Harsha Gangammanavar

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Education

Ohio State University — **Columbus, OH**
Ph.D. Integrated Systems Engineering, August 2013
Dissertation Title: Multiple Timescale Stochastic Optimization with Application to Integrating Renewable Resources in Power Systems
Advisor: Prof. Suvrajeet Sen
Minors: Computer Science and Statistics

M.S. Electrical and Computer Engineering — December 2009

Visvesvaraya Technological University — **Bangalore, India**
B.E. Electronics and Communications Engineering — May 2007

Appointments

Southern Methodist University — **Dallas, TX**
Operations Research and Engineering Management
Assistant Professor — August 2016 - present

Clemson University — **Clemson, SC**
Industrial Engineering
Postdoctoral Fellow — July 2015 - July 2016
Adjunct Assistant Professor — April 2017 - July 2021

University of Southern California — **Los Angeles, CA**
Industrial and Systems Engineering
Visiting Assistant Professor — August 2013 - May 2015

Ohio State University — **Columbus, OH**
Integrated Systems Engineering
Graduate Research and Teaching Assistant — January 2010 - July 2013

Research Interests

Methodologies: Operations research; stochastic programming; large-scale optimization.
Applications: Renewable energy integration in power systems; healthcare logistics; communication networks.

Journal Publications

J17. N. Sakhavand[†] and H. Gangammanavar, Subproblem sampling vs. scenario reduction: Efficacy comparison for stochastic programs in power systems applications, accepted for publication in *Energy Systems*, 2022.

J16. D. Wood, S. Çetinkaya, H. Gangammanavar, L. Weiguo, and J. Wang, On the Value of a Multi-stage Optimization Approach for Intensity-Modulated Radiation Therapy Planning, *Physics in*

[†]Graduate student advisee

Medicine and Biology, 67(14), 2022; DOI: https://doi.org/10.1088/1361-6560/ac7a8a.

J15. H. Gangammanavar and M. Bansal, Stochastic Decomposition Method for Two-Stage Distributionally Robust Linear Optimization, *SIAM Journal on Optimization*, 32:3, 1901-1930, 2022; DOI: https://doi.org/10.1137/20M1378600.

J14. S. Ariyarathne[†], H. Gangammanavar, and R. Sundararajan, Change Point Detection in Non-stationary Sub-Hourly Wind Time Series, *Applied Energy*, Volume 310, 118501, 2022; DOI: https://doi.org/10.1016/j.apenergy.2021.118501.

J13. S. Atakan, H. Gangammanavar and S. Sen, Stochastic Hierarchical Planning for High Renewable Power Systems, accepted for publication in *European Journal on Operational Research*, December 2021; DOI: https://doi.org/10.1016/j.ejor.2021.12.042.

J12. D. Troxell[‡], H. Ahn, and H. Gangammanavar, A Cardinality Minimization Approach to Security-Constrained Economic Dispatch, accepted for publication in *IEEE Transactions on Power Systems*, November 2021; DOI: https://doi.org/10.1109/TPWRS.2021.3133379.

J11. A. Alobaidi[§], M. Khodayar, A. Vafamehr, H. Gangammanavar, and M. Khodayar, Security Constrained Expansion Planning of Battery Energy Storage in Distribution Network with Data Centers, in *International Journal of Electrical Power and Energy Systems*, Volume 133, 107231, December 2021; DOI: https://doi.org/10.1016/j.ijepes.2021.107231.

J10. H. Gangammanavar and S. Sen, Stochastic Dynamic Linear Program: A Distribution-free Multistage Stochastic Programming Algorithm, *SIAM Journal on Optimization*, 31:3, 2111-2140, 2021; DOI: https://doi.org/10.1137/19M1290735.

J9. S. Yin[§], J. Wang, and H. Gangammanavar, Stochastic Market Operation for Coordinated Transmission and Distribution Systems, in *IEEE Transactions on Sustainable Energy*, vol. 12, no. 4, pp. 1996-2007, October 2021; DOI: https://doi.org/10.1109/TSTE.2021.3076037.

J8. H. Gangammanavar, Y. Liu, and S. Sen, Stochastic decomposition for two-stage stochastic linear programs with random cost coefficients, *INFORMS Journal on Computing*, 33(1):51–71, January 2021; DOI: https://doi.org/10.1287/ijoc.2019.0929.

