F 2013/14, F2012/13, F 2011/2)
- CSC 242: Introduction to Computer Science II (W 2012/3)
- CSC 316: Fundamentals of Web Development (S 1999/2000, W 1999/2000).
- CSC 319: Database Technology (F 2003/4, F 2002/3).
- CSC 321: Design and Analysis of Algorithms (S 2014/15, F 2011/12, W 2002/3, W 1999/2000, F 1999/2000).
- CSC 333: Cryptology (S 2013/14, S 2002/3).
- CSC 347: Concepts of Programming Languages (F 2003/4).
- CSC 355: Database Systems (S 2014/15, F 2014/15, S 2013/14, W 2013/14, S 2011/12, S 2010/11).
- CSC 401: Introduction to Programming (F 2014/15, F 2013/14).
- CSC 412: Tools and Techniques for Computational Analysis (F 2015/16, W 2014/15, W 2013/14)
- CSC 421: Applied Algorithms and Structures (F 2012/13).
- CSC 431: Scientific Computing (W 2009/2010).
- CSC 440: Cryptology (W 2014/15, W 2012/13, W 2011/12, W 2010/11, W 2009/10, W 2008/9, F 2006/7, W 2006/7, W 2005/6, W 2004/5, S 2003/4, S 2002/3, F 2002/3).
- CSC 444: (CSC 344): Automata Theory (F 2010/11)
- CSC 449: Database Technologies (W 2002/3, S 2001/2, W 2001/2).
- CSC 491: Algorithms, F 2006/7.
- CSC 543: Spatial Databases, S 2008/9.
- CSC 544: (CSC 389): Theory of Computation (W 2003/4, S 2001/2, W 2000/1).
- DC 270: Topics in Digital Cinema (Werner Herzog) (S 2007).
- DC 270: Topics in Digital Cinema (History of Horror Film) (S 2006).
- ECT 270: Client Side Web Application Development (S 2000/1, W 2000/1, F 2000/1).
- ECT 353: Web Application Development with Scripting (F 2001/2, W 2000/1).
- ECT 410: Web Application Development with Scripting (F 2000/1).
- GAM 206: History of Games (S 2009/10, S 2008/9, S 2007/8, W 2007/8)
- GPH 425: Survey of Computer Graphics (F 2005/6).
- HCI 332: User-Centered Web-Development (S 2001/2, W 2001/2, F 2001/2, S 2000/1).
- IT 130: The Internet and the Web (F 2004/5, F 2005/6, S 2006).
- IT 223: Data Analysis (F 2004/5).
- IT 240: Introduction to Desktop Databases (F 2010/11, S 2009/10, W 2007/8, W 2004/5)
- MAT 372: Set Theory and Logic (S 2003/4).

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Teaching Experience

University of Chicago

- CS 115: Introduction to Programming I (Scheme) (F 1998).
- CSPP 500: Discrete Mathematics (Summer 1998).
- CS 101: Introduction to the World Wide Web (W 1998).
- CS 105: Fundamentals of Programming I (Scheme) (F 1997).
- MS 120: Mathematical Sciences (S 1997).

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Research Refereed Journal Publications

