

Holly Dinkel

PH.D. CANDIDATE, ROBOTICS RESEARCHER (SHE/HER)

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Education

University of Illinois Urbana-Champaign (UIUC)

PH.D. AEROSPACE ENGINEERING (ANTICIPATED)

- Thesis: Representation and Manipulation of Deformable Linear Objects

Urbana, IL

May 2025

Stanford University

M.S. AERONAUTICS AND ASTRONAUTICS, GRADUATE SCHOOL OF BUSINESS ENTREPRENEURSHIP CERTIFICATE

Stanford, CA

June 2020

University of Missouri

B.S. CHEMICAL ENGINEERING, B.A. MUSIC

Columbia, MO

May 2017

Honors & Awards

INTERNATIONAL

2023	P.E.O. Scholar (110/825 doctoral applicants in the U.S. and Canada) , P.E.O. International	Des Moines, IA
2023	Amelia Earhart Graduate Fellow (30 awarded) , Zonta International	Oak Park, IL
2023	First Prize, Core Track of OpenCV AI Competition (7/45 teams) , OpenCV Foundation	San Francisco, CA
2022	Amelia Earhart Fellowship Finalist (30 awarded) , Zonta International	Buffalo, NY
2021	Best Technical Presentation Finalist (12/500 papers) , IAF GLEX Conference	St. Petersburg, Russia
2020	Space Cooperation Delegate (5% accepted) , Stanford U.S.-Russia Forum	Stanford, CA

NATIONAL

2022	Critical Language Scholar (Russian, 10% accepted) , U.S. Department of State	Washington D.C.
2021	Space Technology Graduate Research Opportunity Recipient (70 accepted) , NASA	Washington D.C.
2020	Graduate Assistant in Areas of National Need , U.S. Department of Education	Washington D.C.
2016	Nuclear Energy University Programs Scholar (30 awarded) , U.S. Department of Energy	Idaho Falls, ID
2015	Nuclear Energy University Programs Scholar (50 awarded) , U.S. Department of Energy	Idaho Falls, ID

REGIONAL

2023	Outstanding Graduate Student Award , UIUC Department of Aerospace Engineering	Urbana, IL
2021	Travel Grant Recipient , UIUC Grainger College of Engineering	Urbana, IL
2021	Graduate Fellow , Illinois Space Grant Consortium	Urbana, IL
2020	Mavis Future Faculty Scholar , UIUC Grainger College of Engineering	Urbana, IL
2019	Threshold Ventures Fellow (12/80 accepted) , Stanford Technology Ventures Program	Stanford, CA
2017	Magna Cum Laude with University Honors (3 ChE students awarded) , University of Missouri	Columbia, MO
2017	Phi Beta Kappa , University of Missouri	Columbia, MO
2015	Junior Scholar (2 awarded) , University of Missouri Honors College	Columbia, MO
2014	Sophomore Scholar (3 awarded) , University of Missouri Honors College	Columbia, MO
2012	Engineering Excellence Award , University of Missouri College of Engineering	Columbia, MO
2012	Curator's Scholar , University of Missouri	Columbia, MO
2012	Bright Flight Scholar (3% of MO students) , Missouri Department of Higher Education	Jefferson City, MO
2012	International Baccalaureate Diploma Recipient , St. Joseph Central High School	St. Joseph, MO
2012	Valedictorian (Rank: 1/354) , St. Joseph Central High School	St. Joseph, MO

Research Experience

NASA Ames Research Center

Moffett Field, CA

DEXTEROUS ROBOTICS LABORATORY VISITING RESEARCHER

March 2023 - June 2023, 40 hrs/week

- Developed object discovery and real-time scene change detection for the Astrobee free-flying robot on the International Space Station

UIUC Coordinated Science Laboratory

Urbana, IL

NASA GRADUATE RESEARCH FELLOW

June 2021 - Present, 40 hrs/week

- Lead the Representing and Manipulating Deformable Linear Objects (RMDLO) team comprising seven undergraduate students, one M.S. student, and research scientists in the NASA Ames Research Center Intelligent Robotics Group and the NASA Johnson Space Center Dexterous Manipulation Laboratory to study perception and manipulation of deformable linear objects with applications to robotic caretaking of space habitats
- Built a robot work cell and custom desktop computer from components (two ABB IRB 120 industrial manipulators, one OnRobot 2FG7 parallel-jaw gripper, DIGIT visuo-tactile sensors, an Intel RealSense RGBD camera, and state-of-the-art computing components)
- Developed, open-sourced, and published TrackDLO, a state-of-the-art algorithm for tracking the shape of wires and ropes from RGBD imagery
- Developed and open-sourced Python code for perceiving wire instances in RGB imagery by training a Mask R-CNN deep learning-based instance segmentation model on synthetic images