J7. S. Wang[§], S. J. Mason, and H. Gangammanavar, Stochastic optimization for flow-shop scheduling with on-site renewable energy generation using a case in the United States, *Computers and Industrial Engineering*, 149:106812, 2020; DOI: https://doi.org/10.1016/j.cie.2020.106812.

J6. S. Wang[§], H. Gangammanavar, S. Ekşioğlu, and S. J. Mason, Statistical estimation of operating reserve requirements using rolling horizon stochastic optimization, *Annals of Operations Research*, 292(1): 371–397, 2020; DOI: https://doi.org/10.1007/s10479-019-03482-x.

J5. Z. Azadi[§], H. Gangammanavar, and S. Ekşioğlu, Developing childhood vaccine administration and inventory replenishment policies that minimize open vial wastage. *Annals of Operations Research*, 292(1): 215–247, 2020; DOI: https://doi.org/10.1007/s10479-019-03164-8.

J4. S. Wang[§], H. Gangammanavar, S. D. Eksioglu and S. J. Mason, Stochastic Optimization for Energy Management in Power Systems With Multiple Microgrids, in *IEEE Transactions on Smart Grid*, vol. 10, no. 1, pp. 1068-1079, Jan. 2019; DOI: https://doi.org/10.1109/TSG.2017.2759159.

J3. H. Gangammanavar and S. Sen, Two-scale Stochastic Optimization for Controlling Distributed Storage Devices, in *IEEE Transactions on Smart Grid*, vol. 9, no. 4, pp. 2691-2702, July 2018; DOI: https://doi.org/10.1109/TSG.2016.2616881.

J2. H. Gangammanavar, S. Sen and V. M. Zavala, Stochastic Optimization of Sub-Hourly Economic Dispatch With Wind Energy, in *IEEE Transactions on Power Systems*, 31(2), 949-959, March 2016; DOI: https://doi.org/10.1109/TPWRS.2015.2410301.

J1. R. Li, H. Gangammanavar and A. Eryilmaz, Optimal Dynamic Coding and Rate-Control for Serving Deadline-Constrained Traffic over Time-Varying Channels, in *IEEE Transactions on Information Theory*, 58(10):6556-6571, 2012; DOI: https://doi.org/10.1109/TIT.2012.2204031.

Book Chapter

C1. Gangammanavar, H. (2023). Sampling-Based Decomposition Algorithms for Multistage Stochastic Programming. In: Pardalos, P.M., Prokopyev, O.A. (eds) Encyclopedia of Optimization. Springer, Cham.; DOI: https://doi.org/10.1007/978-3-030-54621-2_845-1.

Conference Proceedings

P2. Z. Azadi[§], H. Gangammanavar and S. D. Ekşioğlu, Stochastic Optimization for Vaccine Vial Replenishment, in *Proceedings of the 2016 Industrial and Systems Engineering Research Conference (ISERC)*, Anaheim, CA.

P1. H. Gangammanavar and A. Eryilmaz, Dynamic Coding and Rate-Control for Serving Deadline-Constrained Traffic over Fading Channels, in *Proceedings of IEEE International Symposium on Information Theory (ISIT)* Austin TX, pp. 1788–1792, 13-18 June 2010.

Under Review

R4. S. Ariyarathne[†] and H. Gangammanavar, New Formulations and Pricing Mechanisms for Stochastic Electricity Market Clearing Problem, 2023 (first review).

R3. M. Ahn, H. Gangammanavar, and D. Troxell[‡], Tractable Continuous Approximations for Constraint Selection via Cardinality Minimization, 2022 (under first revision).

R2. N. Sakhavand, V. Chen, H. Gangammanavar, and J. Rosenberger, Design of Experiments for the Stochastic Unit Commitment with Economic Dispatch Models, 2022 (under first revision).

R1. S. Tabrizian[†], H. Gangammanavar, and H. Üster, An Adaptive Cluster Sampling-based Solution Method for Two-stage Stochastic Linear Programs, 2020 (under revision).

Working Papers

W1. N. Fadavi[†] and H. Gangammanavar, An Active-set Method for Two-stage Stochastic Quadratic Programming, 2023.