- Marcus Schaefer, Daniel Štefankovič. Fixed Points, Nash Equilibria, and the Existential Theory of the Reals, *Theory of Computing Systems*, online, November 2015.
- Timothy Chan, Fabrizio Frati, Carsten Gutwenger, Anna Lubiw, Petra Mutzel, Marcus Schaefer. Drawing Partially Embedded and Simultaneous Planar Graphs, Special Issue on *Graph Drawing 2014*, *Journal of Graph Algorithms and Applications*, 2015.
- Philipp Kindermann, Benjamin Niedermann, Ignaz Rutter, Marcus Schaefer, André Schulz and Alexander Wolff. Multi-Sided Boundary Labeling, *Algorithmica*, online, July 2015.
- Marcus Schaefer. The Graph Crossing Number and its Variants: A Survey, *Electronic Journal of Combinatorics*, Dynamic Survey 21, 100pp, 2014 (updated from original 2013 version).
- Marcus Schaefer, Toward a Theory of Planarity: Hanani-Tutte and Planarity Variants, Special Issue on *Graph Drawing 2012*, *Journal of Graph Algorithms and Applications*, 17(4), 367–440, 2013.
- Radoslav Fulek, Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Adjacent Crossings Do Matter, Special Issue on *Graph Drawing 2011*, *Journal of Graph Algorithms and Applications*, 16(3), pages 759–782, 2012.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Independently Even Crossings, *Siam Journal on Discrete Mathematics*, 24(2), 379–393, 2010.
- Iyad A. Kanj, Michael J. Pelsmajer, Marcus Schaefer, Ge Xia. On the Induced Matching Problem, *Journal of Computer and System Sciences*, 77 (6), 1058–1070, 2011.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Crossing Number of Graphs with Rotation Systems, *Algorithmica*, 60(3), 679–702, 2011.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Spiralling and Folding: The Word View, *Algorithmica*, 60(3), 609–626, 2011.
- Michael Pelsmajer, Marcus Schaefer, Despina Stasi. Strong Hanani-Tutte on the Projective Plane, *Siam Journal on Discrete Mathematics*, 23(3), 1317–1323, 2009.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Even Crossings on Surfaces, Special Issue on *Eurocomb '07*, *European Journal of Combinatorics*, 30(7), 1704–1717, 2009.
- Dániel Marx, Marcus Schaefer. The Complexity of Nonrepetitive Coloring. *Discrete Applied Mathematics*, 157, 13–18, 2009.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Odd Crossing Number and Crossing Number Are Not the Same. *Discrete and Computational Geometry*, 39(1–3), 442–454, 2008. *Reprinted as book chapter, see below.*
- Peter Hui, Michael J. Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Train Tracks and Confluent Drawings, Special Issue on *Graph Drawing (GD)*. *Algorithmica*, 47(4), 465–479, 2007.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Even Crossings, *Journal of Combinatorial Theory, Series B*, 97, 489–500, 2007.
- Martin Kummer, Marcus Schaefer. Cuppability of Simple and Hypersimple Sets, *Notre-Dame Journal of Formal Logic*, 48, 349–369, 2007.

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Research Refereed Journal Publications (continued)

- Marcus Schaefer, Daniel Štefankovič. Solvability of Graph Inequalities, *SIAM Journal on Discrete Mathematics*, 19, 728–743, 2005.
- Marcus Schaefer, Daniel Štefankovič. Decidability of String Graphs, Special Issue on *Symposium on the Theory of Computing 2001*, *Journal of Computer and System Sciences*, 68, 2, 319–334, 2004.
- Marcus Schaefer, Pradyut Shah. Induced Graph Ramsey Theory, *Ars Combinatoria*, 66, 3–21, 2003.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Recognizing String Graphs in NP, Special Issue on *Symposium on the Theory of Computing*, *Journal of Computer and System Sciences*, 67, 365–380, 2003.
- Stephen Fenner, Steven Homer, Randall Pruim, Marcus Schaefer. Hyper-Polynomial Hierarchies and the NP-Jump, *Theoretical Computer Science*, 241–256, 2001.
- Marcus Schaefer. Graph Ramsey Theory and the Polynomial Hierarchy, Special Issue on Computational Complexity, *Journal of Computer and System Sciences*, 62, 2, 290–322, 2001.
- Marcus Schaefer. Deciding the VC-dimension is Σ_3 -complete, *Journal of Computer and System Sciences*, 58, 177–182, 1999.
- Stephen Fenner, Marcus Schaefer. Bounded Immunity and Btt-Reductions, *Mathematical Logic Quarterly*, 45, 1, 3–21, 1999.
- Marcus Schaefer. A Guided Tour of Minimal Indices and Shortest Descriptions, *Archive for Mathematical Logic*, 37, 521–548, 1998.

Refereed Book Chapters

- Marcus Schaefer. Hanani-Tutte and related results. In *Geometry—Intuitive, Discrete, and Convex—A Tribute to László Fejes Tóth*, (I. Bárány, K. J. Böröczky, G. Fejes Tóth, J. Pach, Eds.), Bolyai Society Mathematical Studies, Springer, Budapest, 2013.
- Radoslav Fulek, Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Hanani-Tutte, Monotone Drawings, and Level-Planarity. In János Pach, editor, *Thirty Essays on Geometric Graph Theory*, pages 263–287. Springer, 2012.
- Marcus Schaefer. Realizability of Graphs and Linkages. In János Pach, editor, *Thirty Essays on Geometric Graph Theory*, pages 461–481. Springer, 2012.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Odd Crossing Number and Crossing Number Are Not the Same. In Jacob E. Goodman, János Pach, Richard Pollack, editors, *Twentieth Anniversary Volume*, Discrete & Computational Geometry, pages 440–452, Springer, 2009. *Reprint of earlier journal article.*

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Research Refereed Conference Publications