NASA Johnson Space Center

Houston, TX

DEXTEROUS ROBOTICS LABORATORY VISITING RESEARCHER

June 2022 - August 2022, 40 hrs/week

- Developed a system for perceiving a wire in RGBD imagery, computing the pose of the wire tip, and planning a path for a Sawyer robot arm to pick up the wire tip

UIUC Coordinated Science Laboratory

Urbana, IL

GRADUATE RESEARCH ASSISTANT

August 2020 - May 2021, 30 hrs/week

- Lead component selection and assembly of a robot work cell (two Universal Robots UR5 robot manipulators, two Robotiq Hand-E grippers, Intel RealSense and Basler cameras, two state-of-the-art computers for system monitoring and training deep learning-based perception models, a Baxter wheeled robot base for a mobile manipulator, and associated work benches and mounting equipment) used to solve an industrial assembly problem
- Developed real-time communication, control, and data interfacing for all components of the robotic work cell (the robots and their embedded force sensors, the grippers and their embedded force sensors, and the cameras)
- Developed automatic labeling of 30,000 instances of electronic components in camera imagery based on one manually-labeled image, saving hundreds of hours of image annotation, for training a Mask R-CNN instance segmentation model used in part pose estimation
- Developed an algorithm to estimate the pose of an electronic component from camera imagery by optimizing the Intersection-Over-Union score between an instance segmentation mask predicted by Mask R-CNN and a template mask

NASA Ames Research Center

Moffett Field, CA

INTELLIGENT ROBOTICS GROUP INTERN

June 2020 - August 2020, 40 hrs/week

- Developed deformable object perception, segmentation, and reconstruction for the Astrobee free-flying robot

NASA Ames Research Center

Moffett Field, CA

DISTRIBUTED SPACECRAFT AUTONOMY INTERN

March 2020 - June 2020, 30 hrs/week

- Developed Distributed Spacecraft Autonomy (DSA) tools for simulating lunar Positioning, Navigation, and Timing (PNT)
- Generated synthetic measurements among PNT assets considering line of sight, satellite attitude, noise, signal variation due to selected hardware or operational mode
- Developed distributed orbit determination and time synchronization algorithms
- Performed localization accuracy trade studies using DSA tools considering hardware and operational choices, asset locations, algorithm accuracy, and access to ground truth measurements

Stanford Assistive Robotic Manipulation (ARM) Laboratory

Stanford, CA

GRADUATE STUDENT RESEARCHER

January 2020 - Present, 6 hrs/week

- Studied fast motion planning for catching flying objects using a Franka Emika panda robotic manipulator

DOE Argonne National Laboratory

Lemont, IL

SCIENCE UNDERGRADUATE LABORATORY INTERN

January 2016 - August 2016, 40 hrs/week

- Studied the dissolution of Scandium, Yttrium, and Titanium in hydrochloric, sulfuric, and hydrogen fluoride acids to optimize a novel separation process for the production of electron linear accelerator-produced therapeutic and diagnostic medical radioisotopes
- Prepared scientific methods, results, and further studies of scandium medical radioisotope research for inclusion in U.S. patent No. 10344355, "Process for the separation and purification of scandium medical isotopes"
- Collected and analyzed radioactive decay data using Matlab for a project seeking to manufacture a Neptunium tracer for nuclear forensics use in the Argonne Analytical Chemistry Laboratory (ACL)

DOE Fermi National Accelerator Laboratory

Batavia, IL

LEE TENG FELLOW IN ACCELERATOR PHYSICS

May 2015 - August 2015, 40 hrs/week

- Computed particle position, momentum, time, and data group identification (PDGid) information for particles tracked in G4Beamline, a particle tracking simulation software
- Used G4Beamline data to collaborate on the design of a hadron monitor for the Long Baseline Neutrino Facility, comprising the world's highest-intensity neutrino beam. G4Beamline data enabled definition of the electric field and calculation of the number of electron-ion pairs within the monitor, as well as prediction of the spatial arrangement of the neutrino beam cross section incident on the monitor

University of Missouri Dept. of Chemical Engineering

Columbia, MO

HONORS UNDERGRADUATE RESEARCHER

August 2013 - August 2016, 6 hrs/week

- Simulated irradiation and isotopic depletion of small samples of uranium and thorium using OrigenARP and the TRITON sequence in the Oak Ridge National Laboratory-developed SCALE package to assess the risks involved with utilizing thorium as a fuel source in accelerator-driven, portable-power systems
- Assisted a graduate student with irradiation of lithium-intercalated graphite and radioactivity detection for advanced beta-voltaic battery research using the cyclotron at the University of Missouri Research Reactor (MURR)

