

# Harsha Gangammanavar

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<b>Education</b>	<b>Ohio State University</b> Ph.D. Integrated Systems Engineering, <i>Dissertation Title:</i> Multiple Timescale Stochastic Optimization with Application to Integrating Renewable Resources in Power Systems <i>Advisor:</i> Prof. Suvrajeet Sen <i>Minors:</i> Computer Science and Statistics  M.S. Electrical and Computer Engineering	<b>Columbus, OH</b> August 2013      December 2009
	<b>Visvesvaraya Technological University</b> B.E. Electronics and Communications Engineering	<b>Bangalore, India</b> May 2007
<b>Appointments</b>	<b>Southern Methodist University</b> Operations Research and Engineering Management <i>Assistant Professor</i>  <b>Clemson University</b> Industrial Engineering <i>Postdoctoral Fellow</i> ( <i>Advisors:</i> Prof. Scott Mason and Sandra Eksioglu) <i>Adjunct Assistant Professor</i>  <b>University of Southern California</b> Industrial and Systems Engineering <i>Visiting Assistant Professor</i>  <b>Ohio State University</b> Integrated Systems Engineering <i>Graduate Research and Teaching Assistant</i>	<b>Dallas, TX</b> August 2016 - present  <b>Clemson, SC</b> July 2015 - July 2016 April 2017 - July 2021  <b>Los Angeles, CA</b> August 2013 - May 2015  <b>Columbus, OH</b> 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**

J1. Sakhavand, N. and Gangammanavar, H. (2022). Subproblem sampling vs. scenario reduction: efficacy comparison for stochastic programs in power systems applications, *Energy Systems*, 1-29; DOI: <https://doi.org/10.1007/s12667-022-00558-9>.

J2. H. Gangammanavar and M. Bansal, Stochastic Decomposition Method for Two-Stage Distributionally Robust Linear Optimization, *SIAM Journal on Optimization*, vol. 32, issue 3, pp. 1901-1930, 2022; DOI: <https://doi.org/10.1137/20M1378600>.

J3. D. Wood<sup>‡</sup>, S. Çetinkaya, H. Gangammanavar, L. Weiguo, and J. Wang, On the Value of a Multistage Optimization Approach for Intensity-Modulated Radiation Therapy

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\*Graduate student advisee

<sup>†</sup>Undergraduate student advisee

<sup>‡</sup>Ph.D. student coauthor/mentee

- Planning, *Physics in Medicine and Biology*, vol. 67, no. 14, July 2022; DOI: <https://doi.org/10.1088/1361-6560/ac7a8a>.
- J4. S. Ariyaratne\*, H. Gangammanavar, and R. Sundararajan, Change Point Detection in Nonstationary Sub-Hourly Wind Time Series, *Applied Energy*, vol. 310, 118501, March 2022; DOI: <https://doi.org/10.1016/j.apenergy.2021.118501>.
- J5. S. Atakan, H. Gangammanavar, and S. Sen, Stochastic Hierarchical Planning for High Renewable Power Systems, *European Journal on Operational Research*, vol. 302, issue 1, pp. 381-391, October 2022; DOI: <https://doi.org/10.1016/j.ejor.2021.12.042>.
- J6. D. Troxell<sup>†</sup>, H. Ahn, and H. Gangammanavar, A Cardinality Minimization Approach to Security-Constrained Economic Dispatch, *IEEE Transactions on Power Systems*, vol. 37, no. 5, pp. 3642-3652, September 2022; DOI: <https://doi.org/10.1109/TPWRS.2021.3133379>.
- J7. A. Alobaidi<sup>‡</sup>, 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*, vol. 133, 107231, December 2021; DOI: <https://doi.org/10.1016/j.ijepes.2021.107231>.
- J8. H. Gangammanavar and S. Sen, Stochastic Dynamic Linear Program: A Distribution-free Multistage Stochastic Programming Algorithm, *SIAM Journal on Optimization*, vol. 31, issue 3, pp. 2111-2140, 2021; DOI: <https://doi.org/10.1137/19M1290735>.
- J9. S. Yin<sup>‡</sup>, 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>.
- J10. H. Gangammanavar, Y. Liu, and S. Sen, Stochastic decomposition for two-stage stochastic linear programs with random cost coefficients, *INFORMS Journal on Computing*, vol. 33, no. 1, pp 51-71, January 2021; DOI: <https://doi.org/10.1287/ijoc.2019.0929>.
- J11. S. Wang<sup>‡</sup>, 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*, vol. 149, 106812, November 2020; DOI: <https://doi.org/10.1016/j.cie.2020.106812>.
- J12. S. Wang<sup>‡</sup>, H. Gangammanavar, S. Ekşioğlu, and S. J. Mason, Statistical estimation of operating reserve requirements using rolling horizon stochastic optimization, *Annals of Operations Research*, vol. 292, issue 1, pp. 371-397, 2020; DOI: <https://doi.org/10.1007/s10479-019-03482-x>.
- J13. Z. Azadi<sup>‡</sup>, H. Gangammanavar, and S. Ekşioğlu, Developing childhood vaccine administration and inventory replenishment policies that minimize open vial wastage. *Annals of Operations Research*, vol. 292, issue 1, pp. 215-247, 2020; DOI: <https://doi.org/10.1007/s10479-019-03164-8>.
- J14. S. Wang<sup>‡</sup>, H. Gangammanavar, S. D. Ekşioğlu, 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>.
- J15. 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>.

