

SUBHRAJIT BHATTACHARYA

Associate Professor

Department of Mechanical Engineering and Mechanics, Lehigh University

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A. BIOGRAPHICAL INFORMATION

Educational History

M.S. and Ph.D., Mechanical Engineering and Applied Mechanics: (January 2012)

University of Pennsylvania, USA.

Ph.D. dissertation title: *Topological and Geometric Techniques in Graph Search-Based Robot Planning.*

Ph.D. supervisors: Prof. Vijay Kumar and Prof. Maxim Likhachev.

B.Tech., Mechanical Engineering: (June 2006)

Indian Institute of Technology, Kharagpur, India.

Employment History and Professional Experience

Associate Professor: (August, 2024 – present)

Department of Mechanical Engineering and Mechanics, Lehigh University, USA.

Assistant Professor: (August, 2016 – August, 2024)

Department of Mechanical Engineering and Mechanics, Lehigh University, USA.

Postdoctoral Researcher: (February 2012 – August 15, 2016)

Department of Mathematics, University of Pennsylvania, USA.

Supervisors: Prof. Vijay Kumar and Prof. Robert Ghrist.

B. PUBLICATIONS

Refereed Journal Publications

1. Alp Sahin, Nicolas Kozachuk, Rick S Blum and Subhrajit Bhattacharya, “*Spectrum Optimization of Dynamic Networks for Reduction of Vulnerability Against Adversarial Resonance Attacks*”, *Frontiers in Complex Systems: Complex Networks*, 2025, doi: 10.3389/frobt.2021.691637.
2. Alp Sahin and Subhrajit Bhattacharya, “*Topo-Geometrically Distinct Path Computation Using Neighborhood-Augmented Graph, and Its Application to Path Planning for a Tethered Robot in 3-D*”, *IEEE Transactions on Robotics*, vol. 41, pp. 20-41, 2025, doi: 10.1109/TRO.2024.3492386.
3. MohammadSaleh Teymouri and Subhrajit Bhattacharya, “*Landmark-based Distributed Topological Mapping and Navigation in GPS-denied Urban Environments Using Teams of Low-cost Robots*”. *Autonomous Agents and Multi-agent Systems*, 38(1), 6, Springer, 2024.
4. Xiaolong Wang, Alp Sahin and Subhrajit Bhattacharya, “*Coordination-free Multi-robot Path Planning for Congestion Reduction Using Topological Reasoning*”, *Journal of Intelligent and Robotic Systems (JINT)*, Springer Nature, 2023. DOI:10.1007/s10846-023-01878-3.
5. Subhrajit Bhattacharya, “*On some bounds on the perturbation of invariant subspaces of normal matrices with application to a graph connection problem*”, *Journal of Inequalities and Applications*, 1:75, Springer, 2022.
6. Xiaolong Wang, Matt Bilsky and Subhrajit Bhattacharya, “*Search-based Configuration Planning and Motion Control Algorithms for a Snake-like Robot Performing Load-intensive Operations*”, *Autonomous Robots (AURO)*, 45:1047-1076, Springer, 2021.
7. Leiming Zhang, Amanda Prorok and Subhrajit Bhattacharya, “*Pursuer Assignment and Control Strategies in Multi-Agent Pursuit-Evasion Under Uncertainties*”, *Frontiers in Robotics and AI*, 8:262, 2021. DOI:10.3389/frobt.2021.691637.
8. Leiming Zhang, Brian M. Sadler, Rick S. Blum and Subhrajit Bhattacharya, “*Inter-cluster Transmission Control Using Graph Modal Barriers*”, *IEEE Transactions on Signal and Information Processing over Networks*, 7:275-293, April, 2021. DOI:10.1109/TSIPN.2021.3071219.
9. Subhrajit Bhattacharya, “*Towards Optimal Path Computation in a Simplicial Complex*”, *International Journal of Robotics Research (IJRR)*, 38(8):981-1009, June, 2019. DOI: 10.1177/0278364919855422.

10. Bo Tian and Subhrajit Bhattacharya, “*Modelling and Control of a Spatial Dynamic Cable*”, *Acta Mechanica Sinica*, 35:866-878, Springer, Apr, 2019.
11. Subhrajit Bhattacharya and Robert Ghrist, “*Path Homotopy Invariants and their Application to Optimal Trajectory Planning*”, *Annals of Mathematics and Artificial Intelligence*, 84(3-4):139-160, Springer International Publishing, December, 2018.
12. Xiaolong Wang and Subhrajit Bhattacharya, “*A Topological Approach to Workspace and Motion Planning for a Cable-controlled Robot in Cluttered Environments*”, *IEEE Robotics and Automation Letters (RA-L)*, 3(3):2600-2607, July 2018. DOI: 10.1109/LRA.2018.2817684.
13. Dhanushka Kularatne, Subhrajit Bhattacharya and M Ani Hsieh, “*Going with the flow: a graph based approach to optimal path planning in general flows*”, *Autonomous Robots (AURO)*, 42(7):1369-1387, Springer, Oct, 2018. DOI: 10.1007/s10514-018-9741-6
14. Monroe Kennedy III, Dinesh Thakur, M. Ani Hsieh, Subhrajit Bhattacharya and Vijay Kumar, “*Optimal Paths for Polygonal Robots in SE(2)*”, *ASME Journal of Mechanisms and Robotics*, 10(2):021005-021005-8, Feb, 2018. DOI:10.1115/1.4038980.
15. Dhanushka Kularatne, Subhrajit Bhattacharya and M. Ani Hsieh, “*Optimal Path Planning in Time-Varying Flows using Adaptive Discretization*”, *IEEE Robotics and Automation Letters (RA-L)*, 3(1):458-465, 2017.
16. Sikang Liu, Michael Watterson, Kartik Mohta, Ke Sun, Subhrajit Bhattacharya, Camillo Jose Taylor and Vijay Kumar, “*Planning Dynamically Feasible Trajectories using Safe Flight Corridors in 3-D Complex Environments*”, *IEEE Robotics and Automation Letters (RA-L)*, 2(3):1688-1695, January, 2017.
17. Rattanachai Ramaithitima, Michael Whitzer, Subhrajit Bhattacharya and Vijay Kumar, “*Automated Creation of Topological Maps in Unknown Environments Using a Swarm of Resource-Constrained Robots*”, *IEEE Robotics and Automation Letters (RA-L)*, 1(2):746–753, January, 2016. DOI: 10.1109/LRA.2016.2523600.
18. Subhrajit Bhattacharya, Robert Ghrist and Vijay Kumar, “*Persistent Homology for Path Planning in Uncertain Environments*”, *IEEE Transactions on Robotics (T-RO)*, 31(3):578-590, April, 2015. DOI: 10.1109/TRO.2015.2412051.
19. Subhrajit Bhattacharya, Soonkyum Kim, Hordur Heidarsson, Gaurav Sukhatme and Vijay Kumar, “*A Topological Approach to using cables to separate and manipulate sets of objects*”, *International Journal of Robotics Research (IJRR)*, 34(6):799–815, April, 2015. DOI: 10.1177/0278364914562236.
20. Subhrajit Bhattacharya and Mihail Pivtoraiko, “*A Classification of Configuration Spaces of Planar Robot Arms for a Continuous Inverse Kinematics Problem*”, *Acta Applicandae Mathematicae*, 139(1):133-166, October 2015, Springer Netherlands. DOI: 10.1007/s10440-014-9973-1.
21. Subhrajit Bhattacharya, Robert Ghrist and Vijay Kumar, “*Multi-robot Coverage and Exploration on Riemannian Manifolds with Boundary*”. *International Journal of Robotics Research (IJRR)*, 33(1):113-137, October 2013, SAGE Publishers. DOI: 10.1177/0278364913507324.
22. Subhrajit Bhattacharya, David Lipsky, Robert Ghrist and Vijay Kumar, “*Invariants for Homology Classes with Application to Optimal Search and Planning Problem in Robotics*”, *Annals of Mathematics and Artificial Intelligence (AMAI)*, 67(3-4):251-281, March 2013, Springer. DOI: 10.1007/s10472-013-9357-7.
23. Subhrajit Bhattacharya, Maxim Likhachev and Vijay Kumar, “*Topological Constraints in Search-based Robot Path Planning*”, *Autonomous Robots (AURO)*, 33(3):273-290, October 2012, Springer Netherlands. DOI: 10.1007/s10514-012-9304-1.
24. Subhrajit Bhattacharya, Siddharth Talapatra, “*Robot Motion Planning Using Neural Networks: A Modified Theory*”, *International Journal of Lateral Computing*, Vol.2, No.1, December 2005, ISSN 0973-208X, 9-13.