W2. S. Ariyarathne[†], H. Gangammanavar, and J. Wang, Multiagent Optimization for Coordinated Transmission-distribution System, 2023.

W3. D. L. Cole, H. Gangammanavar, and V. M. Zavala, Hierarchical Graph Modeling for Multi-Scale Optimization of Power Systems, 2023.

W4. K. Baker and H. Gangammanavar, Relationship of Locational Marginal Prices to Network Properties and its Implications, 2023.

Grants

G1. *New Abstractions and Randomized Algorithms for Multiscale Stochastic Optimization*, Role: Lead PI; Department of Energy - Office of Science, #DE-SC0023361; 2022 - 2025.

G2. *Stochastic Programming Decomposition Models and Algorithms for Discrete-event Dynamic Systems*, Role: Sole PI; Office of Naval Research, #N00014-22-1-2603; 2022-2025.

[‡]Undergraduate student advisee
[§]Member of students Dissertation Committee

G3. *"Data Assimilation for Radiation Therapy Planning via Optimization: Adaptive Deterministic Models"*, Role: PI (with S. Çetinkaya), SMU Lyle School Research Seed Funding; 2020.

G4. *"Multi-temporal Flexibility Services in Transactive Energy Architecture"*, Role: Co-PI (with M. Khodayar), SMU Lyle School Research Seed Funding; 2018.

G5. *"A Data-Driven Support System for Coordinated Operation of Electricity and Natural Gas Infrastructure*, Role: PI (with M. Khodayar), SMU Lyle School Research Seed Funding; 2017.

G6. *"Statistical Optimality, Algorithms and Resilience in Time-Staged Stochastic Systems"*, Role: Co-PI (with S. Sen (PI)), Air Force Office of Scientific Research, #FA9550-15-1-0267; 2015 - 2018.

Honors

- Honorable mention at Undergraduate Operations Research Prize (for UG student D. Troxell; joint work with M. Ahn), INFORMS Annual Meeting, Anaheim, Oct. 2021;
- Fellow of the Dedman College Interdisciplinary Institute 2017-18, Southern Methodist University;
- Honorable mention at Minority Issues Forum poster competition (for Z. Azadi*; joint work with S. Eksioglu), INFORMS Annual Meeting, Nashville, Nov. 2016;
- Postdoctoral Fellowship, Clemson University, 2015-16;
- Travel grant recipient, PhD Winter School on Managing Uncertainty in Energy Infrastructure Investment, Oppdal, Norway, 2011;
- Travel grant recipient, llinois Wireless Summer School, University of Illinois at Urbana-Champaign 2009.

Courses taught

At Southern Methodist University*†

- OREM 3360 Operations Research (UG): Spring 2017 (26), 2018 (20), 2019 (24), 2022 (19), 2023 (7); Fall 2021 (25), 2022 (13);
- OREM 5364 Advanced Operations Research (UG): Fall 2022 (10), Fall 2023 (5);
- OREM 8360 Operations Research Models (G): Fall 2016 (26), 2017 (13), 2018 (15), 2020 (4); Spring 2020 (10), 2021 (2);
- OREM 8371 Linear Programming (G): Fall 2018 (6), 2019 (9); Spring 2022 (10);
- OREM 8384 Stochastic Programming (G): Spring 2018 (13), 2020 (6).

At University of Southern California

- ISE 310 Facilities and Logistics (UG): Spring 2015;
- ISE 330 Introduction to Operations Research: Deterministic Models (UG): Spring 2015, 2014; Fall 2014, 2013;
- ISE 499 Special Topics: Integrative Systems Engineering (UG): Spring 2015, 2014;
- ISE 536 Linear Programming and Extensions (G): Fall 2014.

*Parenthetical terms indicate course enrollment size.
†Course numbers were encoded with "EMIS" prefix prior to Fall 2022.

