

# Curriculum Vitae

## SINAN G. AKSOY

Office Address:	Pacific Northwest National Laboratory	Email:	sinanaksoy90@gmail.com
	PO Box 999	Website:	<a href="http://www.sinanaksoy.com">www.sinanaksoy.com</a>
	MSIN: K7-28	Phone:	509-375-2564
	Richland, WA 99352	Citizenship:	United States

### Research Interests

Applied combinatorics and network science, spectral and extremal graph theory, stochastic processes on graphs, mathematics of data science.

### Education

- 2014 – 2017    **Ph.D., Mathematics**, University of California, San Diego.  
                  Advisor: Fan Chung Graham
- 2012 – 2014    **M.A., Applied Mathematics**, University of California, San Diego.
- 2008 – 2012    **B.A., Mathematics, B.A., Economics** University of Chicago.  
                  *General Honors*

### Professional Experience

- 2017 –            **Data Scientist**, Pacific Northwest National Laboratory
- 2016 Sum.       **Intern**, Pacific Northwest National Laboratory.
- 2015 Fall        **Visiting Scholar**, National Taiwan University, Mathematics Division NCTS.
- 2015 Sum.       **Intern**, Sandia National Laboratories, Livermore.

### Journal Articles

- 2020 13. S. Aksoy, E. Purvine, S. Young, *Directional Laplacian centrality for cyber situational awareness*, submitted.
12. S. Aksoy, M. Kempton, S. Young, *Spectral threshold for extremal cyclic edge-connectivity*, submitted, [arXiv:2003.02393](https://arxiv.org/abs/2003.02393)
11. S. Aksoy, C. Joslyn, C. Ortiz-Marrero, B. Praggastis, E. Purvine, *Hypernetwork science via high-order walks*, EPJ Data Science, **9**(16), 2020, DOI: [10.1140/epjds/s13688-020-00231-0](https://doi.org/10.1140/epjds/s13688-020-00231-0)
10. S. Aksoy, P. Bruillard, S. Young, M. Raugas, *Ramanujan graphs and the spectral gap of supercomputing topologies*, Journal of Supercomputing, DOI: [10.1007/s11227-020-03291-1](https://doi.org/10.1007/s11227-020-03291-1)
- 2019 9. S. Aksoy, K. Nowak, E. Purvine, S. Young, *Relative Hausdorff distance for network analysis*, Applied Network Science, **4**(80), 2019, DOI: [10.1007/s41109-019-0198-0](https://doi.org/10.1007/s41109-019-0198-0)
8. S. Aksoy, K. Nowak, S. Young, *A linear-time algorithm and analysis of graph Relative Hausdorff distance*, SIAM J. Mathematics of Data Science, **1**(4):647–666, 2019, DOI: [10.1137/19M1248224](https://doi.org/10.1137/19M1248224)
- 2018 7. S. Aksoy, F. Chung, M. Tait, J. Tobin, *The maximum relaxation time of a random walk*, Advances in Applied Mathematics, **101**:1–14, 2018, DOI: [10.1016/j.aam.2018.07.002](https://doi.org/10.1016/j.aam.2018.07.002)
6. S. Aksoy, E. Purvine, E. Cotilla-Sanchez, M. Halappanavar, *A generative graph model for electrical infrastructure networks*, Journal of Complex Networks, **7**(1):128–162, DOI: [10.1093/com-net/cny016](https://doi.org/10.1093/com-net/cny016)
- 2017 5. S. Aksoy, T. G. Kolda, A. Pinar, *Measuring and modeling bipartite graphs with community structure*, Journal of Complex Networks, **5**(4):581–603, 2017, DOI: [10.1093/comnet/cnx001](https://doi.org/10.1093/comnet/cnx001)
- 2016 4. S. Aksoy, F. Chung, X. Peng, *Extreme values of the stationary distribution of random walks on directed graphs*, Advances in Applied Mathematics, **81**:128–155, 2016, DOI: [10.1016/j.aam.2016.06.012](https://doi.org/10.1016/j.aam.2016.06.012)

3. S. Aksoy, P. Horn, *Graphs with many strong orientations*, SIAM J. Discrete Math., **30**(2):1269–1282, 2016, DOI: [10.1137/15M1018885](https://doi.org/10.1137/15M1018885)
- 2015 2. S. Aksoy, A. Azzam, C. Coppersmith, J. Glass, G. Karaali, X. Zhao, X. Zhu, *Coalitions and cliques in the school choice problem*, Involve, **8**(5):801–823, 2015, DOI: [10.2140/involve.2015.8.801](https://doi.org/10.2140/involve.2015.8.801)
- 2012 1. S. Aksoy, S. Nelson, *Bikei, involutory biracks, and unoriented link invariants*, Journal of Knot Theory and Its Ramifications, **21**(6):13 pp., 2012, DOI: [10.1142/S0218216511009972](https://doi.org/10.1142/S0218216511009972)