Peer-reviewed Conference Publications

1. Alp Sahin and Subhrajit Bhattacharya, “*Topo-Geometrically Distinct Path Computation Using Neighborhood-Augmented Graph, and Its Application to Path Planning for a Tethered Robot in 3-D*”, In 2025 International Conference on Robotics and Automation (ICRA), May 19-23, 2025. [Paper peer-reviewed separately for ICRA conference and T-RO journal, and accepted for publication in T-RO with presentation in ICRA.]
2. Alp Sahin, Stephen Brawner, Matt Bilsky and Subhrajit Bhattacharya. “*Real-Time Joystick-based Kinematics Control of a Snake-like Robot with Robustness Near Singular Configurations*”, In 2024 IEEE Conference on

Control Technology and Applications (CCTA), pp. 663-668. IEEE, 2024.

3. Diego S. D'Antonio, Subhrajit Bhattacharya and David Saldana, "Forming and Controlling Hitches in Midair Using Aerial Robots". In 2023 International Conference on Robotics and Automation (ICRA), May 29-June 2, 2023.
4. Wenyng Wu, Subhrajit Bhattacharya and Amanda Prorok, "Multi-Robot Path Deconfliction through Prioritization by Path Prospects". In 2020 International Conference on Robotics and Automation (ICRA), May-Aug, 2020.
5. Leiming Zhang, Amanda Prorok and Subhrajit Bhattacharya, "Multi-Agent Pursuit-Evasion under Uncertainties with Redundant Robot Assignments", In IEEE International Symposium on Multi-Robot and Multi-Agent Systems. 22-23, August, 2019. [Extended abstract published.]
6. Xiaolong Wang and Subhrajit Bhattacharya, "A Topological Approach to Workspace and Motion Planning for a Cable-Controlled Robot in Cluttered Environments", In International Conference on Intelligent Robots (IROS). 1-5, October, 2018. [Paper peer-reviewed separately for IROS conference and RA-L journal, and accepted for publication in RA-L with presentation in IROS.]
7. Rattanachai Ramaithitima and Subhrajit Bhattacharya, "Landmark-based Exploration with Swarm of Resource Constrained Robots", In International Conference on Robotics and Automation (ICRA), 2018.
8. Monroe Kennedy III, Dinesh Thakur, M. Ani Hsieh, Subhrajit Bhattacharya and Vijay Kumar, "Optimal Paths for Polygonal Robots in $SE(2)$ ", In Proceedings of the ASME 2017 International Design Engineering Technical Conferences (IDETC). Cleveland, OH, USA, Aug, 2017.
9. Xin Li, Mooi Chuah and Subhrajit Bhattacharya, "UAV Assisted Smart Parking Solution", In 2017 International Conference on Unmanned Aircraft Systems (ICUAS). Miami, FL, USA, June, 2017.
10. Luis Guerrero-Bonilla, Kartik Mohta, Subhrajit Bhattacharya and Vijay Kumar, "Flight Trajectory Tracking and Recovery in Presence of Large Disturbances", In 2017 International Conference on Unmanned Aircraft Systems (ICUAS). Miami, FL, USA, June, 2017.
11. Sikang Liu, Michael Watterson, Kartik Mohta, Ke Sun, Subhrajit Bhattacharya, Camillo Jose Taylor and Vijay Kumar, "Planning Dynamically Feasible Trajectories using Safe Flight Corridors in 3-D Complex Environments", IEEE International Conference on Robotics and Automation (ICRA), May 29 - June 3, Singapore, 2017.
12. Sarah Costrell, Subhrajit Bhattacharya and Robert Ghrist, "Reconstruction of Euclidean Embeddings in Dense Networks", In Proceedings of the IEEE Global Conference on Signal and Information Processing (GlobalSIP). Washington, D.C., USA, IEEE Signal Processing Society, 7-9 Dec, 2016.
13. Rattanachai Ramaithitima, Siddharth Srivastava, Subhrajit Bhattacharya, Alberto Speranzon and Vijay Kumar, "Hierarchical Strategy Synthesis for Pursuit-Evasion Problems", In Proceedings of the European Conference on Artificial Intelligence (ECAI). August, 2016.
14. Michael Whitzer, James Keller, Subhrajit Bhattacharya, Vijay Kumar, Trevor Sands, Lee Ritholtz, Adrian Pope and Dean Dickmann, "In-Flight Formation Control for a Team of Fixed-Wing Aerial Vehicles", In Proceedings of The 2016 International Conference on Unmanned Aircraft Systems (ICUAS), June 2016.
15. Dhanushka Kularatne, Subhrajit Bhattacharya and M. Ani Hsieh, "Time and Energy Optimal Path Planning in General Flows", In Proceedings of the Robotics: Science and System (RSS), June 2016.
16. Rattanachai Ramaithitima, Michael Whitzer, Subhrajit Bhattacharya and Vijay Kumar, "Automated Creation of Topological Maps in Unknown Environments Using a Swarm of Resource-Constrained Robots", In Proceedings of IEEE International Conference on Robotics and Automation (ICRA), May 2016.
17. Subhrajit Bhattacharya and Robert Ghrist, "Path Homotopy Invariants and their Application to Optimal Trajectory Planning", In Proceedings of IMA Conference on Mathematics of Robotics (IMAMR), St Anne's College, University of Oxford, September 9-11, 2015.
18. Rattanachai Ramaithitima, Mickey Whitzer, Subhrajit Bhattacharya and Vijay Kumar, "Sensor Coverage of Unknown Environments by Robot Swarms Using Limited Local Sensing", In Proceedings of IEEE International Conference on Robotics and Automation (ICRA), May 2015.
19. Vijay Govindarajan, Subhrajit Bhattacharya and Vijay Kumar, "Human-Robot Collaborative Topological Explo-

