James D. Motes

University of Illinois Urbana-Champaign
jmotes2@illinois.edu | jamesmotes.github.io

EDUCATION AND TRAINING

Postdoctoral Researcher, University of Illinois Urbana-Champaign August 2023 - Present
Advisor: Dr. Nancy M. Amato

Ph.D. in Computer Science, University of Illinois Urbana-Champaign August 2023
Ph.D. Thesis: Multi-robot Task and Motion Planning in Hybrid State Spaces
Advisor: Dr. Nancy M. Amato

M.S. in Computer Science, Texas A&M University August 2019
M.S. Thesis: Interaction Templates for Multi-Robot Systems
Advisor: Dr. Nancy M. Amato

B.S. in Computer Engineering, Texas A&M University May 2018
Minor in Mathematics, Engineering Honors, Undergraduate Research Scholar
Undergraduate Thesis: Multi-Agent Persistent Task Performance
Advisor: Dr. Nancy M. Amato

RESEARCH INTERESTS

Multi-Robot Planning: Apply growing general intelligence within the complexity of multi-robot problems.

Human-Robot Co-planning: Develop co-planning systems in which humans and robots/AI jointly create and refine plans.

Hardware and Software Accelerated Planning: Design planning architectures that exploit modern HW/SW techniques.

Applications: Smart manufacturing and assembly; logistics and warehousing; agriculture; automated labs; healthcare and in-home assistive robotics

EXPERIENCE

Postdoctoral Researcher, Parasol Lab, University of Illinois Urbana-Champaign August 2023 - Present

- Lead multiple graduate research teams (17 graduate students across the lifetime of the projects, some carried over from Ph.D. Graduate Researcher position)
- Primary author for grant proposals (Submissions to NSF Foundational Research in Robotics, 6 industry collaborations)
- Lead software development for the open source deployment of the Parasol Planning Library (PPL)
- Develop theoretical frameworks for multi-robot planning with applications in autonomous factories, logistics, biofabrication labs, and mining
- Design interfaces for human-robot collaborative planning including natural language-conditioned motion planning and AR/VR interfaces for motion planning
- Leverage computational geometry techniques and GPU serialization for accelerating core motion planning algorithms in dynamic environments

Optigon Inc., Principal Software Engineer May 2024 - Present

- Lead software development for DOE SBIR-funded, high-throughput, non-contact spectroscopic metrology and analysis tools for clean-energy materials (e.g., perovskite photovoltaics)
- Advise on machine learning-based analytical models of solar cell behaviors

Normandy Automation, Founder May 2023 - August 2025

- Developed autonomous robotic manufacturing solutions
- Leveraged AI and multi-robot systems for just-in-time manufacturing with minimal human reprogramming
- Wrote NSF SBIR proposals for autonomous welding and CNC machine tending

QuickReports, Founder May 2023 - August 2025

- Developed software for healthcare management service organization business development teams
- Provided autonomously generated competition and demographics reports for brick and mortar healthcare practices

Lead Instructor, AI4ALL August 2021 - December 2023

- Instructor for Discover AI introductory artificial intelligence courses at the University of Texas at El Paso, New Mexico State University (Spring 2022), Worcester Polytechnic Institute (Fall 2022 and Spring 2023), and Texas A&M University (Fall 2022, Spring 2023, Fall 2023)
- Developed course curriculum for Discover AI introductory artificial intelligence course (Summer 2022)
- Led and mentored team of instructors at other universities
- Teaching assistant for Discover AI introductory artificial intelligence course at the University of Illinois Urbana-Champaign (Fall 2021)

Graduate Researcher, Parasol Lab, University of Illinois Urbana–Champaign August 2019 - August 2023

- Led graduate research team studying multi-robot planning
- Designed theoretical frameworks for large scale multi-robot task and motion planning with multiple publications in top robotics journals (IEEE T-RO and RA-L)
- Developed parallelized variants of core multi-agent pathfinding method
- Collaborated with Foxconn Interconnect Technologies and two other research labs at UIUC (Dr. Timothy Bretl, Dr. Katherine Driggs-Campbell) on a series of projects for a collaborative human-robot factory

Teaching Assistant, University of Illinois Urbana-Champaign January 2021 - May 2021

- Computer Science Ph.D. seminar course
- Organized guest speakers, managed grading and student assignments

Graduate Researcher, Parasol Lab, Texas A&M University May 2018 - August 2019

- Developed the Interaction Template Method for reusing expensive precomputed coordinated interactions (e.g., handoffs) in multi-robot task and motion planning
- Culminated in master's thesis and IEEE RA-L publication
- Mentored undergraduate researchers who contributed to the publication

Undergraduate Research Scholar, Parasol Lab, Texas A&M University September 2017 - May 2018