University of Missouri Dept. of Molecular Microbiology and Immunology

Columbia, MO

RESEARCH ASSISTANT

August 2012 - May 2013, 10 hrs/week

- Assisted a graduate student with protein analysis of tetanus neurotoxin by completing ion-release assays and phase partitioning assays

Engineering Experience

NASA Marshall Space Flight Center

Huntsville, AL

PROBABILISTIC RISK ASSESSMENT (PRA) ANALYST, BASTION TECHNOLOGIES INC.

May 2017 - August 2018, 40 hrs/week

- Developed fault tree analyses for Artemis Program loss of mission and loss of crew scenarios
- Developed system-level PRAs for the Space Launch System upper stage reaction control system (RCS); core, booster, and upper stage thrust vector control systems; and ground systems
- Supported the development, review, and assessment of the Day-of-Launch I-Load Update (DOLILU) operations support plan, which determines the day-of-launch weather-dependent SLS trajectory optimization routines
- Awarded a Bastion Technologies contract-wide on-the-spot award for identifying an upper stage RCS design in violation of NASA's single-fault-tolerance requirement and presenting the risks of this design to the SLS chief safety officer
- Recruited and mentored a Bastion full-time employee and a NASA Pathways intern in PRA and supported their developments of the interim cryogenic propulsion stage RCS PRA and the exploration upper stage RCS PRA, respectively
- Analyzed system reliability of the self-propelled modular transporter to identify risks of transporting the SLS core stage between NASA centers
- Supported presentation of the integrated SLS PRA model to the SLS engineering review board
- Communicated PRA element model design and results to the NASA PRA team ahead of schedule, and developed a team template for all future presentations
- Collaborated with a NASA reliability engineer to collect historical space shuttle hydrazine leak data and analyze statistics on this data for use in SLS risk quantification

Skills

Programming Python, C++, Matlab, Bash, ROS, Git, Docker, LaTeX

Languages English (native), Mandarin Chinese (advanced), Russian (intermediate)

Grant Writing

NASA

Urbana, IL

SPACE TECHNOLOGY GRADUATE RESEARCH OPPORTUNITY

November 2021

- Wrote grant proposal for \$328,000 for four years of funding from the NASA Space Technology Graduate Research Opportunity program
- Grant title: Instance-Aware Semantic Mapping for Robotic Caretaking of Space Habitats
- Status: Awarded

DOE

Urbana, IL

FERMI NATIONAL LABORATORY OSCURA EXPERIMENT

February 2023

- Wrote grant proposal for \$2,321,112 for five years of funding to support manufacture of detectors for the Oscura Experiment
- Grant title: Robotic Work Cell for Assembling Multi-Chip Modules for Detectors for High-Energy Physics Experiments
- Status: Denied

NASA

Urbana, IL

NASA LUNAR SPACE TECHNOLOGY READINESS SOLICITATION

April 2023

- Wrote grant proposal for \$1,600,000 for two years of funding to support multi-agent robotic exploration of lunar craters
- Grant title: Robotic Exploration and Multi-Agent Teammate Extraction
- Status: Denied

Teaching Experience

UIUC

Urbana, IL

UNDERGRADUATE RESEARCH MENTOR

January 2021 - Present, 10 hrs/week

- Mentored undergraduate and graduate research through the following programs and courses:
 - Illinois Space Grant Consortium Undergraduate Research Opportunity Program (UROP)
 - Undergraduate Research Apprenticeship Program (URAP)
 - Promoting Undergraduate Research in Engineering (PURE)
 - AE 597: Graduate Independent Study
 - AE 497: Undergraduate Independent Study
 - AE 298: Undergraduate Research Mentoring
 - ECE 497: Senior Thesis
 - ECE 397: Undergraduate Independent Study
 - CS 397: Undergraduate Independent Study

Stanford Dept. of Aeronautics and Astronautics

Stanford, CA

GLOBAL POSITIONING SYSTEM (AA 115Q) COURSE DEVELOPMENT ASSISTANT

December 2019 - March 2020, 10 hrs/week

- Wrote and tested course projects involving using a sextant for celestial navigation and determining the accuracy of global positioning system measurements in the presence of interference

Stanford Athletic Academic Resource Center

Stanford, CA

ACADEMIC SKILLS TUTOR

September 2019 - June 2020, 6 hrs/week

- Facilitated undergraduate group tutorial sessions for Dynamics, Probabilistic Analysis, Introduction to Optimization, Mechanics of Materials, and Introduction to Single-Variable Calculus