- Radoslav Fulek, Michael Pelsmajer, Marcus Schaefer. Hanani-Tutte for Radial Planarity, *Graph Drawing (GD 15)*, in *Lecture Notes in Computer Science*, Springer, 2015 (to appear).
- Marcus Schaefer, Daniel Štefankovič. The Degenerate Crossing Number and Higher-Genus Embeddings, *Graph Drawing (GD 15)*, in *Lecture Notes in Computer Science*, Springer, 2015 (to appear).
- Timothy Chan, Fabrizio Frati, Carsten Gutwenger, Anna Lubiw, Petra Mutzel, Marcus Schaefer. Drawing Partially Embedded and Simultaneous Planar Graphs, *Graph Drawing (GD 14)*, volume 8871 of *Lecture Notes in Computer Science*, 25-39, Springer, 2014.
- Eyal Ackerman, Marcus Schaefer. A crossing lemma for the pair-crossing number, *Graph Drawing (GD 14)*, volume 8871 of *Lecture Notes in Computer Science*, 222-233, Springer, 2014.
- Marcus Schaefer. Picking Planar Edges; or, Drawing a Graph with a Planar Subgraph, *Graph Drawing (GD 14)*, volume 8871 of *Lecture Notes in Computer Science*, 13-24, Springer, 2014.
- Carsten Gutwenger, Petra Mutzel, Marcus Schaefer. Practical Experience with Hanani-Tutte for Testing c-Planarity, *SIAM Meeting on Algorithm Engineering & Experiments (ALENEX)*, 86-97, SIAM, 2014.
- Marcus Schaefer, Daniel Štefankovič. Block Additivity of \mathbb{Z}_2 -Embeddings, *Graph Drawing (GD 13)*, volume 8242 of *Lecture Notes in Computer Science*, 185-195, Springer, 2013.
- Philipp Kindermann, Benjamin Niedermann, Ignaz Rutter, Marcus Schaefer, André Schulz and Alexander Wolff. Two-Sided Boundary Labeling with Adjacent Sides, *Algorithms and Data Structures Symposium (WADS)*, 463-474, 2013.
- Marcus Schaefer. Toward a Theory of Planarity: Hanani-Tutte and Planarity Variants, *Graph Drawing 2012*, volume 7704 of *Lecture Notes in Computer Science*, 162-173. Springer, 2013.
- Radoslav Fulek, Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Adjacent Crossings Do Matter, *Graph Drawing 2011*, volume 7034 of *Lecture Notes in Computer Science*, 343-354. Springer, 2012.
- Radoslav Fulek, Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Hanani-Tutte and monotone drawings, *Workshop on Graph-Theoretic Concepts in Computer Science (WG 2011)*, volume 6986 of *Lecture Notes in Computer Science*, 283-294. Springer, 2011.
- Marcus Schaefer. Complexity of Some Geometric Problems, *Graph Drawing 2009*, volume 5849 of *Lecture Notes in Computer Science*, 334-344. Springer, 2009.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Independently Even Crossings, *Graph Drawing 2009*, volume 5849 of *Lecture Notes in Computer Science*, 201-206. Springer, 2009.
- Iyad A. Kanj, Michael J. Pelsmajer, Marcus Schaefer, Ge Xia. On the Induced Matching Problem, *Symposium on Theoretical Aspects of Computer Science (STACS 2008)*, 397-408, 2008.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Computing Dehn Twists and Geometric Intersection Numbers in Polynomial Time, *Canadian Conference on Computational Geometry (CCCG 08)*, 111-114, 2008.

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Research Refereed Conference Publications (continued)