- Developed proactive multi-agent persistent task performance system under battery constraint
- Culminated in undergraduate thesis

Hewlett Packard Enterprise - Design Verification Engineer Intern May - August 2017

- Worked on Gen-Z Switch Fabric project within the Silicon Design Lab
- Developed VLSI Design Verification components utilizing Universal Verification Methodology (UVM)

HONORS

Engineering Graduate Merit Fellowship	August 2018 - August 2019
Presidential Endowed Scholarship	August 2014 - May 2018
Distinguished Student Award - Dwight Look College of Engineering	May 2017
Industrial Affiliates Program Scholarship	August 2014 - May 2018
Dell Merit Scholarship	August 2017 - May 2018
Salutatorian, Rowlett High School (2/591)	June 2014

PUBLICATIONS (14, Google Scholar citations = 329, h = 7 as of 01/30/2026) ****direct mentorship**

Journal Articles (11)

- C. McBeth,** **James D. Motes**, I. Ngui,** M. Morales, and N. M. Amato, "Scalable Multi-Robot Motion Planning Using Guidance-Informed Hypergraphs," *IEEE Robotics and Automation Letters (RA-L)*, conditionally accepted, 2026.
- S. Lee,** **James D. Motes**, I. Ngui,** M. Morales, and N. M. Amato, "Lazy-DaSH: Lazy Approach for Hypergraph-based Multi-Robot Task and Motion Planning," *IEEE Transactions on Robotics (T-RO)*, conditionally accepted, 2026.
- H. Lee,** **James D. Motes**, M. Morales, and N. M. Amato, "An Analysis of Constraint-Based Multi-Agent Pathfinding Algorithms," *IEEE Transactions on Robotics (T-RO)*, to appear, 2026.
- M. Qin,** I. Solis,** **James D. Motes**, M. Morales, and N. M. Amato, "K-ARC: Adaptive Robot Coordination for Multi-Robot Kinodynamic Planning," *IEEE Robotics and Automation Letters (RA-L)*, 2025. To be presented at the IEEE International Conference on Robotics and Automation (ICRA), Vienna, Austria, June 2026.
- I. Solis,** **James D. Motes**, M. Qin,** M. Morales, and N. M. Amato, "Adaptive Robot Coordination: A Subproblem-based Approach for Hybrid Multi-Robot Motion Planning," *IEEE Robotics and Automation Letters (RA-L)*, 2024. Presented at *IEEE ICRA@40*, Rotterdam, The Netherlands, Sept. 2024.

- C. McBeth,** **James D. Motes**, D. Uwacu, M. Morales, and N. M. Amato, "Scalable Multi-Robot Motion Planning for Congested Environments With Topological Guidance," *IEEE Robotics and Automation Letters (RA-L)*, 2023. Presented at *IEEE International Conference on Robotics and Automation (ICRA)*, Yokohama, Japan, May, 2024.
- **James D. Motes**, T. Chen, T. Bretl, M. M. Aguirre, and N. M. Amato, "Hypergraph-Based Multi-Robot Task and Motion Planning," *IEEE Transactions on Robotics (T-RO)*, 2023. Presented at the *IEEE International Conference on Robotics and Automation (ICRA)*, Yokohama, Japan, May 2024.
- H. Lee,** **James D. Motes**, M. Morales, and N. M. Amato, "Parallel Hierarchical Composition Conflict-Based Search for Optimal Multi-Agent Pathfinding," *IEEE Robotics and Automation Letters (RA-L)*, vol. 6, no. 4, pp. 7001–7008, 2021. Presented at *IEEE International Conference on Intelligent Robots and Systems (IROS)*, Prague, Czech Republic, 2021 (virtual).
- I. Solis,** **James D. Motes**, R. Sandström, and N. M. Amato, "Roadmap-Optimal Multi-Robot Motion Planning Using Conflict-Based Search," *IEEE Robotics and Automation Letters (RA-L)*, vol. 6, no. 3, pp. 4608–4615, 2021. Presented at *IEEE International Conference on Robotics and Automation (ICRA)*, Xi'an, China, 2021 (virtual).
- **James D. Motes**, R. Sandström, H. Lee,** S. Thomas, and N. M. Amato, "Multi-Robot Task and Motion Planning With Subtask Dependencies," *IEEE Robotics and Automation Letters (RA-L)*, vol. 5, no. 2, pp. 3338–3345, 2020. Presented at *IEEE International Conference on Robotics and Automation, Paris (ICRA)*, France, 2020 (virtual).
- **James D. Motes**, R. Sandström, W. Adams, T. Ogunyale,** S. Thomas, and N. M. Amato, "Interaction Templates for Multi-Robot Systems," *IEEE Robotics and Automation Letters (RA-L)*, vol. 4, no. 3, pp. 2926–2933, 2019. Presented at *IEEE International Conference on Intelligent Robots and Systems (IROS)*, Macao, China, 2019.

