CV: Shankarachary Ragi

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1 Personal Information

1.1 Contact Information

Shankarachary Ragi
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1.2 Education

Degree	*Date*	*University*
B.Tech.	Apr. 2009	Indian Institute of Technology Madras
M.Tech.	Apr. 2009	Indian Institute of Technology Madras
Ph.D.	May 2014	Colorado State University

Doctoral Dissertation:
Cooperative Control of Mobile Sensor Platforms in Dynamic Environments

1.3 Awards and Honors

[1] Senior Member of the IEEE, 2019.

[2] Emerging Researcher Award, for research efforts and activities in the Electrical and Computer Engineering Department, South Dakota School of Mines and Technology, 2019.

[3] Pratibha Scholarship, awarded by the Government of Andhra Pradesh, India for academic performance in 2004.

1.4 Professional Appointments

Aug. 2018–present

Assistant Professor, Dept. of Electrical Engineering, South Dakota School of Mines and Technology

Jan. 2016–Jul. 2018

Postdoctoral Researcher, School of Mathematical and Statistical Sciences, Arizona State University

Aug. 2014–Nov. 2015

Sr. Controls Engineer, Cummins Emission Solutions, Columbus, IN

Jan. 2010–May 2014

Research Assistant, Dept. of Electrical and Computer Engineering, Colorado State University

May 2012–Jul. 2012

Research Intern, Mitsubishi Electric Research Laboratories, Cambridge, MA

2 Research Activities

2.1 Research Grants

[1] Co-Principle Investigator: "Optimizing Systems with Conflicting Objectives Competing for a Limited Resource," Air Force Office of Scientific Research, Award No. FA9550-19-1-0070, 2019–2022, $344,850 (Subaward from Arizona State University, PI: Hans D. Mittelmann, Ragi's portion of grant: $131,603).

[2] Senior Personnel: "RII Track-2 FEC: Data Driven Material Discovery Center for Bioengineering Innovation" National Science Foundation EPSCoR Research Infrastructure, Award No. 1920954, 2019–2023, $6M, Ragi's portion: $60K.

[3] Principle Investigator: "UAV-based hyperspectral sensing (UHS) solution for agricultural soil monitoring", South Dakota Bioscience Commercialization Alliance i6 Program, Industry Partner: Raven Applied Technology, Jan–Dec 2020, $25K.

[4] Principle Investigator: "Exploring rheology properties of biofilm with multifractal and multiscale data analytics", NSF EPSCoR RII Track-1 Seed Grants (Co-PIs: T. Walker, J. Kalimuthu), Jan–Dec 2020, $50K.

[5] Principle Investigator: "Near real-time wildfire smoke detection and monitoring from satellite imagery using artificial intelligence", South Dakota NASA EPSCoR Research Initiation Grant (Co-PI: Xiaoyang Zhang), 2020–2022, $86,250 ($57,500 from NASA, $28,750 cost sharing via investigators' time).

2.2 Journal Articles

[J1] A. V. Weigel, S. Ragi, M. L. Reid, E. K. P. Chong, M. M. Tamkun, and D. Krapf, "Obstructed diffusion propagator analysis for single-particle tracking," *Physical Review E*, vol. 85, no. 4, paper 041924, 2012.

[J2] S. Ragi and E. K. P. Chong, "UAV path planning in a dynamic environment via partially observable Markov decision process," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 49, no. 4, pp. 2397-2412, 2013.

[J3] S. Ragi, C. Tan, and E. K. P. Chong, "Guidance of autonomous amphibious vehicles for flood rescue support," *Mathematical Problems in Engineering*, vol. 2013, 2013.

[J4] S. Ragi and E. K. P. Chong, "Decentralized guidance control of UAVs with explicit optimization of communication," *Journal of Intelligent and Robotic Systems*, special issue on *Unmanned Aircraft Systems (UAS)*, Part I, vol. 73, no. 1-4, pp. 811–822, 2014.