- ration for Search and Rescue Applications*”, In International Symposium on Distributed Autonomous Robotic Systems (DARS), November 2014.
20. Chanyoung Jun, Subhrajit Bhattacharya and Robert Ghrist, “*Pursuit-Evasion Game for Normal Distributions*”, In Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), September 2014.
 21. Soonkyum Kim, Subhrajit Bhattacharya and Vijay Kumar, “*Path Planning for a Tethered Mobile Robot*”, In Proceedings of IEEE International Conference on Robotics and Automation (ICRA), May 2014.
 22. Soonkyum Kim, Subhrajit Bhattacharya, Robert Ghrist and Vijay Kumar, “*Topological Exploration of Unknown and Partially Known Environments*”, In Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Tokyo, Japan, November 3-7, 2013.
 23. Soonkyum Kim, Subhrajit Bhattacharya and Vijay Kumar, “*Dynamic Simulation of Autonomous Boats for Cooperative Skimming and Cleanup*”, In Proceedings of the ASME 2013 International Design Engineering Technical Conferences (IDETC), Portland, USA, August 4-7, 2013.
 24. Soonkyum Kim, Subhrajit Bhattacharya, Hordur Heidarsson, Gaurav Sukhatme and Vijay Kumar, “*A Topological Approach to Using Cables to Separate and Manipulate Sets of Objects*”. In Proceedings of the Robotics: Science and System (RSS), Sydney, Australia, June 24-28, 2013.
 25. Soonkyum Kim, Koushil Sreenath, Subhrajit Bhattacharya and Vijay Kumar, “*Optimal Trajectory Generation Under Homology Class Constraints*”, In 51st IEEE Conference on Decision and Control. 10-13 Dec., 2012.
 26. Soonkyum Kim, Koushil Sreenath, Subhrajit Bhattacharya and Vijay Kumar, “*Trajectory Planning for Systems with Homotopy Class Constraints*”. In 13th International Symposium on Advances in Robot Kinematics (ARK), Innsbruck, Austria, June 2012, Springer, Netherlands, pages 83-90.
 27. Subhrajit Bhattacharya, Robert Ghrist and Vijay Kumar, “*Multi-Robot Coverage and Exploration in Non-Euclidean Metric Spaces*”, In Proceedings of The Tenth International Workshop on the Algorithmic Foundations of Robotics (WAFR). 13-15 June, 2012.
 28. Subhrajit Bhattacharya, Maxim Likhachev and Vijay Kumar, “*Identification and Representation of Homotopy Classes of Trajectories for Search-based Path Planning in 3D*” (Original title: *Identifying Homotopy Classes of Trajectories for Robot Exploration and Path Planning*) [*Winner of Best Paper Award*], In Proceedings of Robotics: Science and Systems. 27-30 June, 2011.
 29. Subhrajit Bhattacharya, Hordur Heidarsson, Gaurav S. Sukhatme and Vijay Kumar, “*Cooperative Control of Autonomous Surface Vehicles for Oil Skimming and Cleanup*”, In Proceedings of IEEE International Conference on Robotics and Automation (ICRA). 9-13 May, 2011.
 30. Subhrajit Bhattacharya, Nathan Michael and Vijay Kumar, “*Distributed Coverage and Exploration in Unknown Non-Convex Environments*”, In Proceedings of 10th International Symposium on Distributed Autonomous Robotics Systems. 1-3 Nov 2010, Springer.
 31. Subhrajit Bhattacharya, Vijay Kumar and Maxim Likhachev, “*Search-based Path Planning with Homotopy Class Constraints*”, In Proceedings of The Third Annual Symposium on Combinatorial Search, [*non-archival*]. Atlanta, Georgia, 8-10 July, 2010.
 32. Subhrajit Bhattacharya, Vijay Kumar and Maxim Likhachev, “*Search-based Path Planning with Homotopy Class Constraints*”. In Proceedings of The Twenty-Fourth AAAI Conference on Artificial Intelligence. Atlanta, Georgia, 11-15 July, 2010.
 33. Subhrajit Bhattacharya, Vijay Kumar and Maxim Likhachev, “*Distributed Optimization with Pairwise Constraints and its Application to Multi-robot Path Planning*”. In Proceedings of Robotics: Science and Systems. Zaragoza, Spain, 27-30 June 2010, MIT Press.
 34. Subhrajit Bhattacharya, Maxim Likhachev and Vijay Kumar, “*Multi-agent Path Planning with Multiple Tasks and Distance Constraints*”. In Proceedings of IEEE International Conference on Robotics and Automation (ICRA). Anchorage, Alaska, 3-8 May 2010.
 35. Paul Vernaza, Maxim Likhachev, Subhrajit Bhattacharya, Sachin Chitta, Aleksandr Kushleyev and Daniel D. Lee, “*Search-based planning for a legged robot over rough terrain*”. In Proceedings of IEEE International Conference on Robotics and Automation (ICRA), pages 2380-2387, 12-17 May 2009.

