

Vishaal Krishnan

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RESEARCH INTERESTS

- **Complex Adaptive Systems and Robotics:** Design, analysis and control of large-scale robot swarms.
- **Control and Learning:** Optimal control, Robust control, Data-driven control, Cyber-physical security.
- **Navigation and Transport:** Multi-agent optimal transport, Navigation in complex environments.
- **Biology:** Animal navigation, Collective motion.

EMPLOYMENT

- **Harvard University** Cambridge, MA
Postdoctoral Fellow, School of Engineering and Applied Sciences
Jan 2022 to present
 - Advisor: Prof. L. Mahadevan
- **Lund University** Lund, Sweden
Postdoctoral Fellow (joint appointment with above), Department of Biology
Jan 2022 to present
 - Advisor: Prof. Marie Dacke
- **University of California, Riverside** Riverside, CA
Postdoctoral Scholar, Mechanical Engineering Department
Jan 2020 to Jan 2022
 - Advisor: Prof. Fabio Pasqualetti

RESEARCH ASSISTANTSHIPS AND INTERNSHIPS

- **University of California, San Diego** La Jolla, CA
Graduate Assistant, Mechanical and Aerospace Engineering Department
Oct 2014 to Dec 2019
 - Advisor: Prof. Sonia Martínez
- **Indian Institute of Technology, Madras** Chennai, India
Research Assistant, Electrical Engineering Department
Aug 2012 to May 2014
 - Advisor: Prof. Arun D. Mahindrakar
- **National Center for Biological Sciences** Bangalore, India
Research Assistant, Biomechanics and Motor Control Lab
May 2013 to Aug 2014
 - Advisor: Prof. Madhusudhan Venkadesan
- **GE Global Research** Bangalore, India
Research Intern, Electromechanical Control Systems Lab
May 2012 to Aug 2012
 - Advisor: Mr. Prashant Srinivasan

EDUCATION

- **University of California, San Diego** La Jolla, CA
Ph.D. in Engineering Sciences (Mechanical Engineering)
Sep 2014 – Dec 2019
 - **Dissertation:** Large-scale multi-agent transport: Theory, Algorithms and Analysis
 - **Committee:** Prof. Jorge Cortés, Prof. Miroslav Krstić, Prof. Lei Ni, Prof. Andrej Zlatos
- **University of California, San Diego** La Jolla, CA
M.S. in Engineering Sciences (Mechanical Engineering)
Sep 2014 – Jun 2015
- **Indian Institute of Technology, Madras** Chennai, India
B.Tech and M.Tech in Mechanical Engineering
Aug 2009 – Jun 2014

Journal Papers:

1. Data-Driven Feedback Linearization using the Koopman Generator,
D. Gadginmath, **V. Krishnan** and F. Pasqualetti,
In Review.
2. Distributed Online Optimization for Multi-Agent Optimal Transport,
V. Krishnan and S. Martínez,
In Review.
3. Learning Lipschitz Feedback Policies From Expert Demonstrations: Closed-Loop Guarantees, Robustness and Generalization,
A. Al Makdah, **V. Krishnan** and F. Pasqualetti,
IEEE Open Journal of Control Systems, 1, pp. 85–99, 2022.
4. A Multiscale Analysis of Multi-Agent Coverage Control Algorithms,
V. Krishnan and S. Martínez,
Automatica, Vol. 145, 110516, 2022.
5. Data-Driven Attack Detection for Linear Systems,
V. Krishnan and F. Pasqualetti,
IEEE Control Systems Letters, 5(2), pp. 671–676, 2021.
6. A Probabilistic Framework for Moving Horizon Estimation: Stability and Privacy Considerations,
V. Krishnan and S. Martínez,
IEEE Transactions on Automatic Control, 66(4), pp. 1817–1824, 2021.
7. Identification of critical nodes in large-scale spatial networks,
V. Krishnan and S. Martínez,
IEEE Transactions on Control of Network Systems, 6(2), pp. 842–851, 2019.
8. Distributed Control for Spatial Self-Organization of Multi-Agent Swarms,
V. Krishnan and S. Martínez,
SIAM Journal on Control and Optimization, 56(5), pp. 3642–3667, 2018.
9. Formation control and trajectory tracking of nonholonomic mobile robots,
A. Saradgi, V. Muralidharan, **V. Krishnan**, S. Menta and A. D. Mahindrakar
IEEE Transactions on Control Systems Technology, 26(6), pp. 2250–2258, 2017.

