

Hristo N. Djidjev

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Research Interests

- *Combinatorial optimization*: graph algorithms, computational geometry, shortest paths
- *Parallel computing*: parallel combinatorial algorithms, load balancing, software-hardware co-design for HPC
- *Complex networks*: community structure detection, data mining, cybersecurity
- *Sensor networks*: coverage and placement optimization, quality of service (QoS)
- *Algorithm engineering*: implementation, tuning, and experimentation with combinatorial optimization algorithms

Professional Experience

- *Technical Staff Member*, Los Alamos National Lab, Los Alamos, 2005-current
- *Research Adjunct Professor*, Carleton University, Ottawa, 1990-current
- *Research Professor*, University of New Mexico, 2008–2011.
- *Senior Lecturer*, University of Warwick, 1998-2002
- *Assistant Professor and Research Scientist*, Rice University, 1992-1998
- *Research Associate and Senior Research Associate*, Institute of Mathematics, Bulgarian Academy of Sciences, 1986-1991

Education

- Ph. D. in Computer Science, Sofia University
- M. Sc. in Applied Mathematics, Sofia University

Professional Activities

- Member of the standing committee and editor of *Parallel Processing Letters*
- Editor of *Discrete Mathematics and Theoretical Computer Science*
- Chairman of the organizing committee of the international workshop on *Optimal Algorithms*
- Editor of vol. 401 of Lecture Notes of Computer Science
- Reviewer for *Algorithmica*, *SIAM Journal of Discrete Mathematics*, *SIAM Journal on Computing*, *Computational Geometry: Theory and Applications*, *Journal of Algorithms*, *Information and Computation*, *Information Processing Letters*, *Networks*, *Theoretical Computer Science*, EPSRC, National Science Foundation, and others

Funding and Awards

- Software/Hardware Mapping for Data Locality Optimization, 20130252ER, PI, LANL, 2012-2015.

- Optimization Principles for Co-Design Applied to Molecular Dynamics, 20120038DR, LANL, 2011-2014.
- Algorithmic Co-Design: Paradigms for Unstructured Problems on Accelerated Architectures, 20110195ER, LANL, co-PI, 2010-2013.
- Multi-Perspective Network-Scale Modeling and Detection for Cyber Systems, 20110093DR, LANL, 2010-2013.
- Ultra-Fast DFT-Quality Forces for Molecular Dynamics Simulations of Materials, 20100366ER, LANL, 2009-2012.
- ALCOLM-FT: IST Programme of the EU under contract number IST-1999-14186 *Algorithms and complexity - future technologies*, member of the University of Warwick team, 2000-2003
- EPSRC Award GR/M60750: *Algorithms and tools for graph partitioning*, PI, 1999–2002.
- RTDF Award 98/99-0140 *Algorithms and tools for web searching*, PI, 1999–2001.
- EPA Award R82-5207-010: *Partitioning algorithms and their application to massively parallel computations of multiphase fluid flows in porous media*, PI, 1996–2000.
- NSF Award CCR-9409181 *RIA: Efficient algorithms for special classes of graphs*, PI, 1994–1997.
- First Prizes at the 1983 and 1984 Annual National Review of the Scientific and Technical Achievements of Young Researchers, Bulgaria.
- First Prize at the International Competition for Young Researchers in Mathematics from Balkan Nations, Pitesti, Romania, September 1982.

