

Edgar Solomonik

POSITION	Assistant Professor , University of Illinois at Urbana-Champaign
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RESEARCH INTERESTS	The research area of communication complexity is a unifying triangle of high performance computing, numerical linear algebra, and theoretical computer science. Quantification of data movement and synchronization costs improves understanding of the efficiency and scalability of algorithms. My work seeks new methods and better software libraries for (sparse) tensor computations as well as combinatorial problems such as sorting. My favorite application domain is quantum chemistry.
EDUCATION	Ph.D. University of California, Berkeley August 2010 – August 2014 Computer Science Adviser: James W. Demmel, Committee: Katherine Yelick, Martin Head-Gordon Dissertation: <i>Provably efficient algorithms for numerical tensor algebra</i> B.S. University of Illinois at Urbana-Champaign August 2008 – May 2010 Computer Science, Adviser: Laxmikant V. Kale
FELLOWSHIPS	ETH Zurich Postdoctoral Fellowship, 2014-2016 Department of Energy Computational Science Graduate Fellowship (DOE CSGF), 2010-2014 ACM/IEEE-CS George Michael Memorial High Performance Computing Fellowship, 2013 NSF Graduate Fellowship Honorable Mention, 2010
AWARDS	Alston S. Householder Prize XX, 2017 Berkeley EECS Department David J. Sakrison Memorial Prize, 2014 NERSC Award for Innovative Use of High Performance Computing, 2013 Distinguished Paper Award, Euro-Par, 2011 Finalist for CRA Outstanding Undergraduate Research Award, 2010 University of Illinois CS Department Best Undergraduate Research Project Award, 2009
TEACHING	<i>CS 554 / CSE 512: Parallel Numerical Algorithms</i> , Instructor, UIUC, Fall 2017 <i>CS 357: Numerical Methods</i> , Instructor (Section N), UIUC, Spring 2017 <i>CS 598: Communication Cost Analysis of Algorithms</i> , Instructor, UIUC, Fall 2016 <i>CS 263-2800: Design of Parallel and High-Performance Computing</i> , guest lecturer for instructors Torsten Hoefer and Markus Püschel, ETH Zurich, Fall 2014 and Fall 2015 <i>CS 170: Efficient Algorithms and Intractable Problems</i> , co-head TA for instructor Satish Rao, UC Berkeley, Spring 2013
ADVISING	Tobias Wicky (2015 BS, 2017 MS), Edward Hutter (2017 BS)
PRESENTATIONS	60+ research talks since 2010, see <i>webpage</i> for all slides

SERVICE

Organizing committees: ARRAY 2017
Program committees: SPAA 2018, IPDPS 2018, GABB 2017, PACT 2017
Departmental committees: advisory (2016-2018), awards (2016-2018)

PUBLICATIONS

1. [arXiv] Edward Hutter and Edgar Solomonik. *Communication-avoiding Cholesky-QR2 for rectangular matrices*. arXiv:1710.08471 [cs.DC], October 2017.
2. [arXiv] Edwin Pednault, John A. Gunnels, Giacomo Nannicini, Lior Horesh, Thomas Magerlein, Edgar Solomonik, and Robert Wisnieff. *Breaking the 49-qubit barrier in the simulation of quantum circuits*. arXiv:1710.05867 [quant-ph], October 2017.
3. [SC] Edgar Solomonik, Maciej Besta, Flavio Vella, and Torsten Hoefler. *Scaling betweenness centrality using communication-efficient sparse matrix multiplication*. ACM/IEEE Supercomputing Conference, Denver, Colorado, 2017 (to appear).
4. [arXiv] Edgar Solomonik, James Demmel, and Torsten Hoefler. *Communication lower bounds of bilinear algorithms for symmetric tensor contractions*. arXiv:1707.04618 [cs.DC], July 2017.
5. [SPAA] Edgar Solomonik, Grey Ballard, James Demmel, and Torsten Hoefler. *A communication-avoiding parallel algorithm for the symmetric eigenvalue problem*. ACM Symposium on Parallelism in Algorithms and Architectures, 2017.
6. [HPDC] Maciej Besta, Michal Podstawski, Linus Groner, Edgar Solomonik, and Torsten Hoefler. *To push or to pull: on reducing communication and synchronization in graph computations*. 26th ACM Symposium on High Performance Parallel and Distributed Computing, Washington DC, 2017.
7. [IPDPS] Tobias Wicky, Edgar Solomonik, and Torsten Hoefler. *Communication-avoiding parallel algorithms for solving triangular systems of linear equations*. IEEE International Parallel and Distributed Processing Symposium, 2017 (to appear).
8. [IPDPS] Maciej Besta, Florian Marending, Edgar Solomonik and Torsten Hoefler. *SlimSell: A vectorizable graph representation for breadth-first search*. IEEE International Parallel and Distributed Processing Symposium, 2017 (to appear).
9. [TOPC] Edgar Solomonik, Erin Carson, Nicholas Knight, and James Demmel. *Tradeoffs between synchronization, communication, and computation in parallel linear algebra computations*. ACM Transactions on Parallel Computing, 2016.
- 10.[arXiv] Edgar Solomonik and Torsten Hoefler. *Sparse tensor algebra as a parallel programming model*. arXiv:1512.00066 [cs.MS], 2015.
- 11.[ETH] Edgar Solomonik, James Demmel, and Torsten Hoefler. *Communication lower bounds for tensor contraction algorithms*. Technical Report, ETH Zurich, 2015.
- 12.[ETH] Edgar Solomonik and James Demmel. *Contracting symmetric tensors using fewer multiplications*. Technical Report, ETH Zurich, 2015.
- 13.[JPDC] Edgar Solomonik, Devin Matthews, Jeff Hammond, James Demmel, and John F Stanton. *A massively parallel tensor contraction framework for coupled-cluster computations*. Journal of Parallel and Distributed Computing, 2014.
- 14.[SPAA] Edgar Solomonik, Erin Carson, Nicholas Knight, and James Demmel. *Tradeoffs between synchronization, communication, and work in parallel linear algebra computations*. ACM Symposium on Parallelism in Algorithms and Architectures, 2014.
- 15.[IPDPS] Grey Ballard, James Demmel, Laura Grigori, Mathias Jacquelin, Hong Diep Nguyen, and Edgar Solomonik. *Reconstructing Householder vectors from Tall-Skinny QR*. IEEE International Parallel and Distributed Processing Symposium, 2014.