### Refereed Conference & Workshop Proceedings

- 2020 7. K. Hayashi, S. Aksoy, C. Park, H. Park, *Hypergraph random walks, Laplacians, and clustering*, submitted.
6. C. Joslyn, S. Aksoy, D. Arendt, L. Jenkins, B. Praggastis, E. Purvine, M. Zalewski, *Hypergraph Analytics of Domain Name System Relationships*, to appear, Workshop on Algorithms and Models for the Web Graph 2020.
5. C. Joslyn, S. Aksoy, T. Callahan, L. Hunter, B. Jefferson, B. Praggastis, E. Purvine, I. Tripodi, *Hypernetwork Science: From Multidimensional Networks to Computational Topology*, to appear, International Conference on Computational Science 2020.
4. X. Fan, S. Aksoy, D. Wang, Q. Huang, J.P. Ogle, A. Tbaileh, R. Huang, *Automated Realistic Testbed Synthesis for Power System Communication Networks based on Graph Metrics*, 2020 IEEE Conference on Innovative Smart Grid Technologies North America, DOI: [10.1109/ISGT45199.2020.9087672](https://doi.org/10.1109/ISGT45199.2020.9087672)
- 2018 3. L. Jenkins, T. Bhuiyan, S. Harun, C. Lightsey, D. Mentgen, S. Aksoy, T. Stavenger, M. Zalewski, H. Medal, C. Joslyn, *Chapel HyperGraph Library (CHGL)*, 2018 IEEE High Performance Extreme Computing Conference (HPEC 18), DOI: [10.1109/HPEC.2018.8547520](https://doi.org/10.1109/HPEC.2018.8547520)
2. E. Purvine, S. Aksoy, C. Joslyn, K. Nowak, B. Praggastis, M. Robinson, *A topological approach to representational data models*, In International Conference on Human Interface and the Management of Information, pp. 90–109. Springer, Cham, DOI: [10.1007/978-3-319-92043-6\\_8](https://doi.org/10.1007/978-3-319-92043-6_8)
- 2012 1. S. Aksoy, A. Azzam, C. Coppersmith, J. Glass, G. Karaali, X. Zhao, X. Zhu, *School Choice as a One-Sided Matching Problem: Cardinal Utilities and Optimization*, 2012 International Symposium on Artificial Intelligence, [arXiv:1304.7413](https://arxiv.org/abs/1304.7413)

### Technical Reports

- 2020 3. S. Aksoy, J. Taft, *Connectivity, Centrality, and Bottleneckedness: On Graph Theoretic Methods for Power Systems*, Tech. Rep. PNNL-29662, [PDF](#)
- 2019 2. X. Fan, S. Aksoy, Q. Huang, J.P. Ogle, D. Wang, A. Tbaileh, and T. Fu, *Coordination of Transmission, Distribution and Communication Systems for Prompt Power System Recovery after Disasters Report*, Tech. Rep. PNNL-28598, [PDF](#)
1. Q. Huang, A. Tbaileh, S. Sharma, Q. Li, S. Aksoy, X. Fan, and R. Huang, *Mechanisms and data needed for coordinating restoration*, PNNL Tech. Rep. PNNL-28387

### Software

- [Chapel Hypergraph Library](#) (Chapel) – Large-scale hypergraph generation and analysis.
- [HyperNetX](#) (Python) – Hypergraph visualization and exploratory data analytics.
- [Transactive Energy Simulation Platform](#) (Python) – Valuation and simulation of energy market mechanisms and participants.