Journal and Refereed Conference Papers

- H. Djidjev, M. Onus. Using Graph Partitioning for Efficient Network Modularity Optimization, in *Graph Partitioning and Graph Clustering*, Contemporary Mathematics, AMS, 2013 (in print).
- Hristo N. Djidjev, Melih Onus, Scalable and Accurate Graph Clustering and Community Structure Detection, *IEEE Transactions on Parallel and Distributed Systems*, vol 99, no. preprint, 2012.
- Hristo Djidjev, Imrich Vrt'no: Planar Crossing Numbers of Graphs of Bounded Genus. *Discrete & Computational Geometry* 48(2): 393-415 (2012).
- Hristo Djidjev, Miodrag Potkonjak, Coverage Problems in Sensor Networks, a chapter in *Intelligent Sensor Networks: Across Sensing, Signal Processing, and Machine Learning*, CRC Press, 2012.
- Hristo Djidjev, Christian Sommer, Approximate Distance Queries for Weighted Polyhedral Surfaces, European Symposium on Algorithms (ESA), *Lecture Notes in Computer Science*, vol. 6942, pp. 579–590, 2011.
- Hristo Djidjev, Gary Sandine, Curtis Storlie, Scott Vander Wiel. Graph Based Statistical Analysis of Network Traffic, Workshop on *Mining and Learning with Graphs* (MLG), San Diego, August 2011.
- Hristo N. Djidjev. 2010. A faster algorithm for computing the girth of planar and bounded genus graphs. *ACM Trans. Algorithms* 7, 1, pp. 1–16, 2010.
- L. Aleksandrov, H. Djidjev, H. Guo, A. Maheswari, D. Nussbaum, J. Sack, Algorithms for Approximate Shortest Path Queries on Weighted Polyhedral Surfaces” *Discrete and Computational Geometry*, Volume 44, Number 4, pp. 762-801, 2010.
- Hristo Djidjev. Approximation algorithms for computing minimum exposure paths in a sensor field. *ACM Transactions of Sensor Networks*, vol. 7, no. 3, pp. 1-23, 2010.

- Hristo Djidjev. A Scalable Multilevel Algorithm for Graph Clustering and Community Structure Detection. Workshop on Algorithms and Models for the Web Graph, in *Lecture Notes in Computer Science*, vol. 4936, pp. 117–128, 2007.
- Hristo Djidjev. Efficient computation of minimum exposure paths in a sensor network field. Hristo Djidjev. Proc. IEEE International Conference on Distributed Computing in Sensor Networks (DCOSS), *Lecture Notes in Computer Science* vol. 4549, 2007.
- Hristo Djidjev. A Linear Algorithm for the Maximal Planar Subgraph Problem. *SIAM Journal on Discrete Mathematics*, 20:2, pp 444–462, 2006.
- Lyudmil Aleksandrov, Hristo Djidjev, Hua Guo and Anil Maheshwari. Partitioning Planar Graphs with Costs and Weights. *ACM Journal of Experimental Algorithmics*, art. 1.5, 2006.
- Hristo Djidjev and Imrich Vrto. Planar Crossing Numbers of Genus-g Graphs. Proc. of International Colloquium on Automata, Languages, and Programming (ICALP), *Lecture Notes in Computer Science*, vol. 4051, pp. 419 - 430, 2006.
- L. Aleksandrov, H. Djidjev, H. Guo, A. Maheshwari, D. Nussbaum and J.-R. Sack. Approximate Shortest Path Queries on Weighted Polyhedral Surfaces. Proc. of Mathematical Foundations of Computer Science (MFCS), *Lecture Notes in Computer Science* vol. 4162, pp. 98-109, 2006.
- Hristo Djidjev, Imrich Vrto, Crossing Numbers and Cutwidths, *J. Graph Algorithms and Applications*, vol. 7, no. 3, pp. 245–251, 2003.
- Lyudmil Aleksandrov, Hristo Djidjev, Hua Guo and Anil Maheshwari, Partitioning planar graphs with costs and weights, *Proc. of 2nd Workshop on Algorithm Engineering and Experiments (ALENEX)*, San Francisco, 2002.
- H. Djidjev, I. Vrto, An Improved Lower Bound for Crossing Numbers, *Proc. 9th Intl. Symp. on Graph Drawing*, Lecture Notes in Computer Science 2265, Springer Verlag, Berlin, 2002, pp. 95–101.
- H. Djidjev, Finding shortest cycles in networks of bounded genus, *International Workshop on Interconnection Networks (IWIN'01)*, Vall de Nuria, 2001.
- H. Djidjev, M. Joy, A. Twigg, Collecting and Classifying Information from the WWW, *Proceedings of SSGRR'01* (invited), Rome, 2001.
- H. Djidjev, Computing the girth of a planar graph, International Colloquium on Automata, Languages and Programming (ICALP'00), *Lecture Notes in Computer Science*, vol. 1853, 2000, pp. 821–831.
- H. Djidjev, Partitioning planar graphs with vertex costs: algorithms and applications, *Algorithmica*, vol. 28 (2000), pp. 51–75.
- L. Alexandrov, H. N. Djidjev, J.-R. Sack, Finding a shortest central link segment of a simple polygon in $O(n \log n)$ time, *International Journal of Computational Geometry and Applications*, vol. 10, no. 2, 2000, pp. 157-188.
- L. Aleksandrov and H. Djidjev, A Dynamic Algorithm for Maintaining Graph Partitions, Scandinavian Workshop on Algorithm Theory (SWAT'00), *Lecture Notes in Computer Science*, vol. 1851, 2000, pp. 71–82.
- H. Djidjev, G. Pantziou and C. Zaroliagis, Improved Algorithms for Dynamic Shortest Paths, *Algorithmica*, vol. 28:4, 2000, pp. 367–389.
- H. Djidjev, Force-directed methods for smoothing unstructured triangular and tetrahedral meshes, *Proceedings of the 9th International Meshing Roundtable*, October 2-5, 2000, New Orleans, pp. 395–406.
- H. Djidjev, Force-directed methods for mesh improvement, *Proc. of 2nd Workshop on Algorithm Engineering and Experiments (ALENEX 00)*, 2000, pp. 29–42.