36. Subhrajit Bhattacharya, Sachin Chitta, Vijay Kumar and Daniel Lee, “*Optimization of a Planer Quadrupeled Dynamic Leap*” [*Winner of MSC Simulation Software Award*], In Proceedings of 2008 ASME International Design Engineering Technical Conferences (IDETC), New York City, NY, 3-6 August, 2008.
37. Subhrajit Bhattacharya, “*A Study on Effect of Stiffener Geometry on the Modal Frequencies of a Rotating Disk with Radial Stiffeners using FEM and Analytical Methods*”, Proceedings of Ninth International Conference on Recent Advances in Structural Dynamics, University of Southampton on July 2006.
38. Subhrajit Bhattacharya, “*A study on a generalized wave equation for disturbances propagating through a one-dimensional medium placed in a two-dimensional space*”, Proceedings of International Conference on Theoretical, Applied, Computational and Experimental Mechanics, p. 235-237, Indian Institute of Technology, Kharagpur, 2004.

Editorials

1. Subhrajit Bhattacharya, Florian T. Pokorny and Howie Choset, “*Guest Editorial: Special issue on Topological Methods in Robotics*”. *Autonomous Robots (AURO)* Springer, 45:611-612, 2021.
2. *Associate Editor*, *Robotics and Automation Letters (RA-L)*, IEEE, 2025.

Selected Preprints

1. Jitian Liu, Nicolas Kozachuk and Subhrajit Bhattacharya, “*Distributed Optimization of Pairwise Polynomial Graph Spectral Functions via Subgraph Optimization*”, Electronic Pre-print, Nov 2025, arXiv:2511.11517 [cs.OC].
2. Subhrajit Bhattacharya, “*Trace of Multi-variable Matrix Functions and its Application to Functions of Graph Spectrum*”, Electronic Pre-print, Jan 2025, arXiv:2501.14515 [cs.FA].
3. Alp Sahin and Subhrajit Bhattacharya, “*Topo-Geometrically Distinct Path Computation using Neighborhood-augmented Graph, and its Application to Path Planning for a Tethered Robot in 3D*”, Electronic Pre-print, June 2023. arXiv:2306.01203 [cs.RO]. [*Complete publication in IEEE Transactions on Robotics, 2025.*]
4. Shunsaku Yadokoro and Subhrajit Bhattacharya, “*Weighted Combinatorial Laplacian and its Application to Coverage Repair in Sensor Networks*”, Electronic Pre-print, Apr 2024, arXiv:2312.04825 [cs.RO].
5. Xiaolong Wang, Alp Sahin and Subhrajit Bhattacharya, “*Coordination-free Multi-robot Path Planning for Congestion Reduction Using Topological Reasoning*”, Electronic Pre-print, 2022. arXiv:2205.00955 [cs.RO]. [*Complete publication in Journal of Intelligent and Robotic Systems (JINT), Springer Nature, 2023.*]
6. Zhan Gao, Subhrajit Bhattacharya, Leiming Zhang, Rick Blum, Alejandro Ribeiro and Brian M. Sadler, “*Training Robust Graph Neural Networks with Topology Adaptive Edge Dropping*”, Electronic Pre-print, June 2021. arXiv:2106.02892 [cs.LG].
7. Leiming Zhang, Amanda Prorok and Subhrajit Bhattacharya, “*Pursuer Assignment and Control Strategies in Multi-agent Pursuit-Evasion Under Uncertainties*”, Electronic Pre-print, March 2021. arXiv:2103.15660 [cs.RO]. [*Complete publication in IEEE International Symposium on Multi-Robot and Multi-Agent Systems, 2019.*]
8. Subhrajit Bhattacharya, “*On Some Bounds on the Perturbation of Invariant Subspaces of Normal Matrices with Application to a Graph Connection Problem*”, Electronic Pre-print, March 2021. arXiv:2103.09413 [cs.SP]. [*Complete publication in Journal of Inequalities and Applications (JIAP), Springer, 2022.*]
9. Mohammad S. Teymouri and Subhrajit Bhattacharya, “*Landmark-based Distributed Topological Mapping and Navigation in GPS-denied Urban Environments Using Teams of Low-cost Robots*”, Electronic Pre-print, 2021. arXiv:2103.03741 [cs.RO].
10. Leiming Zhang, Brian M. Sadler, Rick S. Blum and Subhrajit Bhattacharya, “*Inter-cluster Transmission Control Using Graph Modal Barriers*”, Electronic Pre-print, Oct, 2020. arXiv:2010.04790 [cs.SI]. [*Complete publication in IEEE Transactions on Signal and Information Processing over Networks (T-SIPN), 2021.*]
11. Subhrajit Bhattacharya and Robert Ghrist, “*Path Homotopy Invariants and their Application to Optimal Trajectory Planning*”, Electronic Pre-print, 2017. arXiv:1710.02871 [cs.RO]. [*Complete publication in Annals of Mathematics and Artificial Intelligence (AMAI), Springer International Publishing, 2018.*]
12. Subhrajit Bhattacharya, “*Approximate Structure Construction Using Large Statistical Swarms*”, Electronic Pre-print, June, 2017. arXiv:1706.03842 [cs.RO].