- J16. H. Gangammanavar, S. Sen, and V. M. Zavala, Stochastic Optimization of Sub-Hourly Economic Dispatch With Wind Energy, in *IEEE Transactions on Power Systems*, vol. 31, no. 2, pp. 949-959, March 2016; DOI: <https://doi.org/10.1109/TPWRS.2015.2410301>.
- J17. 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*, vol. 58, no. 10, pp. 6556-6571, 2012; DOI: <https://doi.org/10.1109/TIT.2012.2204031>.
- Conference Proceedings**
- C1. Z. Azadi<sup>‡</sup>, 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.
- C2. 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**
- R1. S. Ariyaratne\* and H. Gangammanavar, New Formulations and Pricing Mechanisms for Stochastic Electricity Market Clearing Problem, 2023 (first review).
- R2. M. Ahn, H. Gangammanavar, and D. Troxell<sup>‡</sup>, Tractable Continuous Approximations for Constraint Selection via Cardinality Minimization, 2022 (under first revision).
- R3. N. Sakhavand<sup>‡</sup>, V. Chen, H. Gangammanavar, and J. Rosenberger, Design of Experiments for the Stochastic Unit Commitment with Economic Dispatch Models, 2022 (under first revision).
- R4. S. Tabrizian\*, H. Gangammanavar, and H. Üster, An Adaptive Cluster Sampling-based Solution Method for Two-stage Stochastic Linear Programs, 2020 (under first revision).
- Working Papers**
- W1. N. Fadavi\* and H. Gangammanavar, An Active-set Method for Two-stage Stochastic Quadratic Programming, 2023.
- W2. S. Ariyaratne\*, 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; Total award amount: \$2,040,256; October 2022 - September 2025.  
(The total award amount includes \$1,504,256 to SMU (SMU share of \$532,151 and subcontracts to the Ohio State University and University of Southern California) and \$500,000 to Argonne National Laboratories.)
- G2. *Stochastic Programming Decomposition Models and Algorithms for Discrete-event Dynamic Systems*; Role: Sole PI; Office of Naval Research #N00014-22-1-2603; \$387,826; September 2022-August 2025.
- G3. *Data Assimilation for Radiation Therapy Planning via Optimization: Adaptive Deterministic Models*; Role: PI (with S. Çetinkaya); SMU Lyle School Research Seed Funding; \$30,500.00; March - December 2020.

- G4. *Multi-temporal Flexibility Services in Transactive Energy Architecture*; Role: Co-PI (with M. Khodayar, PI); SMU Lyle School Research Seed Funding; \$23,760.00; March - December 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; \$25,080.00; March - December 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; \$450,000; August 2015 - December 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, Illinois 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.

## Ph.D. Supervision

### Current Ph.D. Students

- Jackson Forner, Ph.D. Student in Operations Research; 2023 - present; OREM, SMU (co-advised with Prof. Miju Ahn)
- Niloofar Fadavi, PhD Student in Operations Research; Center for Research Computing Fellow; *Admission to candidacy*: Spring 2023; *Expected graduation*: Spring 2024.

- Sakitha Ariyaratne, Ph.D. in Operations Research, SMU;  
*Graduated:* December 2022  
*Dissertation title:* 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  
University Ph.D. Fellow;  
*Graduated:* December 2021 (co-advised with Prof. Halit Uster);  
*Dissertation title:* Sampling-based Algorithms for Two-stage Stochastic Programs and Applications;  
*First position:* Data Scientist at USX Variant, Atlanta, GA.

#### Masters Supervision

- Nahal Sakhavand, M.S. in Operations Research  
*Graduated:* Summer 2018;  
*First position:* Ph.D. student in ISME, University of Texas at Arlington.

#### Undergraduate Mentoring

- David Troxell, B.S. in Management Science  
*Graduated:* Spring 2021;  
*First position:* M.S. student in Data Science, Stanford University.

#### 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 Ziaefar (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); Xinnan 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).

#### 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 2022 (Indianapolis), 2021 (Anaheim), 2019 (Seattle), 2018 (Phoenix), 2014 (San Francisco).
- *Referee:* INFORMS Operations Research, Journal on Computing, and Journal on Optimization; SIAM Journal on Optimization; Mathematical Programming; 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.

- *Panelist*: National Science Foundation, 2023, 2017; Office of Naval Research, 2023, 2022; Department of Energy - Office of Science, 2023.
- *Award Committee Member*: IISE Energy Systems Best Paper Award 2022; George Nicholson Student Paper Competition, INFORMS 2020 and 2021; INFORMS-ENRE Student Paper Competition, INFORMS, 2018.
- *Faculty Advisor*: SMU INFORMS Student Chapter, 2018-2022.
- *Vice-President*: Ohio State University 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).

**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;
- OREM department representative on Lyle Academic Affairs Committee, 2021 – 2022;
- Member and chair, Course Coordination Committee on OR Methods, 2019 – 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), July 2022;
- 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.
- *Stochastic Branch-and-Cut Algorithm from a Sequential Sampling Perspective*
  - SIAM Conference on Optimization, Seattle, WA, May 2023,
- *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).