- H. N. Djidjev, J.R. Gilbert, Separators in graphs with negative or multiple vertex weights, *Algorithmica*, vol. 23 (1999), pp. 57–71.
- L.G. Aleksandrov, H.N. Djidjev, Maintaining Partitions of Dynamic Planar Meshes, *Proceedings of the Canadian Conference on Computational Geometry (CCCG'98)*, 1998, pp. 84–85.
- H. N. Djidjev, S. M. Venkatesan, Reduced constants for simple cycle graph separation, *Acta Informatica*, vol. 34 (1998), pp. 231–243.
- H. N. Djidjev, Weighted graph separators and their application, European Symposium on Algorithms (ESA'97), *Lecture Notes in Computer Science*, 1997, vol. 1284, pp. 130–143.
- H. N. Djidjev, Efficient Algorithms for Shortest Path Queries in Planar Digraphs, in Proc. 22nd Workshop on Graph-Theoretic Concepts in Computer Science (WG '96), *Lecture Notes in Computer Science*, Springer-Verlag, 1996, pp. 151–165.
- L. Aleksandrov and H. Djidjev. Linear Algorithms for Partitioning Embedded Graphs of Bounded Genus. *SIAM Journal of Discrete Mathematics*, vol. 9 (1996), pp. 129–150.
- H. Djidjev, A Linear Algorithm for the Maximal Planar Subgraph Problem, in Proceedings of WADS'95, *Lecture Notes in Computer Science*, vol. 955, pp. 369-380, Springer-Verlag, 1995.
- H. Djidjev, G. Pantziou and C. Zaroliagis, Fast Algorithms for Maintaining Shortest Paths in Outerplanar and Planar Digraphs, Proc. 10th Conf. on Fundamentals of Computation Theory (FCT'95), *Lecture Notes in Computer Science*, vol. 965, pp.191-200, Springer-Verlag, 1995.
- H. N. Djidjev, S. M. Venkatesan, Planarization of graphs embedded on surfaces, in Proc. 21st Workshop on Graph-Theoretic Concepts in Computer Science (WG '95), *Lecture Notes in Computer Science*, vol. 1017, pp. 62–72, Springer-Verlag, 1995.
- H. Djidjev, G. Pantziou, and C. Zaroliagis, On-line and dynamic algorithms for shortest path problems, in *Proc. 12th Symposium on Theoretical Aspects of Computer Science (STACS'95)*, LNCS 900, pp.193-204, Springer-Verlag, 1995.
- H. N. Djidjev, A. Lingas, On computing Voronoi diagrams for sorted point sets, *International Journal of Computational Geometry*, vol. 5 (1995), pp. 327–337.
- H. N. Djidjev, On drawing a graph convexly in the plane, Graph Drawing '94, DIMACS International Workshop, in *Lecture Notes in Computer Science*, vol. 894, Springer-Verlag, 1995, pp. 76-83.
- H. N. Djidjev, K. Diks, O. Sykora, I. Vrto, Edge separators for planar graphs and their applications, *Journal of Algorithms*, vol. 14 (1993), pp. 258-279.
- P. Vassilevsky, H. N. Djidjev, Incomplete block preconditioners for solving elliptic differential equations on systolic processors, *International Journal of Computer Mathematics*, vol. 44 (1992), 341.
- H. N. Djidjev, A. Lingas, and J.-R. Sack, An $O(n \log n)$ algorithm for computing the link center of a simple polygon, *Discrete and Computational Geometry*, vol. 8 (1992), pp. 131-152.
- H.N. Djidjev, J. Reif, An efficient algorithm for the genus problem with explicit construction of forbidden subgraphs, *Proc. Annual ACM Symposium on Theory of Computing (STOC) (1991)*, pp.337-347.
- H. Djidjev, A. Lingas, On computing the Voronoi diagram for restricted planar figures, WADS'91, in *Lecture Notes in Computer Science*, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo (1991), pp. 54-64.
- H. Djidjev, O. Garido, C. Levcopoulos, and A. Lingas, On the maximum q -dependent set problem, *International Conference for Young Computer Scientists ICYCS'91*, pp. 271-274.
- H.N. Djidjev, G.E. Pantziou, C.D. Zaroliagis, Computing shortest paths and distances in planar graphs, ICALP'91, in *Lecture Notes in Computer Science*, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo (1991), v.510, 327-338.