Refereed Conference Papers:

1. Behavioral Feedback for Optimal LQG Control,
A. Al Makdah, **V. Krishnan** and F. Pasqualetti,
IEEE Conference on Decision and Control, 2022, To Appear.
2. Direct vs Indirect Methods for Behavior-based Attack Detection,
D. Gadginmath, **V. Krishnan** and F. Pasqualetti,
IEEE Conference on Decision and Control, 2022, To Appear.
3. On Direct vs Indirect Data-Driven Predictive Control,
V. Krishnan and F. Pasqualetti,
IEEE Conference on Decision and Control, 2021.
4. Lipschitz Bounds and Provably Robust Training by Laplacian Smoothing,
V. Krishnan, A. Al Makdah and F. Pasqualetti,
Advances in Neural Information Processing Systems, 2020.

5. On Observability and Stability of Moving-Horizon Estimation in a Distributional Framework,
V. Krishnan and S. Martínez,
American Control Conference, Philadelphia, USA, July 2019.
6. Distributed optimal transport for the deployment of swarms,
V. Krishnan and S. Martínez,
IEEE Conference on Decision and Control, Miami Beach, USA, December 2018.
7. Identification of critical node clusters for consensus in large-scale spatial networks,
V. Krishnan and S. Martínez,
IFAC World Congress, Toulouse, France, July 2017.
8. Self-Organization in Multi-Agent Swarms via Distributed Computation of Diffeomorphisms,
V. Krishnan and S. Martínez,
Int. Symposium on Mathematical Theory of Networks and Systems, Minneapolis, USA, July 2016.

CONFERENCES AND INVITED TALKS

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| 1. Dynamics and Control Seminar, EE Dept., IIT Madras | <i>Invited talk, Aug 2022</i> |
| 2. Vision Group Seminar, Department of Biology, Lund University | <i>Invited talk, Apr 2022</i> |
| 3. 60th IEEE Conference on Decision and Control (CDC) | <i>Dec 2021</i> |
| 4. Optimization and Systems Theory Division, KTH Sweden | <i>Invited talk, Oct 2021</i> |
| 5. 2020 CDC Workshop on Data-Driven Control | <i>Invited talk, Dec 2020</i> |
| 6. 59th IEEE Conference on Decision and Control (CDC) | <i>Dec 2020</i> |
| 7. Advances in Neural Information Processing Systems (NeurIPS) | <i>Dec 2020</i> |
| 8. American Control Conference | <i>July 2019</i> |
| 9. CMS Caltech | <i>Invited talk, Mar 2019</i> |
| 10. 57th IEEE Conference on Decision and Control | <i>Dec 2018</i> |
| 11. 35th Southern California Control Workshop | <i>Nov 2018</i> |
| 12. ASME Int. Mechanical Engineering Education Leadership Summit | <i>Poster, Mar 2018</i> |
| 13. IFAC World Congress | <i>July 2017</i> |
| 14. 22nd Int. Symposium on Mathematical Theory of Networks and Systems | <i>July 2016</i> |

TEACHING

- **Teaching and Course TA:** MAE 247 – Cooperative Control of Multi-Agent Systems, Course TA for Prof. Martínez, Spring 2018. Taught several classes in Spring 2018 and 2019.

PROFESSIONAL SERVICE

- **Reviewer:** SIAM Journal on Control and Optimization, IEEE Transactions on Automatic Control, Automatica, IEEE Transactions on Control of Network Systems, IEEE Transactions on Robotics, Journal of Geometric Mechanics, IEEE Trans. on Signal and Information Processing over Networks, IEEE Conference on Decision and Control, American Control Conference, Proceedings of the Royal Society A.
- **Organizing committee:** Invited Session on Security and Privacy (American Control Conference, 2021).

GRADUATE AND UNDERGRADUATE RESEARCH MENTORING

1. Abed AlRahman Al Makdah (PhD, EE Dept., UC Riverside) *Apr 2020 to present*
2. Darshan Gadginmath (PhD, ME Dept., UC Riverside) *Apr 2021 to present*
3. Taosha Guo, PhD (ME Dept., UC Riverside) *Jan 2022 to present*
4. Melcior Pijoan Comas (Visiting undergraduate, MAE Dept., UC San Diego) *Jan-Nov 2019*

REFERENCES

1. Prof. Sonia Martínez, Professor, MAE Dept., UC San Diego soniamd@ucsd.edu
2. Prof. Jorge Cortés, Professor, MAE Dept., UC San Diego cortes@ucsd.edu
3. Prof. Fabio Pasqualetti, Professor, ME Dept., UC Riverside fabiopas@enr.ucr.edu
4. Prof. L. Mahadevan, Professor, SEAS, Harvard University lmahadev@g.harvard.edu
5. Prof. Marie Dacke, Professor, Dept. of Biology, Lund University marie.dacke@biol.lu.se