13. Subhrajit Bhattacharya, “A Search Algorithm for Simplicial Complexes”, Electronic preprint, July 2016. arXiv:1607.07009 [cs.DM]. [Complete publication in *International Journal of Robotics Research (IJRR)*, SAGE Publishers, 2019.]
14. Subhrajit Bhattacharya, “A General Continuous Inverse Kinematics Algorithm for a Planar Robot Arm”, Electronic Pre-print, September, 2013-14. [Complete publication in *Acta Applicandae Mathematicae*, 2014, Springer Netherlands.]
15. Subhrajit Bhattacharya and Mihail Pivtoraiko, “A Classification of Configuration Spaces of Planar Robot Arms with Application to a Continuous Inverse Kinematics Problem”, Electronic preprint, September 2013. arXiv:1309.7960 [math.DG] [Complete publication in *Acta Applicandae Mathematicae*, September 2014, Springer Netherlands.].
16. Subhrajit Bhattacharya, David Lipsky, Robert Ghrist and Vijay Kumar, “Invariants for Homology Classes with Application to Optimal Search and Planning Problem in Robotics”, Electronic preprint, 2012, arXiv: 1208.0573 [math.AT] [Complete publication in *Annals of Mathematics and Artificial Intelligence*, 2013].
17. Subhrajit Bhattacharya, Robert Ghrist and Vijay Kumar, “Relationship Between Gradient of Distance Functions and Tangents to Geodesics”, Electronic preprint, 2012. [Complete publication in *International Journal of Robotics Research (IJRR)*, 33(1):113-137, October 2013, SAGE Publishers.]

C. HONORS, RECOGNITIONS AND AWARDS

1. **Senior Member**, Institute of Electrical and Electronics Engineers (IEEE). (Dec 2025)
2. **Class of 1961 Professorship Award**, Lehigh University. (May 2025)
3. **NSF CAREER Award** on “*Topological Abstraction for Robot Path Planning*”. (May 2022)
4. **Best Paper Award** at the seventh Robotics: Science and Systems (RSS), University of Southern California, Los Angeles. (June 2011)
5. **MSC Simulation Software Award** at the 2008 ASME International Design Engineering Technical Conferences (IDETC), New York City, NY. (August 2008)
6. **Best Paper Award (students’)** at Second World Congress on Lateral Computing, 2005, Bangalore. (Dec, 2005)

D. RESEARCH FUNDING

Extramural

Competitively Awarded Research Grants (Current & Past):

1. “*Aerial Hitches: Forming and Controlling Hitches for Fully Autonomous Transportation Using Aerial Robots with Cables*”, National Science Foundation, \$599,429, 2024-2027. PI: David Saldana; co-PI: Subhrajit Bhattacharya.
2. “*Transmission Control in Complex Networks Using Modal Methods*”, Air Force Office of Scientific Research, \$498,433, 2022-2025. PI: Subhrajit Bhattacharya; co-PI: Rick Blum (Lehigh U.).
3. “*CAREER: Topological Abstraction for Robot Path Planning*”, National Science Foundation (FRR program), \$500,246, 2022-2027. PI: Subhrajit Bhattacharya.
4. “*Topological Representations and Algorithms for Robot Swarms*”, Office of Naval Research, \$613,126, 2014-16. PI: Vijay Kumar (U. of Pennsylvania); Senior/key person (in capacity of co-PI): Subhrajit Bhattacharya.
5. “*Human-robot peer-to-peer communication and coordination for tactical operations in urban environment*”, Army Research Laboratory, \$100,000 / year, 2009-17. PI: Dr. Vijay Kumar; Senior/key person (in capacity of co-PI): Subhrajit Bhattacharya.

Extramural Contract/Consulting Work:

1. “*Topological Representations and Algorithms for Robot Swarms*”, subaward from University of Pennsylvania, \$60,000 for 1 year, 2016-17. PI: Subhrajit Bhattacharya.

Intramural

Competitively Awarded Research Grants (Current & Past):

1. “*PITA XXIV: Intelligence and Autonomy Development for a Snake-like Cobot with Inspection and Maintenance Applications*”, Pennsylvania Infrastructure Technology Alliance, \$43,450, 2022-2023. PI: Subhrajit

Bhattacharya; co-PI: Aparna Bharati (Lehigh U.); Industrial Partner: Matthew Bilsky (FLX Solutions, Inc.).

2. “PITA XXIII: User-friendly Cobot Control Algorithms for Inspection and Repair Snake-like Robots”, Pennsylvania Infrastructure Technology Alliance, \$44,550, 2021-2022. PI: Subhrajit Bhattacharya (Lehigh U.); Industrial Partner: Matthew Bilsky (FLX Solutions, Inc.).
3. “PITA XXII: Algorithm Development for a Low-Cost, 3D Printed Snake-Like Robot for Inspection and Repair”, Pennsylvania Infrastructure Technology Alliance, \$49,500, 2020-2021. PI: Subhrajit Bhattacharya (Lehigh U.); Industrial Partner: Matthew Bilsky (FLX Solutions, Inc.).
4. “PITA XX: Systems-level Development of a Snake-like Robot with Construction, Inspection, Aerospace, and Disaster Recovery Applications”, Pennsylvania Infrastructure Technology Alliance, \$40,000, 2018-2019. PI: Subhrajit Bhattacharya (Lehigh U.); Industrial Partner: Matthew Bilsky (FLX Solutions, Inc.).

E. EDITOR/EDITORIAL REVIEW BOARD MEMBERSHIPS

1. Subhrajit Bhattacharya, Florian T. Pokorny and Howie Choset, “Guest Editorial: Special issue on Topological Methods in Robotics. Autonomous Robots (AURO) Springer, 45:611-612, 2021.
2. Associate Editor, Robotics and Automation Letters (RA-L), IEEE, 2025.