Refereed Conference Proceedings (2)

- A. Goddu, T. Brown, M. Paton, **James D. Motes**, and T. Chen, "Modifying ABIT* for Tethered Rappelling Robot Motion Planning," in *Proc. 2025 IEEE 21st International Conference on Automation Science and Engineering (CASE)*, pp. 722–728, 2025.
- S. Ashur, M. Lusardi, M. Markowicz, **James D. Motes**, M. Morales, S. Har-Peled, and N. M. Amato, "SPITE: Simple Polyhedral Intersection Techniques for Modified Environments," in *Algorithmic Foundations of Robotics XVI: Proc. the Sixteenth Workshop on the Algorithmic Foundations of Robotics*, 2024.

Workshop Papers (1)

- T. Chen, Z. Huang, **James D. Motes**, J. Geng, Q. Ta, H. Dinkel, H. Abdul-Rashid, J. Myers, Y. Mun, W. Lin, Y. Huang, S. Liu, M. Morales, N. M. Amato, K. Driggs-Campbell, and T. Bretl, "Insights from an Industrial Collaborative Assembly Project: Lessons in Research and Collaboration," in *IEEE ICRA Workshop on Collaborative Robots and the Work of the Future*, Philadelphia, USA, 2022.

UNDER REVIEW (8 as of 01/30/2026)

- Seongwon Lee,** **James D. Motes**, Marco Morales, and Nancy M. Amato, "PDDL-DaSH: Expanding Hypergraph Planning With Explicit and Implicit Query Strategies."
- Isaac Ngui*, Courtney McBeth*, **James D. Motes**, Marco Morales, and Nancy M. Amato, "Scalable Multi-Robot Motion Planning via Hierarchical Subproblem Expansion and Workspace Decomposition Refinement." *Equal contribution.
- Y. Arad,** M. Markowicz,** S. Ashur, **James D. Motes**, M. Morales, and N. M. Amato, "Serialized Red-Green-Gray: A Quick Heuristic Validation of Edges in Dynamic Roadmap Graphs."
- M. Markowicz,** Y. Arad,** S. Ashur, James D. Motes, M. Morales, and N. M. Amato, "Greedy Lazy SPITE: Heuristic Validation and Lazy Motion Planning With Dynamic Roadmap Graphs."
- I. Ngui, C. McBeth, A. Santos, G. He, K. J. Mimnaugh, **James D. Motes**, L. Soares, M. Morales, and N. M. Amato, "ERUPT: An Open Toolkit for Interfacing with Robot Motion Planners in Extended Reality," *arXiv* preprint arXiv:2510.02464, 2025.
- H. Lee,** Z. Serlin, **James D. Motes**, B. Long, M. Morales, and N. M. Amato, "PRISM: Complete Online Decentralized Multi-Agent Pathfinding With Rapid Information Sharing Using Motion Constraints," *arXiv* preprint arXiv:2505.08025, 2025.
- I. Solis,** **James D. Motes**, M. Qin,** M. Morales, and N. M. Amato, "Experience-Based Subproblem Planning for Multi-Robot Motion Planning," *arXiv* preprint arXiv:2411.08851, 2024.
- A. Attali, S. Ashur, I. B. Love,** C. McBeth,** **James D. Motes**, D. Uwacu, M. Morales, and N. M. Amato, "A Framework for Guided Motion Planning," *arXiv* preprint arXiv:2404.03133, 2024.

IN PREPARATION (3 as of 01/30/2026)

- **James D. Motes**, M. Markowicz,** S. Ashur, Y. Arad,** M. Morales, and N. M. Amato, "sLRS: Semi-Lazy Rearrangement Solver - Leveraging Dynamic Roadmap Graphs in Task and Motion Planning."
- M. Markowicz,** **James D. Motes**, I. Solis,** M. Morales, and N. M. Amato, "MR-SPITE: Leveraging Dynamic Roadmap Graphs in Multi-Robot Motion Planning."
- I. B. Love,** D. J. Lohan, **James D. Motes**, E. M. Dede, M. Morales, and N. M. Amato, "A Hierarchical Approach for the Generation of Varied Cable Harness Designs."