Ph.D. Supervision

- Jackson Forner, Ph.D. Student
  2023 - present; OREM, SMU (co-advised with Prof. Miju Ahn)
- Niloofar Fadavi, Ph.D. Candidate
  2020 - present; OREM, SMU.
- Sakitha Ariyarathne, Ph.D. in Operations Research, SMU; December 2022
  Thesis: *Study of Stochastic Market Clearing Problem in Power Systems With High Renewable Integration*;
  First position: Data Scientist, BHG Financial.
- Siavash Tabrizian, Ph.D. in Operations Research, SMU;, December 2021
  OREM, SMU (co-advised with Prof. Halit Uster)
  Thesis: *Sampling-based Algorithms for Two-stage Stochastic Programs and Applications*;
  First position: Data Scientist, USX Variant.

Masters Supervision

- Nahal Sakhavand, M.S. in Operations Research;
  EMIS, Southern Methodist University. Graduated: Summer 2018.

Undergraduate Mentoring

- David Troxell, B.S. in Management Science;
  OREM, Southern Methodist University. Graduated: Spring 2021.

Professional Society Service

- *Organization Committee Member*:
  - Organizing committee member and co-chair of contributed sessions tracks at INFORMS Annual Meeting 2023;
  - Program committee member (Energy System Track) at IISE Annual Conference and Expo 2022;
  - NSF Operations Engineering Workshop, SMU, March 2019.
- *Conference Session Chair*:
  - INFORMS Annual Meetings 2023 (Phoenix), 2022 (Indianopolis), 2021 (Anaheim), 2019 (Seattle), INFORMS 2018 (Phoenix), 2014 (San Francisco).
- *Referee*: *INFORMS Operations Research, Journal on Computing, and Journal on Optimization; SIAM Journal on Optimization; Mathematical Optimization; Computational Optimization and Applications; IISE Transactions; Optimization Letters; Energy Systems; Omega: International Journal of Management Science; IEEE Transaction on Power Systems, Transactions on Smart Grid, and Transactions on Sustainable Energy; Electric Power Systems Research; IET Generation, Transmission and Distribution.*
- *Proposal reviews*: National Science Foundation, 2023, 2017; Office of Naval Research, 2023, 2022; Department of Energy - Office of Science, 2023.
- *Committee Member*: George Nicholson Student Paper Competition, INFORMS 2020, 2021; INFORMS-ENRE Student Paper Competition, INFORMS, 2018.
- *Faculty Advisor*: SMU INFORMS Student Chapter, 2018-2022.
- *Vice-President*: OSU INFORMS Student Chapter, 2011-2012.

Professional Society Membership

- Institute for Operations Research and Management Science (INFORMS): Optimization Society; Computing Society; and Energy, Natural Resources, and Environment Society.
- Society of Industrial and Applied Mathematics (SIAM).
- Mathematical Optimization Society (MOS).

Graduate Committee Service

Program	Students
Ph.D. (OREM/EMIS)	Ongoing: Toby Huskinson, Chengyu Ke; Completed: Hedieh Ashrafi (2021); Justin B. Brown (2021); Naderehsadat Mansouri (2019); Amin Ziaeifar (2019).
Ph.D. (ECE)	Ongoing: Abdulraheem Alobaidi, Yazeed Alkhrijah, Bin Huang, Yanling Lin, You Lin, Xinyun Lu, Tao Wu; Completed: Shengfei Yin (2021); Mahdi Khodayar (2020); Xinan Wang (2020); Ying Zhang (2020).
Praxis (OREM/EMIS)	Emily McIntosh (2022); Mohammed Abdul Qaudeer (2020); Peng Yang (2019).
Ph.D. (UTA IMSE)	Nahal Sakhavand (2021).
Ph.D. (Clemson IE)	Shasha Wang (2020); Site Wang (2018).

Administrative Service

- Lyle School representative, SMU Faculty Senate; member, Economic Status committee, 2023 - present;
- Member and chair, OREM Graduate Committee, 2022 - present;
- OREM Department Seminar Organizer, 2020 – 2023.
- Member and chair, Course Coordination Committee on OR Methods, 2019 – 2022;
- OREM department representative on Lyle Academic Affairs Committee, 2021 – 2022;
- Member, Accreditation and Academic Programs, 2020 – 2021;
- Member, Faculty search committee, 2018-19, 2019-20, 2021-22;
- Instructor, Summer Bit Blast, workshop organized by the Center for Research Computing (SMU), 2022, 2023;
- Judge, Dallas Regional Science and Engineering Fair, 2020 and 2021;
- Judge, Lyle Research Day, 2016, 2017, 2018, and 2019.

