

Ioannis Koutis

Education

PhD 2007 : Carnegie Mellon University, Pittsburgh.

Thesis: Combinatorial and algebraic tools for optimal multilevel algorithms; Advisor: Gary L. Miller.

BSc/Diploma 1998: Computer Engineering and Informatics Department, University of Patras.

Thesis: Parallel algorithms for the computation of pseudospectra; Advisor: Efstratios Gallopoulos.

Engineering School Valedictorian

Placed 2nd in 93-95, 1st in 95-98, 1st in graduation

Employment

2010-present: Assistant Professor, University of Puerto Rico-Rio Piedras, San Juan.

2008-2010: Systems Scientist, Special Faculty, Carnegie Mellon University, Pittsburgh.

2007-2008: Postdoctoral Researcher, Carnegie Mellon University, Pittsburgh.

Refereed Conference Publications

[15] I. Koutis, A. Levin, R. Peng, Improved spectral sparsification and numerical algorithms for SDD matrices, In: *Proceedings of the 29th Annual Symposium on Theoretical Aspects of Computer Science, STACS 2012*.

[14] I. Koutis, G. Miller, R. Peng, A nearly- $m \log n$ solver for SDD linear systems, In: *Proceedings of the 52nd Annual IEEE Symposium on Foundations of Computer Science, FOCS 2011*.

[13] G. Blelloch, I. Koutis, A. Gupta, G. Miller, R. Peng, K. Tangwongsan, Near linear-work parallel SDD solvers, low-diameter decomposition and low-stretch subgraphs, In: *Proceedings of the 23rd Annual Symposium on Parallelism in Algorithms and Architectures, SPAA 2011*

[12] I. Koutis, G. Miller, R. Peng, Approaching optimality for solving symmetric diagonally dominant systems, In: *Proceedings of the 51st Annual IEEE Symposium on Foundations of Computer Science, FOCS 2010*.

[11] G. Blelloch, I. Koutis, G. Miller, K. Tangwongsan, Hierarchical Diagonal Blocking with precision reduction applied to combinatorial multigrid, In: *Proceedings of the 23rd ACM/IEEE Conference on High Performance Computing, SC 2010*.

[10] C. Tsourakakis, P. Drineas, E. Michelakis, I. Koutis, C. Faloutsos, C. Tsourakakis, P. Drineas, E. Michelakis, I. Koutis, C. Faloutsos, Spectral Counting of Triangles via Element-Wise Sparsification and Triangle-based Link Recommendation, In: *Social Network Analysis and Mining, 2011*

[9] I. Koutis, G. Miller, D. Tolliver, Combinatorial preconditioners and multilevel solvers for problems in computer vision and image processing, 2009, In: *Proceedings of the 5th International Symposium on Visual Computing, ISVC 2009*.

[8] I. Koutis and R. Williams, Limitations and applications of group algebras for parameterized problems, In: *Proceedings of the 35th International Colloquium on Automata, Languages and Programming, ICALP 2009*.

- [7] C. Tsourakakis, P. Drineas, E. Michelakis, I. Koutis, C. Faloutsos, Spectral counting of triangles in power-law networks via element-wise sparsification, In: *Proceedings of the 2009 International Conference on Advances in Social Networks Analysis and Mining, ASONAM 2009*.
- [6] I. Koutis, Faster algebraic algorithms for path and packing problems. In: *Proceedings of the 35th International Colloquium on Automata, Languages and Programming, ICALP 2008*.
- [5] I. Koutis, G. Miller, Graph partitioning into isolated, high conductance clusters: theory, computation and applications to preconditioning. In: *Proceedings of the 20th Symposium on Parallelism in Algorithms and Architectures, SPAA 2008*.
- [4] D. Tolliver, I. Koutis, H. Ishikawa, J.S. Schuman, and G.L. Miller, Unassisted segmentation of multiple retinal layers via spectral rounding. In *the Association of Research in Vision and Ophthalmology, ARVO 2008 Annual Meeting*.
- [3] I. Koutis, G. L. Miller, A linear work, $O(n^{1/6})$ time, parallel algorithm for solving planar Laplacians. In: *Proceedings of the 18th ACM-SIAM Symposium on Discrete Algorithms, SODA 2007*.
- [2] I. Koutis, On the hardness of multivariate integration. In: *Proceedings of the 6th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, pp. 122-128, APPROX, 2003*.
- [1] C. Bekas, E. Kokiopoulou, I. Koutis and E. Gallopoulos, Parallel computation of matrix pseudospectra. In: *Proceedings of the 15th ACM International Conference On Supercomputing, ICS 2001, pp. 260-269*.

Journal Publications

- [4] I. Koutis, G. Miller, D. Tolliver, Combinatorial preconditioners and multilevel solvers for problems in computer vision and image processing, In: *Computer Vision and Image Understanding*, In press. (invited)
- [3] C. Tsourakakis, P. Drineas, E. Michelakis, I. Koutis, C. Faloutsos, Spectral counting of triangles in power-law networks via element-wise sparsification and triangle-based link recommendation, In: *Social Network Analysis and Mining* Vol. 1, No. 2, pp. 75–81, 2011.
- [2] I. Koutis, Parameterized complexity and improved inapproximability for computing the largest j -simplex in a V -polytope. In: *Information Processing Letters* 1, No. 1, pp. 8–13, 2006.
- [1] I. Koutis, A faster parameterized algorithm for set packing. In: *Information Processing Letters*, No. 1, pp. 4–7, 2005.