[J5] S. Ragi, H. D. Mittelmann, and E. K. P. Chong, "Directional sensor control: Heuristic approaches," *IEEE Sensors Journal*, vol. 15, no. 1, pp. 374–381, 2015.

[J6] A. Chiriyath, S. Ragi, H. D. Mittelmann, and D. W. Bliss, "Novel Radar Waveform Optimization for a Cooperative Radar-Communications System," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 55, no. 3, pp. 1160-1173, 2019.

[J7] S. Ragi, E. K. P. Chong, and H. D. Mittelmann, "Polynomial-time methods to solve unimodular quadratic programs with performance guarantees," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 55, no. 5, pp. 2118-2127, 2019.

[J8] A. Chiriyath, S. Ragi, H. D. Mittelmann, and D. W. Bliss, "Radar Waveform Optimization for Joint Radar Communications Performance," *Electronics*, special issue on *Cooperative Communications for Future Wireless Systems*, vol. 8, no. 12, 2019.

[J9] M. Azam, H. D. Mittelmann, and S. Ragi "UAV formation shape control via decentralized Markov decision processes," *Algorithms*, special issue on *Algorithms in Stochastic Models*, vol. 14, no. 3, March 2021.

[J10] S. Ragi and H. D. Mittelmann, "Random-sampling Monte-Carlo tree search methods for cost approximation in long-horizon optimal control," *IEEE Control Systems Letters (L-CSS)*, vol. 5, no. 5, pp. 1759-1764, November 2021.

2.3 Conference Proceedings and Presentations

[C1] S. Ragi and E. K. P. Chong, "Dynamic UAV path planning for multitarget tracking," presented (poster) at the *1st Southwest Workshop on Theory and Applications of Cyber-Physical Systems*, Tucson, Arizona, March 10–11, 2011.

[C2] S. Ragi and E. K. P. Chong, "Dynamic UAV path planning for multitarget tracking," in *Proceedings of The 2012 American Control Conference (ACC 2012)*, Montreal, Canada, June 27–29, 2012, pp. 3845–3850.

[C3] S. Ragi and E. K. P. Chong, "Decentralized control of unmanned aerial vehicles for multitarget tracking," in *Proceedings of the 2013 International Conference on Unmanned Aircraft Systems (ICUAS'13)*, Atlanta, Georgia, May 28–31, 2013, pp. 260–268.

[C4] S. Ragi, C. S. Tan, and E. K. P. Chong, "Feasibility study of POMDP in autonomous amphibious vehicle guidance," in *Proceedings of the 2013 IFAC Symposium on Intelligent Autonomous Vehicles (IAV 2013)*, Gold Coast, Australia, June 26–28, June 2013, pp. 85–90.

[C5] S. Ragi, H. D. Mittelmann, and E. K. P. Chong, "Directional sensor control for maximizing information gain," in *Proceedings of SPIE Optical Engineering + Applications (SPIE Vol. 8857), part of SPIE Optics + Photonics Symposium*, San Diego, CA, August 25–29, 2013.

[C6] S. Ragi, E. K. P. Chong, and H. D. Mittelmann, "Heuristic methods for designing unimodular code sequences with performance guarantees," in *Proceedings of 42nd IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, New Orleans, LA, March 5–9, 2017 pp. 3221–3225.

[C7] S. Ragi and H. D. Mittelmann, "Mixed-integer nonlinear programming formulation of a UAV path optimization problem," in *Proceedings of The 2017 American Control Conference (ACC 2017)*, Seattle, WA, May 24–26, 2017, pp. 406–411.

[C8] C. Kaji, R. Hoover, and S. Ragi, "Underwater navigation using geomagnetic field variations," in *Proceedings of the 2019 IEEE International Conference on Electro Information Technology (EIT)*, Brookings, SD, May 20–22, 2019, pp. 339–344.