F. SCHOLARLY PRESENTATIONS

Invited Presentations

1. Subhrajit Bhattacharya, “Optimal Multi-path Planning – From Topology to Geometry”, at the AMS Special Session on Topological and Algebraic Properties of Additive Manufacturing, at the 2025 Joint Mathematica Meeting (JMM) (January 2025).
2. Subhrajit Bhattacharya, “Recent Advances in Topological Path Planning” at the 2023 SIAM-NNP Annual Meeting (October 2023).
3. Subhrajit Bhattacharya, “Planning and Control on Riemannian Manifolds with Boundaries” at the workshop on “Bringing geometric methods to robot learning, optimization and control” at the 2020 International Conference on Intelligent Robots and Systems (IROS).
4. Subhrajit Bhattacharya, “Topological Representations in Planning” at the weekly seminar of the Search-based Planning Lab, Robotics Institute, Carnegie Mellon University, Nov 22, 2019.
5. Subhrajit Bhattacharya, “Recent Advances in Topological Path Planning” at the 2018 AMS Sectional Meeting on Applied Algebraic Topology, Newark, Delaware, September 29-30, 2018..
6. Subhrajit Bhattacharya, “Some Applications of Topological Motion Planning” at the Topological Robotics seminar, Department of Mathematics, Lehigh University, April 2017.
7. Subhrajit Bhattacharya, “Homotopy Invariants and Their Applications to Optimal Motion Planning” at the Topological Robotics seminar, Department of Mathematics, Lehigh University, October 2016.
8. Subhrajit Bhattacharya, “Topological Methods in Robot Motion Planning” at the EECS Friday seminar, University of California, Berkeley, January 15, 2016.
9. Subhrajit Bhattacharya, “Path Homotopy Invariants and their Application to Optimal Trajectory Planning” at the Applied Topology Seminar, University of Pennsylvania, October 19, 2015.
10. Subhrajit Bhattacharya, “Effective path planning for end effector of high-DOF planar robot arms through Reeb graph construction” at the Mathematics Colloquium, Lehigh University, April 22, 2015.
11. Subhrajit Bhattacharya, “Topological Techniques in Graph Search-based Motion Planning” at the Geometry-Topology Seminar, University of Pennsylvania, Feb 12, 2015.
12. Subhrajit Bhattacharya, “Topological Techniques in Graph Search-based Robot Planning” at the IMA Annual Workshop on “Topological Systems: Communication, Sensing, and Actuation”, University of Minnesota, March 3-7, 2014.
13. Subhrajit Bhattacharya, “Topological Techniques in Graph Search-based Planning” as part of the Center for Foundations of Robotics’ seminar series at the Carnegie Mellon University, Pittsburgh, Nov 18, 2013.
14. Subhrajit Bhattacharya, Maxim Likhachev and Vijay Kumar “Search-based Path Planning with Homotopy Class Constraints in 3D” at the sub-area spotlights track on ‘Best-paper talks’ of the Twenty-Sixth Conference on

Artificial Intelligence (AAAI-12), July 22-26, 2012. [*Because of inability to travel, the presentation was made by Prof. Maxim Likhachev.*]

15. Subhrajit Bhattacharya, A talk on the ‘Littledog’ Robot and ‘Learning Locomotion’ project for an undergraduate level class on robotics at the Swarthmore College, Pennsylvania, April 15, 2008. Invited by Prof. Ani M. Hsieh.

Organized or Chaired Sessions

1. *Chair*; sessions on “UAS Control - I” and “UAS Applications - V”, at the 2017 International Conference on Unmanned Aircraft Systems (ICUAS), June 13-16, 2017.

Workshops and Tutorial Talks:

1. “*Recent Advances in Topological Path Planning*” at the Workshop on *Topological Methods in Robot Planning*, IEEE International Conference on Robotics and Automation (ICRA), May 2019. (co-organized by Subhrajit Bhattacharya, Florian T. Pokorny and Vijay Kumar).
2. “*Topological motion planning*” at the Workshop on *Emerging Topological Techniques in Robotics*, IEEE International Conference on Robotics and Automation (ICRA), May 2016. (Workshop co-organized by Subhrajit Bhattacharya, Vijay Kumar, Florian T. Pokorny and Subramanian Ramamoorthy).

G. TEACHING AND RESEARCH ADVISING

Teaching

Courses Taught:

- ME 205: Applications of Differential Equations in Mechanical Engineering; Fall 2025, 2024, Lehigh University. *Instructor*. Description: *Undergraduate-level course on applications of differential equation in mechanical engineering problems.*
- ME 295: Mathematical Applications in Mechanical Engineering; Spring 2023, Lehigh University. *Instructor*. Description: *Undergraduate-level course on applications of differential equation in mechanical engineering problems.*
- Mech 102: Dynamics; Fall 2025, 2023, 2022, 2021, 2020, 2019, 2018, 2017, 2016, Spring 2024, Lehigh University. *Instructor*. Description: *Undergraduate-level course on Dynamics.*
- ME 435: Robot Motion Planning and Control; Spring 2026, Fall 2023, 2021, 2020, 2019, 2018, Lehigh University. *Instructor*. Description: *Graduate-level course on motion planning, coverage exploration and control.*
- Mech 425: Analytical Methods in Dynamics and Vibrations; Spring 2026, 2025, 2024, 2023, 2022, 2021, 2020, 2019, 2017, Lehigh University. *Instructor*. Description: *Graduate-level course on Dynamics and Vibration, covering topics that include Lagrangian & Hamiltonian mechanics and rigid-body dynamics.*
- Math 114: Calculus II; Spring 2016, University of Pennsylvania. *Instructor*. Description: *Undergraduate-level course on vector and multi-variable calculus.*
- Math 170: Ideas in Mathematics; Fall 2015, 2014 University of Pennsylvania. *Instructor*. Description: *Undergraduate level course on topics in mathematics including sets theory, logic, topology, graph theory, geometry, and their applications.*
- MEAM 899: Introduction to Topology and Differential Geometry for Application to Robotics; Fall 2014, University of Pennsylvania. *Instructor*. Description: *Graduate-level independent study for first and second year graduate students pursuing research in Robotics.*
- Engineering Pre-freshman Program on Mathematics; Summer 2014, University of Pennsylvania. *Co-instructed* with Dr. Robert Ghrist and Dr. Vidit Nanda. Description: *Math 103 level undergraduate calculus course for incoming first year undergraduate students.*
- MEAM 899: Independent study on Topics in Robotics; Fall 2012, University of Pennsylvania. *Co-instructed* with Dr. Koushil Sreenath and Steven Gray. Description: *Graduate-level independent study for first and second year graduate students pursuing research in Robotics. Was responsible for lectures on “Configuration Spaces and Topology”.*

Teaching Assistant:

- “Calculus: Single Variable”; Summer 2014, Spring 2014. Coursera massive open online course (MOOC) instructed by Prof. Robert Ghrist.
- MEAM 535: Advanced Dynamics; Fall 2010, Fall 2007. Graduate level course instructed by Prof. Vijay Kumar

and Prof. Michael A. Carchidi.

- CSE 390: Robotics and Automation; Fall 2008. Graduate & undergraduate level course instructed by Prof. Jonathan Fiene and Prof. Jianbo Shi.
- MEAM 211: Engineering Mechanics: Dynamics; Spring 2008. Undergraduate level course instructed by Prof. Michael A. Carchidi and Prof. Jonathan Fiene.