Stanford Schwab Learning Center

Stanford, CA

ACADEMIC SKILLS TUTOR

January 2019 - June 2020, 5 hrs/week

- Provided individual tutoring to ensure academic success for students with attention-deficit hyperactivity disorder, dyslexia, and other learning disabilities for Dynamics and Physics: Light and Heat

University of Missouri Community Music Program

Columbia, MO

COMMUNITY MUSIC PROGRAM CLARINET INSTRUCTOR

August 2016 - May 2017, 5 hrs/week

- Coached clarinet performance techniques to middle- and high-school music students, stressing the importance of performance as a learning tool through encouraging every student to participate in a public recital each semester

Mentored Students

Various
May 2017 - Present

- **Achintya Gahalaut**, January 2023 - Present
Program: UIUC Undergraduate Research Apprenticeship Program
Project: Development of an Adaptive Gripper Finger Position and Force Controller
Current Junior in Computer Engineering
- **Justin Galardi**, May 2017 - August 2017
Program: Argonne National Laboratory Student Research Participation Program
Project: Scandium-47 Separation Chromatography
Graduated from SUNY Brockport in 2018, current Ph.D. Candidate in Biochemistry at the University of Rochester School of Medicine
- **Naixiang Gao**, January 2023 - Present
Program: ECE 397 Independent Research
Projects: Wire Tracking Under Occlusion
Current Senior in Computer Engineering
- **Cameron Hines**, May 2018 - August 2018
Program: NASA Pathways Internship Program at NASA Marshall Space Flight Center
Project: Space Launch System Interim Cryogenic Propulsion Stage Probabilistic Risk Assessment
Graduated from the Georgia Institute of Technology in 2019, current P.I. at NASA Marshall Space Flight Center
- **Zikun Liu**, August 2022 - Present
Program: UIUC Promoting Undergraduate Research in Engineering, ECE 397 Independent Research
Projects: Gripper Finger Design and Prototyping to Incorporate a Tactile Sensor in-hand, Optical Flow on Tactile Sensing Imagery
Current Sophomore in Computer Engineering
- **Raghavendra Navaratna**, August 2022 - Present
Program: AE 597 Independent Research
Projects: Coordinated Manipulation of Two Robotic Manipulators, Extrinsic Calibration of Two Robot Arms
Current Master's student in Aerospace Engineering
- **Yash Rathod**, August 2022 - August 2023
Program: UIUC Promoting Undergraduate Research in Engineering, CS 397 Independent Research
Projects: Open-Sourcing Automated Dataset Generation and Object Instance Segmentation Model Training, Deep Learning Model Training on Supercomputers, and Implementation of Mask Scoring R-CNN for Object Instance Segmentation
Current Junior in Computer Science
- **Fuad Samhouri**, August 2022 - May 2023
Program: AE 298 Undergraduate Research Mentoring, AE 497 Independent Research
Project: 3D Object Reconstruction from RGB Imagery with OpenSfM
Graduated from UIUC in 2023, current space roboticist at NASA Johnson Space Center
- **Jingyi Xiang**, January 2022 - Present
Program: UIUC Undergraduate Research Apprenticeship Program, Illinois Space Grant Consortium Undergraduate Research Opportunities Program, ECE 397 Independent Research Course, ECE 497 Senior Thesis
Projects: Automated Dataset Generation and Labeling for Training Instance Segmentation Models, Camera Extrinsic Calibration, Robotic Manipulator Control and Motion Planning, Wire Tracking Under Occlusion
Current UIUC Senior in Electrical Engineering
- **Harry Zhao**, January 2021 - August 2023
Program: AE 497 Independent Research, Illinois Space Grant Consortium Undergraduate Research Opportunity Program
Projects: Single-Shot Bounding Box Detection, Automated Dataset Generation and Labeling for Training Instance Segmentation Models, Proposal Writing
Graduated from UIUC in 2023, current M.S. student in Aeronautics and Astronautics at Stanford University

Outreach and Review

International Astronautical Federation (IAF) Abstract Mentor Program

Online

MENTOR

February 2023 - Present

- Review and provide feedback on abstracts submitted by young researchers to IAF events including the International Astronautical Congress

Robotics and Automation Letters

Online

REVIEWER

September 2021 - Present

- Review manuscripts submitted to *IEEE Robotics and Automation Letters*

Future Problem Solving Program

Melbourne, FL

GLOBAL ISSUES PROBLEM SOLVING EVALUATOR

October 2016 - June 2018

- Evaluated the feasibility and originality of solutions to future scenarios analyzed by interdisciplinary problem-solving students in an international writing competition to teach students how to think creatively about the future