- 16.[IPDPS] Edgar Solomonik, Devin Matthews, Jeff Hammond, and James Demmel. *Cyclops Tensor Framework: reducing communication and eliminating load imbalance in massively parallel contractions*. IEEE International Parallel and Distributed Processing Symposium, 2013.
- 17.[IPDPS] Edgar Solomonik, Aydin Buluc, and James Demmel. *Minimizing communication in all-pairs shortest-paths*. IEEE International Parallel and Distributed Processing Symposium, 2013.
- 18.[IPDPS] Michael Driscoll, Evangelos Georganas, Penporn Koanantakool, Edgar Solomonik, and Katherine Yelick. *A communication-optimal n-body algorithm for direct interactions*. IEEE International Parallel and Distributed Processing Symposium, 2013.
- 19.[VECPAR] Edgar Solomonik and James Demmel. *Matrix multiplication on multidimensional torus networks*. Lecture Notes in Computer Science. Springer Berlin Heidelberg, 2013.
- 20.[SC] Evangelos Georganas, Jorge Gonzalez-Dominguez, Edgar Solomonik, Yili Zheng, Juan Tourino and Katherine Yelick. *Communication avoiding and overlapping for numerical linear algebra*. ACM/IEEE Supercomputing Conference, 2012.
- 21.[UCB] Edgar Solomonik, Jeff Hammond, and James Demmel. *A preliminary analysis of Cyclops Tensor Framework*. Technical Report, University of California, Berkeley, 2012.
- 22.[SC] Edgar Solomonik, Abhinav Bhatele, and James Demmel. *Improving communication performance in dense linear algebra via topology aware collectives*. ACM/IEEE Supercomputing Conference, 2011.
- 23.[Euro-Par] Edgar Solomonik and James Demmel. *Communication-optimal parallel 2.5D matrix multiplication and LU factorization algorithms*. Lecture Notes in Computer Science, Euro-Par, 2011.
- 24.[Enc. Par. Comp.] Laxmikant Kale and Edgar Solomonik. *Parallel sorting*. Encyclopedia of Parallel Computing, Springer, David Padua, Ed., 2011.
- 25.[IJHPCA] Abhinav Bhatele, Lukasz Wesolowski, Eric Bohm, Edgar Solomonik, and Laxmikant V. Kale. *Understanding application performance via micro-benchmarks on three large supercomputers: Intrepid, Ranger and Jaguar*. International Journal of High Performance Computing Applications, 2010.
- 26.[IPDPS] Edgar Solomonik and Laxmikant V. Kale. *Highly scalable parallel sorting*. IEEE International Parallel and Distributed Processing Symposium, 2010.
- 27.[ParaPLOP] Vivek Kale and Edgar Solomonik. *Parallel sorting pattern*. Workshop on Parallel Programming Patterns, 2010.