Outreach:

- A “Capture-the-flag” Activity using a Team of Ground Robots for Teaching Fundamentals of Robot Motion Planning and Control; June 2023, Lehigh University. *Principal Organizer, Instructor* at the 2023 Lehigh CHOICES camp. Description: *CHOICES is a engineering and science outreach program for middle-school girls.*
- Presentations and demonstrations at the AIR lab for the LWE PreLUision program; July 2022, Lehigh University. *co-organizer.* Description: *PreLUision is a summer pre-orientation experience offered for female students starting at Lehigh in the Fall.*
- Delivered lessons on “Fundamentals of Robot Motion Planning and Control” and organized a “Capture-the-flag” Activity using a Team of Ground Robots; June 2022, Lehigh University. *Principal Organizer, Instructor* at the 2022 Lehigh CHOICES camp. Description: *CHOICES is a engineering and science outreach program for middle-school girls.*
- Short course: Fundamentals of Robot Motion Planning and Control; March 2021, Lehigh University. *Instructor* at the 2021 Lehigh CHOICES camp. Description: *CHOICES is a engineering and science outreach program for middle-school girls.*

Advising – Research Direction

Doctoral Students:

1. *Kumara Ritvik Oruganti* (Fall 2025 – present)
2. *Crockett Hensley* (Fall 2025 – present); Co-advised with Cristian Vasile
3. *Jitian Liu* (Summer 2024 – present)
4. *Alp Sahin* (Fall 2021 – present)
5. *Xiaolong Wang* (Fall 2018 – March 2022)
6. *Leiming Zhang* – Graduated (Spring 2018 – August 2021)
7. *Rattanachai Ramaithitima* – Graduated from University of Pennsylvania; Co-advised with Dr. Vijay Kumar (2016 – 2019)

Masters Students:

1. *Nicolas Kozachuk* (Fall 2023 – Spring 2025). Research topic: *Graph Eigenspectrum Optimization Methods.*
2. *Zhenyu Jin* (Fall/Winter 2022). Research topic: *Control Algorithms of a Snake-like Robot.*
3. *Chenkai Ou* (Summer 2022). Research topic: *Joystick-based User-interface Development for a Snake-like Robot.*
4. *MohammadSaleh Teymouri* (Fall 2017 – Summer 2021). Research topic: *Towards Optimal Landmark Distribution for Landmark-based Localization and Mapping with Directional Sensors.*
5. *Yutian Wang* (Spring 2019 – Summer 2020). Research topic: *Analysis of Configuration Classes and Numerical Computation of Vital Critical Points for a Planar Robotic Arm in a Domain with Point Obstacles.*
6. *Sagar Jagina* (Spring 2018 – Spring 2019). Research topic: *Reconstruction of Euclidean Embedding of a Landmarks Complex from Noisy Distance Measurements.*
7. *Xiaolong Wang* (Summer 2017 – Spring 2018). Research topic: *A Topological Approach to Workspace and Motion Planning for a Cable-controlled Robot in Cluttered Environments.*
8. *Leiming Zhang* (Summer & Fall 2017) Research topic: *Multi-agent Pursuit-Evasion Under Sensing Uncertainties.*
9. *Bo Tian* (Summer 2017 – Spring 2018) Research topic: *Shape Control of a Spatial Cable.*
10. *Chengwei Zhao* (Fall 2017) : Research topic: *Visual Homing based Control of Spatial Robots.*

Undergraduate Students:

1. *Nick Kozachuk* (Summer 2023): Research topic: *Adversarial Resonance Attack in Networks with Second Order Dynamics*.
2. *Jitong Ding* (Summer 2021): Research topic: *Multi-robot experimentation for “Topological Trajectory Planning for Large Swarms in Dynamic Unpredictable Environments”*.
3. *Jennie-Rose Barrella* (Fall 2017): Research topic: *Assembly, testing and controller development for a Raspberry Pi based robot*.
4. *Brook Glassman* (Summer/Fall 2017): Research topic: *Assembly, testing and controller development for a Raspberry Pi based robot*.
5. *Xinyue Shi* (Spring 2017): Research topic: *Development and Testing of Controllers and Algorithms for a Quad-Copter*.
6. *Vijay Govindarajan* – Co-supervised with Prof. Vijay Kumar (Spring 2013 – Spring 2015), U. of Pennsylvania

H. SERVICE

University

Service to University:

- *Member, Faculty Senate*, Lehigh University, Fall 2024 - present.
 - *Member / Faculty Senate Representative, University Faculty/Staff Benefits Review Working Group*, Summer 2025 - present.
 - *Member, Senate Subcommittee on Course and Curriculum*, Lehigh University, Fall 2024 - Spring 2025.
- *Faculty Recruitment Ambassador*, Lehigh University, Fall 2023 - Spring 2024.
- *Member, Disciplinary Appeals Committee*, Lehigh University, Fall 2017 - Summer 2021.
- *Member, Algebraic Geometry Search Committee*, Department of Mathematics, Lehigh University, Fall 2017.

Service to College:

- *Member, Rossin Awards Committee*, Lehigh University, Spring 2025.
- *Chair, Robotics Search Committee*, Lehigh University, Fall 2023 - Spring 2024.
- *Member, Rossin Awards Committee*, Lehigh University, Spring 2024.
- *Member, Robotics Search Committee*, Lehigh University, Fall 2022 - Spring 2023.
- *Member, CSE Department Search Committee*, Lehigh University, Fall 2020.
- *Member, CSE Department Search Committee*, Lehigh University, Fall 2019 - Spring 2020.
- *Member, Robotics and Controls Search Committee*, College of Engineering and Applied Science, Lehigh University, Fall 2018-2019.
- *Member, Robotics and Controls Search Committee*, College of Engineering and Applied Science, Lehigh University, Fall 2017-2018.

Service to Department:

- *Member, MEM Graduate Admissions Committee*, Mechanical Engineering and Mechanics, Lehigh University, Fall 2024-present.
- *Member, Graduate Curriculum & Advisory Committee*, Mechanical Engineering and Mechanics, Lehigh University, Fall 2016-present.

Professional

- *Associate Editor*, IEEE Robotics and Automation Letters (RA-L), Summer 2025 - present.
- *Meta-reviewer*, *Robotics Science and Systems (RSS) Pioneers Program*, 2024.
- *Lead guest editor*, special issue on “Topological Methods in Robotics”, *Autonomous Robots*, Springer, May 2019 - June 2021.
- *Co-organizer*, Workshop on “Geometry and Topology in Robotics: Learning, Optimization, Planning, and Control”, *Robotics Science and Systems (RSS)*, July 2021.
- *Senior Program Committee member*, 29th International Joint Conference on Artificial Intelligence and the 17th Pacific Rim International Conference on Artificial Intelligence (IJCAI-PRICAI), 2020.