References

- [1] T. Chen, Z. Huang, J. Motes, J. Geng, Q.M. Ta, **H. Dinkel**, H. Abdul-Rashid, J. Myers, Y.J. Mun, W.C. Lin, Y.Y. Huang, S. Liu, M. Morales, N. Amato, K. Driggs-Campbell, and T. Bretl. “*Insights from an Industrial Collaborative Assembly Project: Lessons in Research and Collaboration*”. In *Workshop on Collaborative Robots and Work of the Future at the IEEE International Conference on Robotics and Automation*, May 2022.
- [2] J. Cornelius, **H. Dinkel**, and A. Kurgan. “*Development of a Private Space Sector in the U.S. and Russia*”. In *IAF Global Space Exploration (GLEx) Conference*, June 2021.
- [3] F. Samhoury and **H. Dinkel**. “*3DRP: OpenSfM for Manipulating Deformable Objects*”. In *UIUC Coordinated Science Laboratory Student Conference*, February 2023.
- [4] J. Santos, **H. Dinkel**, J. Di, P. V.-K. Borges, M. Moreira, B. Coltin, and T. Smith. “*Unsupervised Change Detection for Space Habitats Using 3D Point Clouds*”. In *AIAA Scitech Forum*, January 2024.
- [5] M. Q. Ta*, **H. Dinkel***, H. Abdul-Rashid, Y. Dai, J. Myers, T. Chen, J. Geng, and T. Bretl. “*The Impact of Time Step Frequency on the Realism of Robotic Manipulation Simulation for Objects of Different Scales*”. In *Workshop on Robotics and AI in Future Factory at the IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2023.
- [6] **H. Dinkel*** and J. Cornelius*. “*Vela: A Data-Driven Proposal for Joint Collaboration in Space Exploration*”. In *IAF International Astronautical Congress (IAC)*, September 2022.
- [7] **H. Dinkel** and F. Hark. “*An Assessment of Launch Failures from 1989 - Present*”. In *Reliability, Availability, and Maintainability (RAM) X Training Summit*, October 2017.
- [8] **H. Dinkel** and K. Hashemi. “*Ground Asset Placement Optimization for Lunar Positioning, Navigation, and Timing*”. In *NASA Summer Intern Poster Symposium*, June 2020.
- [9] **H. Dinkel**, M. Bennett, M. A. Brown, and D. Rotsch. “*Separations and Chromatography Studies of Yttrium-90 for Radiolabeling Pharmaceuticals*”. In *Argonne National Laboratory Summer Research Symposium*, August 2016.
- [10] **H. Dinkel**, T. Bretl, B. Coltin, T. Smith, and M. Moreira. “*Conditional Variational Autoencoders on Astrobee RGB-D Imagery*”. In *NASA Summer Intern Poster Symposium*, August 2020.
- [11] **H. Dinkel***, J. Xiang*, H. Zhao, B. Coltin, T. Smith, and T. Bretl. “*Wire Point Cloud Instance Segmentation from RGBD Imagery with Mask R-CNN*”. In *Workshop on Representing and Manipulating Deformable Objects at the IEEE International Conference on Robotics and Automation*, May 2022.
- [12] **H. Dinkel***, J. Di*, J. Santos, K. Albee, P. V.-K. Borges, M. Moreira, O. Alexandrov, B. Coltin, and T. Smith. “*Multi-Agent 3D Map Reconstruction and Change Detection in Microgravity with Free-Flying Robots*”. In *IAF International Astronautical Congress (IAC)*, October 2023.
- [13] J. Xiang and **H. Dinkel**. “*Simultaneous Shape Tracking of Multiple Deformable Linear Objects with Global-Local Topology Preservation*”. In *Workshop on Representing and Manipulating Deformable Objects at the IEEE International Conference on Robotics and Automation*, May 2023.
- [14] J. Xiang, **H. Dinkel**, H. Zhao, N. Gao, B. Coltin, T. Smith, and T. Bretl. “*TrackDLO: Tracking Deformable Linear Objects Under Occlusion with Motion Coherence*”. In *IEEE Robotics and Automation: Letters*, September 2023.
- [15] K. Yonehara, R. Abrams, **H. Dinkel**, B. Freemire, and R. Johnson. “*Gas Filled RF Resonator Hadron Beam Monitor for Intense Neutrino Beam Experiments*”. In *International Conference on Particle Accelerator Physics*, May 2016.