Ragesh Kumar Ramachandran

Contact Information

Autonomous Collective System Lab
School of Engineering Matter Transport and Energy
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Research Interests

Swarm robotics, multi-robot mapping, bio-inspired robotics, optimal and nonlinear control theory, network and graph theory, applied topology and differential geometry, and inverse problems.

Education

Arizona State University, Tempe, Arizona USA

Ph.D. , Mechanical Engineering, *GPA* : 4.00/4.00, **August 2012 - August 2018**

- Dissertation Topic: "Exploration, Mapping and Scalar Field Estimation using a Swarm of Resource-Constrained Robots."
- Advisor: Spring M. Berman

National Institute of Technology Calicut, Calicut, Kerala India

Bachelor of Technology, Civil Engineering, *GPA* : 7.11/10.00, May, 2011

Academic Experience

University Southern California, Los Angeles, California USA

Postdoctoral Fellow **August, 2018 - present**
Advisor: Gaurav Sukhatme

Arizona State University, Tempe, Arizona USA

Graduate Student **August, 2012 - August, 2018**
Includes current Ph.D. research, Ph.D. and Masters level coursework and research/consulting projects.

Teaching Assistant **January, 2013 - May, 2014**
Duties at various times have included office hours and leading weekly lab exercises.

- MAE 322 Structural Mechanics, Spring 2013.
- MAE 419 Experimental Mechanical Engineering, Fall 2013.
- MAE 318 System Dynamics and Control, Spring 2014.

Teaching Experience

University Southern California, Los Angeles, California USA

Introduced a course titled: "Applied Mathematics in Robotics" **Summer 2019**

Journal Publications

1. **Ragesh K. Ramachandran**, Sean. Wilson, and Spring. Berman. A probabilistic approach to automated construction of topological maps using a stochastic robotic swarm. *IEEE Robotics and Automation Letters*, 2(2):616–623, April 2017.
2. Thomas G. Sugar, Andrew Bates, Matthew Holgate, Jason Kerestes, Marc. Mignolet, Philip. New, **Ragesh K. Ramachandran**, Sangram. Redkar, Chase. Wheeler, (2015). Limit cycles to enhance human performance based on phase oscillators. *Journal of Mechanisms and Robotics*, 7, 011001.

Peer Reviewed Conference Publications

1. **Ragesh K. Ramachandran** and Spring Berman. Automated Construction of Metric Maps using a Stochastic Robotic Swarm Leveraging Received Signal Strength. Proceedings of the *International Symposium on Swarm Behavior and Bio-Inspired Robotics (SWARM)* 2019, Okinawa, Japan, November 20–22, 2019.
2. **Ragesh K. Ramachandran**, James A. Preiss and Gaurav S. Sukhatme. Resilience by Reconfiguration: Exploiting Heterogeneity in Robot Teams. In Proceedings of the *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Macau, China, November 4–8, 2019.
3. **Ragesh K. Ramachandran** and Spring Berman. The effect of communication topology on scalar field estimation by large networks with partially accessible measurements. In Proceedings of the *American Control Conference (ACC)*, Seattle, WA, USA, May 24–26, 2017.
4. **Ragesh K. Ramachandran**, Sean Wilson and Spring Berman. A probabilistic topological approach to feature identification using a stochastic robotic swarm. In the Proceedings of *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, London, UK, November 7-9, 2016. (Accepted for oral presentation - 25% acceptance rate)
5. **Ragesh K. Ramachandran**, Karthik Elamvazhuthi, and Spring Berman. An optimal control approach to mapping GPS-denied environments using a stochastic robotic swarm. In *International Symposium on Robotics Research (ISRR)*, 2015.
6. Jason Kerestes, Thomas G Sugar, Thierry Flaven, Matthew Holgate, and **Ragesh K Ramachandran**. A method to add energy to running gait: Pogosuit. In ASME 2014 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, pages V05AT08A005-V05AT08A005. *American Society of Mechanical Engineers*, 2014.
7. **Ragesh K. Ramachandran**, Vivek M Elayidom, A P Sudheer. (2009). Target Location algorithm for Automation Assistance in Weld Industries. The proceedings of the *International Conference on Simulation Modeling and Analysis (COSMA)* , NIT Calicut, December 2009: 194 - 198.