## Talks

- 2019 Sep. **AMS Fall Central Sectional** (Session on Combinatorics, Functions and Logic)  
*The maximum relaxation time of a random walk*
- 2018 Jan. **AMS Joint Math Meetings** (Special Session: Applied and Computational Combinatorics)  
 Invited Talk: *A generative graph model for electrical infrastructure networks.*
- 2017 June **UC San Diego** (Final Defense)  
*Random walks on directed graphs and orientations of graphs.*
- Apr. **AMS Sectional**, Washington State University (Clustering of Graphs: Theory & Practice)  
 Invited Talk: *Measuring and modeling bipartite graphs with community structure.*
- 2016 Nov. **Purdue University** (Geometry Seminar)  
 Invited Talk: *Problems in the spectral theory of directed and oriented graphs.*
- Oct. **AMS Fall Sectional**, University of Denver (Analysis on Graphs & Spectral Graph Theory)  
 Invited Talk: *Extreme values of the stationary distribution of random walks on directed graphs.*
- Aug. **Pacific Northwest National Laboratory** (NSIP Symposium)  
*A generative graph model for the power-grid.*
- June **UC San Diego** (Stochastic Networks Conference: Short Talk & Poster Session)  
*Extreme values of the stationary distribution of random walks on directed graphs.*
- Feb. **Claremont Colleges** (Algebra, Number Theory, & Combinatorics Seminar)  
 Invited Talk: *Strong orientations of graphs and Cheeger's inequality.*
- UC San Diego** (Advancement to Candidacy Seminar)  
*Two problems on the spectral theory of directed graphs*
- Jan. **AMS Joint Math Meetings** (Special Session on Research from the GRWC)  
 Invited Talk: *Graphs with many strong orientations.*
- 2015 Sep. **Sandia National Laboratories, Livermore** (Seminar)  
*A generative bipartite graph model with affiliation structure.*
- 2014 Aug. **University of Denver** (Graduate Research Workshop Open Problem Seminar)  
*The connectivity of randomly oriented graphs.*
- 2010 July **Pomona College** (NSF-funded REU Seminar)  
*Game theory in school choice.*

## Teaching and Interns

evaluations at [math.ucsd.edu/~saksoy/teaching.htm](http://math.ucsd.edu/~saksoy/teaching.htm)

- 2019– **Intern Supervisor**, Pacific Northwest National Laboratory  
 Mentees: Terran Mott (Grinnell), Summer 2019
- 2016–2017 **Head Teaching Assistant**, UC San Diego Math Department  
 Responsibilities: training and evaluating new TAs, serving as a first point of contact for conflicts and grievances, representing graduate students in departmental affairs.
- 2012–2016 **Teaching Assistant**, UC San Diego Math Department  
 12 Courses: Discrete Math & Graph Theory, Combinatorics, Complex Analysis, Mathematical Reasoning, Linear Algebra, Calculus and Analytic Geometry, Calculus I-III.

## Fellowships and Awards

- 2019 **Author of the Year**, Pacific Northwest National Laboratory, National Security Directorate
- 2016 Jun. **Outstanding Poster Award**, Stochastic Networks Conference
- 2013–2014 **Graduate Student Research Fellowship**, UC San Diego
- 2012–2013 **Graduate Assistance in Areas of National Need Fellowship**, UC San Diego
- 2012–2013 **M. Salah Baouendi Graduate Fellowship**, UC San Diego

2012 Jun. **General Honors**, University of Chicago

### Service

2020– **Reviewer:** Mathematical Reviews, MathSciNet

2013– **Referee:** Journal of Combinatorics, Theoretical Computer Science, Linear Algebra & Applications, Graphs & Combinatorics, SIAM J. Math Data Science, Journal of Algebraic Combinatorics, Ars Combinatoria, Network Science

2015–2016 **Graduate Student Association Representative**, UC San Diego Math Department.

2014–2015 **Webmaster**, “Erdős’ Problems on Graphs” [website](#).

### References

#### Fan Chung Graham

Department of Mathematics  
UC San Diego  
La Jolla, CA 92093  
[fan@ucsd.edu](mailto:fan@ucsd.edu)  
858-534-2848

#### Tamara G. Kolda

Data Science and Cyber Analytics  
Sandia National Laboratories  
Livermore, CA 94551  
[tgkolda@sandia.gov](mailto:tgkolda@sandia.gov)  
925-294-4769

#### Paul Horn

Department of Mathematics  
University of Denver  
Denver, CO 80208  
[paul.horn@du.edu](mailto:paul.horn@du.edu)  
303-871-3095

#### John Eggers (teaching)

Department of Mathematics  
UC San Diego  
La Jolla, CA 92093  
[jeggers@ucsd.edu](mailto:jeggers@ucsd.edu)  
858-534-4239

#### Stephen J. Young

Computational Sciences & Mathematics  
Pacific Northwest National Laboratory  
Richland, WA 99354  
[stephen.young@pnnl.gov](mailto:stephen.young@pnnl.gov)  
509-375-3630

#### Emilie Purvine

Computational Sciences & Mathematics  
Pacific Northwest National Laboratory  
Richland, WA 99354  
[Emilie.Purvine@pnnl.gov](mailto:Emilie.Purvine@pnnl.gov)  
206-528-3461