[C9] S. Ragi, S. Dey, M. Azam, and H. D. Mittelmann, "Competing objective optimization in networked swarm systems," in *Proceedings of the National Aerospace & Electronics Conference 2019 (NAECON 2019)*, Dayton, OH, July 15–19, 2019, pp. 88-91.

[C10] M. Azam, S. Dey, H. D. Mittelmann, and S. Ragi, "Average consensus-based data fusion in networked sensor systems for target tracking," in *10th Annual Computing and Communication Workshop and Conference (IEEE CCWC 2020)*, Las Vegas, NV, Jan 06–08, 2020, pp. 964–969.

[C11] M. Azam and S. Ragi, "Decentralized formation shape control of UAV swarm using dynamic programming," in *Proceedings of the Signal Processing, Sensor/Information Fusion, and Target Recognition XXIX, part of SPIE Defense + Commercial Sensing Symposium*, Anaheim, CA, April 26–30, 2020.

[C12] H. Rahman, J. Duckworth, S. Ragi, P. Chundi, G. Chilkoor, and V. Gadhamshetty, "Deep learning approach to extract geometric features of bacterial cells in biofilms," in *Proceedings of The 16th International Conference on Data Science (ICDATA'20)*, Las Vegas, NV, July 27–30, 2020, to appear.

[C13] S. Ragi and H. D. Mittelmann, "Random-sampling multipath hypothesis propagation for cost approximation in long-horizon optimal control," in *Proceedings of the 2020 IEEE Conference on Control Technology and Applications (CCTA)*, Montreal, Canada, August 24–26, 2020, to appear.

[C14] A. D. Chakravarthy, P. Chundi, M. Subramaniam, S. Ragi, and V. R. Gadhamshetty, "A Thrifty Annotation Generation Approach for Semantic Segmentation of Biofilms," in *Proceedings of the 20th IEEE International Conference on Bioinformatics and Bioengineering (BIBE)*, Virtual Conference, Oct 26–28, 2020, to appear.

[C15] S. A. Doly, A. Chiriyath, H. D. Mittelmann, D. W. Bliss, and S. Ragi, "A decision theoretic approach for waveform design in joint radar communications applications," in *Proceedings of the 54th Asilomar Conference on Signals, Systems and Computers (Asilomar 2020)*, Pacific Grove, CA, Nov 01–04, 2020, to appear.

2.4 Research Book Contributions

[R1] S. Ragi and E. K. P. Chong, "UAV guidance algorithms via partially observable Markov decision processes," in *Handbook of Unmanned Aerial Vehicles*, K. P. Valavanis and G. J. Vachtsevanos, Eds., Dordrecht, Netherlands: Springer, ISBN 978-90-481-9706-4, 2015, ch. 73, Section XIII, pp. 1775–1810.

3 Educational Activities

3.1 M.S. Thesis Supervision Completed at SD Mines

Name	*Date*	*Thesis Title*
Chinmaya Kaji	Nov. 2019	Positioning, Navigation, and Robot Motion Planning in GPS Denied Environments
Md Ali Azam	Nov. 2020	UAV Control Optimization via Decentralized Markov Decision Processes
Shawon Dey	Nov. 2020	Competing Objective Optimization in Networked UAV Swarm Systems
Abir Hossen	Apr. 2021	Total Nitrogen Estimation in Agricultural Soils via Aerial Multispectral Imaging and LIBS
Hafizur Rahman	Apr. 2021	Deep Learning Methods for Automatic Extraction of Microscale Geometric Features of Biofilms
Shammi Doly	Apr. 2021	Waveform Codesign for Radar-Communications Spectral Coexistence via Approximate Dynamic Programming

3.2 M.S. Students Currently Being Supervised

Jamison Duckworth (M.S. Thesis)

3.3 Graduate Thesis Committee Member

Kavitha Konduru (EE, 2019)
Kazi Sadman Kabir (EE, 2020)

3.4 Undergraduate Senior Design Projects Supervised

Swarmcopter (2018-19) Served as the advisor for a team of three undergraduate students to develop control algorithms for a swarm of quadcopters.