Submitted Journal Papers

1. **Ragesh K. Ramachandran**, Zahi Kakish and Spring Berman. Information correlated Lévy walk exploration and distributed mapping using a swarm of robots. Submitted to *IEEE Transactions on Robotics* (T-RO), 2019.

Submitted Conference Papers

1. **Ragesh K. Ramachandran**, Lifeng Zhou and Gaurav S. Sukhatme. Resilient Coverage: Exploring the Local-to-Global Trade-off. Submitted to *American Control Conference (ACC)* 2019.
2. **Ragesh K. Ramachandran**, Nicole Fronda and Gaurav S. Sukhatme. Resilience in multi-robot target tracking through reconfiguration. Submitted to *International Conference on Robotics and Automation (ICRA)* 2019.
3. Eric Heiden and Ziang Liu and **Ragesh K. Ramachandran** and Gaurav S. Sukhatme. Physics-based Simulation of Continuous-Wave LIDAR for Localization, Calibration and Tracking. Submitted to *International Conference on Robotics and Automation (ICRA)* 2019.

Refereed Abstracts

1. **Ragesh Kumar Ramachandran**, and James A. Preiss and Gaurav S. Sukhatme. "Resilience by Reconfiguration: Exploiting Heterogeneity in Robot Teams". Workshop on Resilient Robot Teams: Composing, Acting, and Learning, ICRA 2019: International Conference on Robotics and Automation, Montreal, Canada, 2019.
2. **Ragesh Kumar Ramachandran**, and Spring Berman. "Post Processing of Occupancy Grid Maps using Persistent Homology". Workshop on Emerging Topological Techniques in

Robotics, ICRA 2019: International Conference on Robotics and Automation, Montreal, Canada, 2019.

3. **Ragesh Kumar Ramachandran**, and Spring Berman. "Topological Mapping Using a Heterogeneous Robotic Swarm". Workshop on Emerging Topological Techniques in Robotics, ICRA 2016: International Conference on Robotics and Automation, Stockholm, Sweden, 2016.

Invited talks

- "Topological Mapping using a Stochastic Robotic Swarm" Mechanical & Aerospace Engineering Seminar, Arizona State University, Tempe, Arizona USA, April 7, 2017.

Professional Service

- **Mentoring :** Mentored a graduate student (Nicole Fronda) in implement a resilient strategy for distributed target tracking. Mentored a graduate student(Vaibhav Deshmukh) in implementing a decentralized Markov chain based strategy on our robotic platform Pheeno using ROS.
- **Journal Review :** Robotica 2019, IEEE Robotics and Automation Letters 2019, Swarm Intelligence 2019, IEEE Control Systems Letters 2018 and IEEE Transactions on Automation Science and Engineering 2018, Autonomous Robots 2017.
- **Conference Review :** Robotics: Science and Systems(RSS) 2019, International Conference on Intelligent Robots and Systems (IROS) 2018, IEEE International Conference on Robotics and Automation (ICRA) 2016, International Symposium on Distributed Autonomous Robotic Systems (DARS) 2016 and International Conference on Intelligent Robots and Systems (IROS) 2015.

Peer-reviewed conference presentations

(P) = Presenter of a talk or poster

- **Ragesh K. Ramachandran***P* and Spring Berman. The effect of communication topology on scalar field estimation by large networks with partially accessible measurements. In Proceedings of the 2017 *American Control Conference (ACC)*, Seattle, WA, USA, May 24–26, 2017. Oral presentation.
- **Ragesh K. Ramachandran***P*, Sean Wilson, and Spring Berman. A probabilistic topological approach to feature identification using a stochastic robotic swarm. In To appear in the *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, 2016. Oral presentation.
- **Ragesh Kumar Ramachandran***P*, and Spring Berman. "Topological Mapping Using a Heterogeneous Robotic Swarm". Workshop on Emerging Topological Techniques in Robotics, ICRA 2016: International Conference on Robotics and Automation, Stockholm, Sweden, 2016. Poster presentation.
- **Ragesh K. Ramachandran***P*, Karthik Elamvazhuthi, and Spring Berman. An optimal control approach to mapping GPS-denied environments using a stochastic robotic swarm. In *International Symposium on Robotics Research (ISRR)*, 2015. Oral presentation.

Computer Skills

- **Languages/Software:** Python, C/C++, Matlab, Java, Basic, Visual Basic, Unix shell scripts, ROS, LaTeX, HTML, CSS, Javascript
- **Version control:** git, mercurial, svn

References

Gaurav Sukhatme
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