Other Publications and Preprints

- [4] Ioannis Koutis, An unconditional lower bound for integrating multivariate functions in the oracle model, 2010, *In Preparation*.
- [3] Ioannis Koutis, Dimensionality restrictions on sums over \mathbb{Z}_p^d , 2007, *CMU-CS-07-103 Technical Report*.
- [2] Ioannis Koutis, Spectrum through pseudospectrum, 2001, *Arxiv Report No 0701368*.
- [1] Ioannis Koutis and Efstratios Gallopoulos, Iterations on domains for computing the matrix pseudospectrum, 1999, *Manuscript*.

Patents

CMU patent filed: I. Koutis and G. L. Miller.
Title: *Method and apparatuses for solving weighted planar graphs.*

CMU provisional patent filed: I. Koutis and G. L. Miller.
Title: *Methods for solving graph Laplacians.*

Grants

2012-2017: “CAREER:Fast algorithms via a spectral theory for graphs with a prescribed cut structure (NSF)” [\$500K over 5 years]

2010-2013: co-PI in “Algorithm Design Using Spectral Graph Theory (NSF)” [\$500K over 3 years]

2010 :Work supported by Microsoft Research through the Computational Thinking Center at CMU

2008-2009: Co-investigator in the University of Pittsburgh Medical Center (UPMC) grant for the development of new medical imaging methods based on spectral approaches [\$700k over 2 years]

Awards and Honors

2007 SIAM student travel support for CSC07.

2002 SIAM student travel award.

1999 Best Engineering Student award from the Technical Chamber of Greece.

1993-1998 Yearly awards from the Greek State Scholarships Foundation.

Invited Talks

The power of group algebras in constrained monomial detection problems
Seminar on the Exact Complexity of NP-hard problems
Schloss Dagstuhl, November 10, 2010

Graph Sparsification p.2, An $O(m \log^2 n)$ algorithm for solving SDD systems
Microsoft Research, Redmont, September 2, 2010

Graph Sparsification p.1, The Combinatorial Multigrid Solver
Microsoft Research, Redmont, September 2, 2010

How to make a computer see better?
University of Puerto Rico, Rio Piedras, September 15, 2009

Fast detection of square-free terms in multivariate polynomials: one algo-stone, many algo-birds,
University of Puerto Rico, Rio Piedras, September 14, 2009

M-matrix systems and solvers in Computer Science,
University of Wyoming, March 30, 2009

Spectral Graph Theory meets Practice: The Combinatorial Multigrid Solver,
Yale University, January 23, 2009

Advances in the Theory and Computation of Pseudospectra,
Matrix Spectra and Pseudospectra Minisymposium, SIAM 50th Anniversary and Annual Meeting,
July 8-12, 2002, Philadelphia, PA.

Conference and Workshop Presentations

The Combinatorial Multigrid Solver, The 14th Copper Mountain Conference on Multigrid Methods, March 2009, [with Gary L. Miller]

A Linear Work, Parallel Algorithm for Solving Planar Laplacians, Combinatorial Scientific Computing (CSC07), Costa Mesa, California, February 2007, [with Gary L. Miller].

Efficiently Solving Linear systems using Support Tree Preconditioners, Parallel Processing for Scientific Computing (PP06), San Francisco, California, February 2006, [with Gary L. Miller].

Hermitian Methods for Computing Eigenvalues, 5th IMACS Conference on Iterative Methods in Scientific Computing, May 2001, [with E. Gallopoulos].

Iterations on Domains for the Computation of Matrix (Pseudo)-Spectrum, 2nd Conference on the Foundations of Computational Mathematics (FOCM), Oxford, July 1999, [with E. Gallopoulos].

Professional Service

Participation in NSF Panels (AF/CCF)

Referee for most major theoretical CS conferences (FOCS, SODA, SPAA, STACS, ESA, MFCS)

Referee for several journals (Algorithmica, ACM TALG, JCSS, IPL, SIMAX, APNUM)

Teaching Experience

Design and Analysis of Algorithms, UPRRP, Spring 2102

High Level Programming Languages, UPRRP, Spring 2012

Machine Learning, UPRRP, Fall 2011

Numerical Analysis, UPRRP, Spring 2011

Linear Algebra for Computer Scientists, UPRRP, Fall 2010,

Teaching Assistant, Principles of Programming, CMU, Spring 2002.

Teaching Assistant, Formal Languages Automata and Computation, CMU, Spring 2001.

Teaching Assistant, Advanced Scientific Computing, University of Patras, Fall 1999.

Languages

Greek - Native.

English - Very Fluent in Reading, Writing, Comprehension, Speaking.

French - Fluent in Reading and Comprehension. Writing and Speaking not practiced recently.