- L. Aleksandrov, H. N. Djidjev, Improved upper and lower bounds on separation of toroidal graphs, Proc. Optimal algorithms'89, in *Lecture Notes in Computer Science*, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo (1989), vol.401, 126-138.
- N. Djidjev, A. Lingas, and J.-R. Sack, An $O(n \log n)$ algorithm for computing a link center in a simple polygon, Proc. STACS '89, in *Lecture Notes in Computer Science*, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo (1989), vol. 349, 96-107.
- H. N. Djidjev, Design and analysis of systolic implementations, *J. of New Generation Computing Systems*, vol. 1 (1988), 1, 7-20.
- H. N. Djidjev, Linear algorithms for graph separation problems, SWAT'88, *Lecture Notes in Computer Science*, vol. 318, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo, 216-221 (1988).
- K. Diks, H. N. Djidjev, O. Sykora, I. Vrto, Edge separators for planar graphs and their applications, MFCS'88, *Lecture Notes in Computer Science*, vol. 324, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo, 280-290 (1988).
- L. Aleksandrov, H. N. Djidjev, Solving symmetric positive definite systems of linear equations on a systolic processor, Proc. IFIP Working Conference on Parallel Processing, in *Parallel Processing*, M. Cosnard, M.H.Barton and M. Vaneschi (Eds.), Elsevier Science Publishers (North Holland) (1988).
- H. N. Djidjev, VLSI algorithms for combinatorial problems, in *Information Processing'86*, North-Holland, 649-654 (1986).
- H. N. Djidjev, Parallel graph algorithms for the shared memory model, in *Optimal Algorithms*, Sofia, 82-96 (1986).
- H. N. Djidjev, On the synthesis of systolic structures, in G. L. Reijns, M. H. Barton (eds.), *Highly Parallel Computers*, North-Holland, 157-174 (1986).

Books and Book Chapters

- A. Maheshwari, J.R. Sack, and H. Djidjev, Link Distance Problems, Chapter in *Handbook on Computational Geometry*, Elsevier, 2000, pp. 519–558.
- V. Aleksandrov, R. Andonov, H. N. Djidjev, V. Josifov, and C.Ostromski, *Mathematical Aspects of VLSI Design*, Sofia, 1989 (in Bulgarian).
- A. Andreev, H. N. Djidjev, Bl. Sendov, N. Yanev, *Survey on Parallel Computing*, Sofia, 1986 (in Bulgarian).
- R. Lazarov, K. Bojanov, H. N. Djidjev, P. Vassilevsky, L. Aleksandrov, *New Generations High Performance Computing Systems*, Sofia, 1986 (in Bulgarian).