3.5 Courses Taught at Arizona State University

MAT 242 Elementary Linear Algebra, Summer 2016

MAT 343 Applied Linear Algebra, Fall 2016–Spring 2018

3.6 Courses Taught at SD Mines

EE 313 Signals and Systems, Fall 2018–present

EE 314 Control Systems, Spring 2019–present

EE 757 Intelligent Control Systems, Spring 2019

EE 655 Linear System Theory, Spring 2020–present

4 Professional Activities

4.1 Invited Lectures

[1] Postdoc Seminar Series, School of Mathematical and Statistical Sciences, Arizona State University, Nov 07, 2017 (Unimodular Quadratic Programs).

[2] Postdoc Seminar Series, School of Mathematical and Statistical Sciences, Arizona State University, Apr 24, 2018 (Radar Waveform Optimization).

[3] Department of Mechanical and Aerospace Engineering, Missouri University of Science and Technology, Feb 19, 2018 (UAV Motion Planning via POMDPs).

[4] Department of Mechanical and Aerospace Engineering, University of Texas at Arlington, Feb 23, 2018 (UAV Motion Planning via POMDPs).

[5] Graduate Seminar Series, Department of Electrical and Computer Engineering, South Dakota School of Mines and Technology, Oct 18, 2018 (Control and Optimization of UAV and Swarm Systems).

[6] CBE Seminar Series, Department of Chemical and Biological Engineering, South Dakota School of Mines and Technology, Oct 30 2018 (Control and Optimization of UAV and Swarm Systems).

[7] Invited talk, *South Dakota Statewide Geospatial Conference*, Mitchell, SD, July 24–25, 2019 (Networked Swarm Systems).

[8] Invited talk, *Speaking event sponsored by the IEEE Siouxland Section Computer Society*, Brookings, SD, Feb 20, 2020 (Control, decision making, and optimization methods for autonomy and adaptive sensing).

4.2 Editorial Activities

2017–2020 Associate Editor, *IEEE Access*

2020 Guest Editor (with Prof. Edwin Chong), special issue on *Algorithms in Stochastic Models* in the journal *Algorithms*, October 2020.

4.3 Conference Committees and Chair Positions

[1] Co-chair of conference sessions on "Autonomous systems" and "Manufacturing systems & Process control," *The 4th IEEE Conference on Control Technology and Applications (IEEE CCTA)*, Montreal, Canada, August 24–26, 2020.

4.4 Referee/Reviewer Activities

Journals and Conferences:

IEEE Journal of Selected Topics in Signal Processing
IEEE Transactions on Control Systems Technology
IEEE Transactions on Aerospace and Electronic Systems
IEEE Access
IEEE Conference on Decision and Control (CDC)
American Control Conference (ACC)
IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)
International Workshop on Systems, Signal Processing and their Applications (WOSSPA).

Funding Agencies:

Panelist for NSF Graduate Research Fellowship Program, 2019.
Panelist for NSF/CISE, 2020.

5 University Committee/Administrative Activities

5.1 Departmental Committee Activities at SD Mines

Committee: Search committee for Department Head - Electrical Engineering
Activity: Member, Fall 2019

Committee: EE Graduate Program
Activity: Coordinator, Fall 2018–present

Committee: Steven P. Miller Chair Faculty Search Committee
Activity: Member, Fall 2018–Spring 2019

Committee: EE Faculty Search Committee
Activity: Member, Fall 2018–Spring 2019

5.2 University Committee Activities at SD Mines

Committee: University Research Committee
Activity: Member & EE Representative, Fall 2018–Spring 2019

Committee: Council on Graduate Education
Activity: Member & EE Representative, Fall 2018–present