- Alejandro Estrella-Balderrama, Elisabeth Gassner, Michael Jünger, Merijam Percan, Marcus Schaefer and Michael Schulz. Simultaneous Geometric Graph Embeddings, *Graph Drawing (GD 07)*, 280–290, 2007.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Crossing Numbers and Parameterized Complexity, *Graph Drawing (GD 07)*, 31–36, 2007.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Folding and Spiraling: The Word View, *Eurocomb '07*, 101–105, 2007.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Spiraling and Folding: The Topological View, *Canadian Conference on Computational Geometry (CCCG 07)*, 73–76, 2007.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Even Crossings on Surfaces, *Eurocomb '07*, 85–90, 2007.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Crossing Number of Graphs with Rotation Systems, *Graph Drawing (GD 07)*, 3–12, 2007.
- Elisabeth Gassner, Michael Jünger, Merijam Percan, Marcus Schaefer, Michael Schulz. Simultaneous Graph Embeddings with Fixed Edges, *Workshop on Graph-Theoretic Concepts in Computer Science (WG 2006)*, 325–335, 2006.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Odd Crossing Number is Not Crossing Number, *Graph Drawing*, 386–396, 2005.
- Peter Hui, Michael J. Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Train Tracks and Confluent Drawings, *Graph Drawing 2004*, volume 3383 of *Lecture Notes in Computer Science*, 318–328, 2005.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Even Crossings, *Eurocomb '05*, 105–110, 2005.
- Peter Hui, Marcus Schaefer. Paired Pointset Traversal, *International Symposium on Algorithms and Computation (ISAAC)*, 534–544, 2004.
- Iyad Kanj, Michael Pelsmajer, Marcus Schaefer. Parameterized Algorithms for Feedback Vertex Set, *International Workshop on Parameterized and Exact Computation (IWPEC)*, 235–247, 2004.
- Marcus Schaefer, Frank Stephan. Strong Reductions and Immunity for Exponential Time, *Symposium on Theoretical Aspects of Computer Science (STACS 2003)*, 559–570, 2004.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Algorithms for normal curves and surfaces, *Computing & Combinatorics Conference (COCOON)*, 370–380, 2002.
- Marcus Schaefer. Deciding the K-Dimension is PSPACE-complete, *IEEE Conference on Computational Complexity*, 198–203, 2000.
- Marcus Schaefer. Graph Ramsey Theory and the Polynomial Hierarchy, joint session of *Symposium on the Theory of Computing (STOC)* and *IEEE Conference on Computational Complexity*, 592–601, 1999.
- Stephen Fenner, Steven Homer, Randall Pruim, Marcus Schaefer. Hyper-Polynomial Hierarchies and the NP-Jump, *IEEE Conference on Computational Complexity*, 102–110, 1997.
- Marcus Schaefer. Deciding the VC-dimension is Σ_3 -complete, *IEEE Conference on Computational Complexity*, 77–80, 1996.
- Martin Kummer, Marcus Schaefer. Computability of Convex Sets, *Symposium on Theoretical Aspects of Computer Science (STACS)*, 550–561, 1995.

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Research Book

Richard Johnsonbaugh, Marcus Schaefer. *Algorithms*, Prentice-Hall, 2004.

Work in Progress

Marcus Schaefer, Daniel Štefankovič. The Degenerate Crossing Number and Higher-Genus Embeddings.

Nonrefereed Publications

Marcus Schaefer. Some Unexpected(ly) Open Problems, *Midsummer Combinatorial Workshop 2009*, Prague, 2010.

Marcus Schaefer, Chris Umans. Completeness in the Polynomial-Time Hierarchy: Part II; *Sigact News*, December 2002.

Marcus Schaefer, Chris Umans. Completeness in the Polynomial-Time Hierarchy: A Compendium; *Sigact News*, September 2002.

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Research Technical Reports

- Marcus Schaefer. Picking Planar Edges, or Drawing a Graph with a Planar Subgraph. ArXiv report:1311.6839, November 2013.
- Marcus Schaefer. Complexity of Some Geometric Problems. DePaul University Technical Report, TR 08-009, 2008.
- Michael Pelsmajer, Marcus Schaefer, Despina Stasi. Strong Hanani-Tutte on the Projective Plane. DePaul University Technical Report, TR 08-003, 2008.
- Iyad Kanj, Michael Pelsmajer, Marcus Schaefer, Ge Xia. On the Induced Matching Problem. DePaul University Technical Report, TR 07-008, 2007.
- Dániel Marx, Marcus Schaefer. The Complexity of Nonrepetitive Coloring. DePaul University Technical Report, TR 07-007, 2007.
- Michael Pelsmajer, Marcus Schaefer, Kevin Stern. Δ_k -Confluent and O_k -confluent Graphs. DePaul University Technical Report, TR 07-004, 2007.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Removing Even Crossings on Surfaces, DePaul University Technical Report, TR-06-016, 2006.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Crossing Numbers and Parameterized Complexity. DePaul University Technical Report, TR 06-013, 2006.
- Marcus Schaefer, The Graph Sandwich Problem for a coNP property. DePaul University Technical Report, TR 06-011, 2006.
- Elisabeth Gassner, Michael Jünger, Merijam Percan, Marcus Schaefer, Michael Schulz. Simultaneous Graph Embeddings with Fixed Edges, Zaik Technical Report, zaik2006-507, 2006.
- Michael Pelsmajer, Marcus Schaefer, Daniel Štefankovič. Crossing Number of Graphs with Rotation Systems. DePaul University Technical Report, TR-05-017, 2005.
- Marcus Schaefer, Eric Sedgwick, Daniel Štefankovič. Computing Dehn Twists and Geometric Intersection Numbers in Polynomial Time. DePaul University Technical Report, TR-05-009, 2005.
- Peter Hui, Marcus Schaefer. Paired Pointset Traversal, DePaul University Technical Report, TR-04-001, 2004.
- Marcus Schaefer, Frank Stephan. Strong Reductions and Immunity for Exponential Time, DePaul University Technical Report TR-02-004, 2002.
- Marcus Schaefer. Completeness in the Polynomial Time Hierarchy, DePaul University Technical Report TR-01-009, 2001.
- Marcus Schaefer. Deciding the VC-dimension is Σ_3 -complete, II. DePaul University Technical Report TR-00-006, 2000.