NON-PEER REVIEWED (8 as of 01/30/2026)

- M. Markowicz,** S. Ashur,** **James D. Motes**, and N. M. Amato, "Semi-Lazy Rearrangement Solver for Accelerating Task Planning Using SPITE Dynamic Roadmaps," in *Extended Abstract, 4th Workshop on Future of Construction: Safe, Reliable, and Precise Robots in Construction Environments (ICRA 2025)*, Atlanta, GA, USA, May 19, 2025.
- H. Lee,** **James D. Motes**, Z. Serlin, M. Morales, and N. M. Amato, "Distributed Constraint-Based Search Using Multi-Hop Communication," in *Extended Abstract, ICRA@40: 40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, Rotterdam, The Netherlands, Sept. 23–26, 2024.
- I. Ngui,** **James D. Motes**, H. Lee,** M. Morales, and N. M. Amato, "Ergonomic Motion Planning for Human-Robot Collaboration," in *Extended Abstract, ICRA@40: 40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, Rotterdam, The Netherlands, Sept. 23–26, 2024.
- K. Elimelech,* **James D. Motes,*** M. Morales, N. M. Amato, M. Vardi, and L. E. Kavraki, "Encoding Reusable Multi-Robot Planning Strategies as Abstract Hypergraphs," in *Extended Abstract, ICRA@40: 40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, Rotterdam, The Netherlands, Sept. 23–26, 2024. *Equal contribution.
- S. Lee,** **James D. Motes**, I. Ngui,** M. Morales, and N. M. Amato, "Lazy-DaSH: Lazy Approach for Hypergraph-based Multi-Robot Task and Motion Planning," in *Extended Abstract, ICRA@40: 40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, Rotterdam, The Netherlands, Sept. 23–26, 2024.
- M. Lusardi, M. Markowicz, S. Ashur, **James D. Motes**, M. Morales, S. Har-Peled, and N. M. Amato, "SPITE: Simple Polyhedral Intersection Techniques for Modified Environments," in *Extended Abstract, ICRA@40: 40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*, Rotterdam, The Netherlands, Sept. 23–26, 2024.
- I. Ngui,** S. Lee,** **James D. Mote**s, M. Morales, and N. M. Amato, "A Hierarchical Approach to Workstation-based Task-Allocation and Motion Planning," in *Extended Abstract, RAFF2023: Robotics & AI in Future Factory (IROS 2023 Workshop), IROS 2023*, Detroit, MI, USA, Oct. 1–5, 2023.
- A. Attali, S. Ashur, I. B. Love, C. McBeth, **James D. Motes**, D. Uwacu, M. Morales, and N. M. Amato, "Evaluating Guiding Spaces for Motion Planning," in *Extended Abstract, Evaluating Motion Planning Performance, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)*, Kyoto, Japan, Oct. 23, 2022.

FUNDING AUTHORSHIP

National Science Foundation (NSF) - Foundational Research in Robotics (FRR) Proposal September 2025
- Primary author on proposal for customizing robotic motion behaviors for non-expert users via natural language preference specification
- Collaboration with Natural Language Processing researchers at University of Illinois Urbana-Champaign

Industry Proposals and Whitepapers April 2025 - Present
- Primary author on six proposals (secondary author on three more) covering human-robot interaction, multi-robot planning, environment design, and leveraging data in planning

TALKS

- **February 2024 - Invited Lab Seminar.** "Multi-Robot Task and Motion Planning in Hybrid State Spaces." *Kavraki Lab, Department of Computer Science, Rice University*, Houston, TX
- **October 2019 - Invited Workshop Talk.** "Planning Motions and Tasks for Manipulators, Multi-Robot Systems and Biomolecules." *Center for Autonomy Portfolio Discovery Workshop, UIUC*, Urbana, IL

LEADERSHIP, MENTORING, AND PROFESSIONAL ACTIVITIES

Postdoctoral Researcher, University of Illinois Urbana-Champaign (UIUC) August 2023 - Present
- Mentor 17 graduate students (5 graduated), some carried over from Ph.D. Graduate Researcher
- Led to 5 published manuscripts, 7 under review, and 5 in preparation for submission in 2025 (15 total)

Houston Robotics Club August 2023 - Present
- Mentor community college and high school students on AI and robotics projects
- Several now enrolled in STEM undergraduate programs or at internships with local robotics companies

Graduate Researcher, UIUC and Texas A&M University May 2018 - August 2023

- Mentored graduate students (14) within my research group
- Mentored numerous undergraduate students, both local university students and DREU program students
- Led to 7 published manuscripts
- Taught motion planning course for new lab members (2019-2021)

Program Committee Member
- WAFR 2026
- WAFR 2024

Member of IEEE Robotics and Automation Society May 2019 - Present
Reviewer/Referee August 2018 - Present
- IEEE Robotics and Automation Letters (RA-L)
- IEEE Transactions on Robotics (T-RO)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Symposium on Multi-robot and Multi-agent Systems (MRS)
- World Symposium (formerly International Workshop) on Algorithmic Foundations of Robotics (WAFR)
- International Journal of Robotics Research (IJRR)