- *Co-organizer*, Workshop on “Topological Methods in Robot Planning”, IEEE International Conference on Robotics and Automation (ICRA), May 2019.
- *Proposal review panel member*, National Science Foundation (NSF), June 2018, February 2022, March 2023.
- *Ad-hoc proposal reviewer*, Army Research Office, Sept 2021.
- *Chair*, sessions on “UAS Control - I” and “UAS Applications - V”, at the 2017 International Conference on Unmanned Aircraft Systems (ICUAS), June 13-16, 2017.
- *Member of Doctoral Thesis Committees*: Diego Salazar-D’Antonio (CSE, Lehigh U., Fall 2024 – present); Kaier Liang (MEM, Lehigh U., Spring 2023 – present); Disha Kamale (MEM, Lehigh U., Fall 2022 – present); Gustavo A. Cardona (MEM, Lehigh U., Fall 2022 – present); Sudarshan Kalidoss (MEM, Lehigh U., Spring 2018 – Spring 2023); Onur Denizhen (MEM, Lehigh U., Spring 2017 – present); Yaser Ghaedsharaf (MEM, Lehigh U., Fall 2018 – Spring 2019, graduated in Spring 2019); Monroe Kennedy III (U. of Pennsylvania, Fall 2017 – Spring 2019, graduated in Spring 2019); Hossein K. Mousavi (MEM, Lehigh U., Fall 2017 – Fall 2019, graduated in Fall 2019); Mirsaleh Bahavarnia (MEM, Lehigh U., Spring 2017 – Spring 2018, graduated in Spring 2018); Robert Short (Department of Mathematics, Lehigh U., Spring 2017 – Spring 2018, graduated in Spring 2018); Dhanushka Kularatne (Drexel U., Fall 2016 – Fall 2017, graduated in Fall 2017);
- *Interviewer*, Penn Alumni Interview Program, 2017.
- Reviewer for: *Physical Review E* 2025; *Journal of Artificial Intelligence Research (JAIR)* 2025; *IEEE Robotics and Automation Letters (RA-L)* 2016–2025; *IEEE Transactions on Robotics (T-RO)*: 2012, 2014, 2019, 2022–2024; *International Journal of Robotics Research (IJRR)*: 2011, 2012, 2015, 2016, 2024; *Annals of Mathematics and Artificial Intelligence (AMAI)*, Springer: 2024; *IEEE Transactions on Industrial Informatics (TII)*: 2024; *IEEE International Conference on Intelligent Robots and Systems (IROS)* 2011–2016, 2018, 2020–2023, 2025; *IEEE International Conference on Robotics and Automation (ICRA)* 2011–2018, 2021–2023; *Robotics: Science and Systems (RSS)* 2021, 2023; *J. Renewable Energy (RENE)* 2021, 2022, 2023; *Robotics and Autonomous Systems (ROBOT)* 2019, 2023; *Journal of Intelligent and Robotic Systems (JINT)*, Springer 2023; *Autonomous Agents and Multi-agent Systems*, Springer 2019; *IEEE International Symposium on Multi-robot and Multi-agent Systems* 2019; *Autonomous Robots (AURO)*, Springer 2012, 2016, 2017, 2019; *Journal of Applied Soft Computing* 2018; *International Conference on Unmanned Aircraft Systems (ICUAS)* 2018; *American Control Conference* 2018; *Indian Control Conference (ICC)*, 2018; *IEEE Transactions on Cybernetics* 2017; *Signal Processing Letters (SPL)* 2017; *Computational and Applied Mathematics (A Springer journal)* 2017; *Robotica (Cambridge University Press)* 2016, 2017; *Mediterranean Conference on Control and Automation (MED)* 2017; *International Journal of Mechanical Engineering (IJME)* 2016; *Automatica (An Elsevier journal)* 2015; *IEEE Conference on Decision and Control (CDC)* 2012 & 2013; *Tenth International Workshop on the Algorithmic Foundations of Robotics (WAFR)* 2012; *IEEE International Conference on Automation Science and Engineering (CASE)* 2011; *Distributed Autonomous Robotic Systems (DARS)* 2012; *ASME Journal of Dynamic Systems, Measurement and Control*: 2013; *ACM Transactions on Sensor Networks (TSN)*: 2012; *Proceedings of the National Academy of Sciences, India, Section A: Physical Sciences*: 2015; *ASME Journal of Mechanical Design*: 2015; *IEEE Transactions on Automatic Control*: 2015; A *TOP Grant Module submitted to The Netherlands Organisation for Scientific Research (NWO)* 2014.
- *Open-source Development and Community Projects*: *i.* Developer and maintainer of the DOSL (Discrete Optimal Search Library) C++ library [Project page: <https://github.com/subh83/DOSL>]; *ii.* A contributor to the PmWiki content management system – developed several modules for this wiki project [User page: <http://www.pmwiki.org/wiki/Profiles/Subhrajit>]; *iii.* A contributor to Wikipedia [User page: <http://en.wikipedia.org/wiki/User:Subh83>]
- *Co-organizer*, Workshop on “Emerging Topological Techniques in Robotics”, IEEE International Conference on Robotics and Automation (ICRA), May 2016.
- *Member of Conference Program Committees*: “International Symposium on Combinatorial Search” (SoCS), 2015, 2016, 2017, 2019; “Distributed Autonomous Robotic Systems” (DARS) conference, 2016; “International Joint Conference on Artificial Intelligence” (IJCAI) conference, 2016, 2020; “Intelligent Robotics and Multi-Agent Systems” (IRMAS) track of “ACM Symposium on Applied Computing” (SAC), 2016; “Robotics: Science and Systems” (RSS) conference, 2014;
- *Prize Committee*, Department of Mathematics, University of Pennsylvania, 2014-15.
- Volunteer for the The Twenty-Fourth AAAI Conference on Artificial Intelligence, 2010.

Other Professional Experiences:

- *Participant, member of the “Low-cost 3D Printed Snake-like Robots for Inspection and Repair” team, I-Corps Short Course, organized by New York City Regional Innovation Node (NYCRIN), Summer 2019.*