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Research Talks

- Hanani-Tutte for Radial Planarity. Talk at Graph Drawing, Los Angeles, September 2015.
- The Degenerate Crossing Number and Higher-Genus Embeddings. Talk at Graph Drawing, Los Angeles, September 2015.
- The degenerate crossing number and Higher-Genus Embedding. AMS Sectional Meeting, Special Session on Crossing Numbers, Washington, February, 2015.
- $\exists\mathbb{R}$, or The Real Logic of Drawing Graphs. Invited Talk at the Oberwolfach meeting on Discrete Geometry, September, 2014.
- Block Additivity of \mathbb{Z}_2 -Embeddings, Bordeaux, France, September 2013.
- An Algorithm for simultaneous planarity? Canadam, St. John's Newfoundland, June 2013.
- Toward a Theory of Planarity. Universität Köln, December 2012.
- Toward a Theory of Planarity. Invited talk at the EuroGiga workshop, Berlin, October, 2012.
- Toward a Theory of Planarity. Talk at Graph Drawing, September 2012.
- Crossing Number. From Puzzles to Computer Science. Talk in CDM Research Colloquium (DePaul), September 2011.
- Removing Monotone Crossings, Canadam 2011, Special Session on Geometric Representations of Graphs, June 2011.
- Realizability of Graphs and Linkages, AMS Sectional Meeting, Special Session on Graphs and Hypergraphs, November 2010.
- The Real Logic of Drawing Graphs, Applied Math Colloquium, Illinois Institute of Technology, October 2010.
- Realizability of Graphs and Linkages, Conference on Geometric Graph Theory (invited), September 2010.
- Complexity of Some Geometric Problems, Graph Drawing, September, 2009.
- Hanani-Tutte and Related Results, Oberwolfach Seminar 0839 on Discrete Geometry (invited), September 2008.
- On the Induced Matching Problem, SIAM Conference on Discrete Mathematics (invited), June 2008.
- Folding and Spiraling: The Word View, Workshop on Algorithms, Combinatorics, and Geometry (invited), November 2007.
- Graphs with Rotation, Sectional meeting of the AMS (invited), October, 2007.
- Graphs with Rotation, Midwest Theory Day, April 2007.
- Removing Even Crossings, BIRS workshop on Topological Graph Theory and crossing numbers, October 2006 (invited talk, joint with Michael Pelsmajer).

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Research Talks (continued)

- Removing Even Crossings, SIAM Conference on Discrete Mathematics, July 2006 (invited talk).
- String Graphs and Related Problems, Universität Köln, December 2005.
- Removing Even Crossings, Midwest Theory Day, December 2005.
- Crossing Number versus Odd Crossing Number, University of Kentucky, Lexington, November 2005.
- Crossing Number versus Odd Crossing Number, Universität Köln, August 2005.
- The Complexity of String Graphs, Spring Western Section Meeting of the AMS (invited talk), April 2005.
- Recognizing String Graphs in NP (with Daniel Stefankovič), Midwest Theory Day at UIUC, December 2001.
- Graph Ramsey Theory and the Polynomial Hierarchy, Institute of Mathematical Sciences, Chennai, India, December 2000.
- A Guided Tour of Minimal Indices and Shortest Descriptions, Logic Colloquium, Prague, August 1998; ASL annual meeting, Toronto, May 1998.
- Computational Complexity and Graph Ramsey Theory, Midwest Theory Day at University of Kentucky, April 1998.
- Simplicity and Strong Reductions, Midwest Theory Day at Loyola University Chicago, December 1997.