Invited Seminars

- Decision Sciences Area Seminar, Indian Institute of Management, Bangalore, December 2021.
- Industrial Engineering, University of Houston, March 2021.
- Industrial, Manufacturing, and Systems Engineering, University of Texas at Arlington, December 2018.
- Center for Applicable Mathematics, Tata Institute of Fundamental Research, Bangalore, July 2018.
- Department of Mechanical Engineering, University of Texas at Dallas, June 2018.

- Dedman College Interdisciplinary Institute (DCII), Operations Research and Statistics Cluster towards Integrative Analytics, SMU, February 2017.
- Department of Engineering Management, Information, and Systems, Southern Methodist University, February 2016.
- Industrial Engineering Technical Innovation Seminar Series, Clemson University, November 2016.
- Ming Hsieh Department of Electrical Engineering, University of Southern California, October 2014.
- Daniel J Epstein Department of Industrial and Systems Engineering, University of Southern California, October 2014.

Conference Presentations

- *Stochastic dynamic linear programming: A sequential sampling algorithm* with S. Sen,
  - Invited Mini-symposium: International Conference on Stochastic Programming, Davis, CA, June 2023.
  - INFORMS Optimization Society Conference, Greenville, SC, March 2020.
  - 21st Conference of the International Federation of Operational Research Societies, Quebec City, Canada, July 2017,
  - SIAM Conference on Optimization, Vancouver, Canada, May 2017,
- *Sequential sampling-based solution algorithms for distributionally robust optimization*,
  - International Conference on Continuous Optimization, Lehigh, PA, July 2022.
  - International Conference on Stochastic Programming, Trondheim, July 2019.
- *A sampling-based branch-and-cut algorithm for two-stage stochastic mixed-integer programming*,
  - INFORMS Annual Meeting, Anaheim, 2021.
- *Stochastic decomposition for two-stage stochastic linear programs with random cost coefficients*,
  - INFORMS Annual Meeting, Phoenix, Nov. 2018.
- *Stochastic programming framework for coordinated operation of power systems with multiple microgrids*,
  - International Symposium on Mathematical Programming, Bordeaux, July 2018.
  - INFORMS Optimization Society Conference, Denver, March 2018.
- *Sequential sampling-based optimization for power systems application*, INFORMS Annual Meeting, Nashville, Nov. 2016.
- *Convergence proofs of SDDP and multistage stochastic decomposition* with S. Sen, International Conference on Stochastic Programming, Buzios, Brazil, June 2016.
- *Multiple timescale stochastic optimization for integrating renewable resources* with S. Sen:
  - INFORMS Annual Meeting, San Francisco, Nov. 2014
  - Workshop on Optimization Under Uncertainty: Energy, Transportation and Natural Resources, University of California-Davis, Nov. 2014
  - Smartgrid Challenges, University of Arizona, Tucson, Mar. 2013.
- *Stochastic optimization of sub-hourly economic dispatch with wind generation*
  - INFORMS Annual Meeting, San Francisco, Nov. 2014

- INFORMS Annual Meeting, Minneapolis, Oct. 2013.

- *Dynamic coding and rate-control for serving deadline-constrained traffic over fading channels*, with A. Eryilmaz, IEEE International Symposium on Information Theory (ISIT), Austin, Jun. 2010.

Workshops Attended

- "Deep Learning", 25th Annual Teaching Effectiveness Symposium, Center for Teaching Excellence, Southern Methodist University, August 2017.
- New Faculty Colloquium, INFORMS Annual Meeting 2016, Nashville, October 2016.
- "A Conversation between Artificial Intelligence, Operations Research and Control Theory on Stochastic Optimization", NSF Workshop at Rutgers University, 2012.
- "Managing Uncertainty in Energy Infrastructure Investments", Ph.D. Winter School, Oppdal, Norway, 2011 (recipient of workshop travel grant).
- Ph.D. Workshop at 12th International Conference on Stochastic Programming, Halifax, NS, Canada, 2010.
- Illinois Wireless Summer School, University of Illinois, Urbana-Champaign, IL, 2010 (recipient of summer school travel grant).