

# Curriculum Vitae

Grace Gao

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## Academic Appointments

### Assistant Professor

2019–present

James and Anna Marie Spilker Faculty Fellow

Department of Aeronautics and Astronautics

Department of Electrical Engineering (by courtesy)

Director, Navigation and Autonomous Vehicles Laboratory (Stanford NAV Lab)

Co-Director, Stanford Center for AI Safety

Co-Lead, Robotics and Autonomous Systems Area, Stanford SystemX Alliance

*Stanford University*

### Assistant Professor

2012–2019

(Received tenure in 2019, but declined the promotion due to moving to Stanford)

Department of Aerospace Engineering

with affiliate appointments in:

Coordinated Science Laboratory

Department of Electrical and Computer Engineering

Department of Computer Science

Information Trust Institute

Computational Science and Engineering

*University of Illinois at Urbana-Champaign*

## Education

**Ph.D.** Electrical Engineering

Stanford, California

*Stanford University*

2004–2008

**M.S.** Electronics Engineering

Beijing, China

*Tsinghua University*

2001–2003

**B.S.** Mechanical Engineering

Beijing, China

*Tsinghua University*

1997–2001

## Other Work Experience

### Research Associate

Stanford, California

GPS Laboratory, Stanford University

Sep. 2008–Oct. 2012

### Research Intern

San Jose, California

SiRF Technology, Inc.

Summer 2006

### R&D Engineer

Beijing, China

IBM China Research Laboratory

2003–2004

### Research Intern

Beijing, China

Microsoft Research Asia

2002–2003

## Selected Honors and Awards

### Research Awards

2023, 2022, 2021, 2020, 2019, 2018, 2017, 2016, 2015, 2014, 2013, 2012, 2011, 2010, 2008, 2007 2019	Best Paper/Presentation of the Session Award, <i>ION GNSS+ Conference</i> (28 times in total over 17 years, together with students)
2018	CAREER Award, <i>National Science Foundation</i>
2017	Dean's Award for Excellence in Research, <i>College of Engineering, University of Illinois at Urbana-Champaign</i>
2016	Best Paper Award, <i>IEEE/ION PLANS Conference</i>
2009	William E. Jackson Award, for outstanding Ph.D. thesis, <i>Radio Technical Commission for Aeronautics (RTCA)</i>
2008	Early Achievement Award, <i>Institute of Navigation</i>

### Teaching, Advising and Service Awards

2023	AIAA Teacher of the Year, <i>AIAA Stanford Chapter</i>
2022	AIAA Advisor of the Year, <i>AIAA Stanford Chapter</i>
2022	Inspiring Early Academic Career Award, <i>Stanford Faculty Womens Forum</i>
2022	Excellent Reviewer, <i>Journal of Guidance, Control, and Dynamics</i>
2018, 2017	Engineering Council Award for Excellence in Advising, <i>University of Illinois at Urbana-Champaign</i>
2018, 2017, 2015, 2014	Teachers Ranked as Excellent, <i>University of Illinois at Urbana-Champaign</i> (5 times in total)
2016	AIAA Teacher of the Year, <i>AIAA Illinois Chapter</i>
2015	Everitt Award for Teaching Excellence, <i>College of Engineering, University of Illinois at Urbana-Champaign</i>

## Major Research Funding

*\$9.0 Million* allocated to Prof. Gao out of *\$60.2 Million* in total

1. 2022-2024, Ford Motor Company, \$366,062, "Safe Vision-based Localization with Sparse Maps and Illumination Errors," PI
2. 2022-2024, NASA JPL, \$150,000, "Communication-Adaptive Navigation for Autonomous Multi-Robot Systems," PI
3. 2021-2026, Kirtland Air Force Research Lab, \$2,663,313, "R&D to Improve the Integrity and Safety of the PNT Solution Using Current and Future SatNav Signals," PI
4. 2021-2024, Toyota Research Institute, Inc., \$600,000 out of \$2,572,639, "Autonomous Drifting: Demonstrating a Reciprocal Architecture for Motion Planning and Control," Co-PI
5. 2021-2023, Ford Motor Company, \$355,216, "A Framework for Localization Integrity and Robustness through Multi-Modal Sensor Fusion," PI
6. 2020-2023, the Allstate Corporation, \$225,000 out of \$650,000, "Adaptive Stress Testing for Autonomous Vehicle Risk Assessment," Co-PI
7. 2021-2022, Amazon.com, Inc., \$80,000, "Trustworthy Autonomous Vehicle Localization using a Joint Model-driven and Data-driven Approach," PI
8. 2019-2021, Kirtland Air Force Research Lab, \$599,591, "Deep Learning for Optimal Satellite Navigation Codes," PI

9. 2018-2023, National Science Foundation, \$517,473, "CAREER: High Integrity Navigation for Autonomous Vehicles, " PI
10. 2018-2019, Kirtland Air Force Research Lab, \$100,000, "Deep Learning for Optimal Satellite Navigation Codes," PI
11. 2018-2021, Department of Education, \$150,000 out of \$1.2 Million, "GAANN: Enhancing Opportunities for Research and Training in Space Engineering, " Co-PI
12. 2017-2019, Department of Homeland Security, \$449,981, "Networked GPS Spoofing Detection for Power Systems," PI
13. 2017-2022, Air Force Test Wing, \$226,000, "Education Partnership with Edwards Air Force Base for GPS Testing, " PI
14. 2017-2020, Army CERDEC, \$489,204, "GPS Receiver Integrity Monitoring, " PI
15. 2017, NASA Ames, \$60,803, "LiDAR-GPS Integration for Navigating UAVs in Urban Environments, " PI
16. 2016-2018, Kirtland Air Force Research Lab, \$150,000, "Optimal Solutions for GPS Reconfigurability," PI
17. 2015-2020, Department of Energy, \$628,682 out of \$28.1 Million, "Secure GPS-based Timing for the Power Grid, as part of the Center of Resilient Energy Delivery and Control (CREDC) center, " Senior Personnel
18. 2015-2018, Wright-Patterson Air Force Research Lab, \$438,435, "GNSS Vector Correlator: Harnessing Satellite Direction Cosine Diversity for Robust Positioning, " PI
19. 2015-2016, NASA Illinois Space Grant Consortium, \$10,000, "3-D Printing and Assembly of Nano-Satellites in Space," Co-PI
20. 2014-2019, Rockwell Collins, \$100,000, "Gift Fund for Equipment for Advanced Satellite Navigation Laboratory, " PI
21. 2013-2015, UIUC Campus Research Board, \$17,200, "Authenticating GPS Data for Traffic Monitoring," PI
22. 2013-2015, Department of Energy, \$488,140 out of \$18 Million, "GPS-based Timing for the Power Grid, as part of the Trustworthy Cyber Infrastructure for the Power Grid (TCIPG) center," Senior Personnel

### Invited Talks

2024	Department of Aerospace and Mechanical Engineering, University of Southern California
2023	Indian Institute of Technology Bombay
2023	Indian Institute of Technology Delhi
2023	Robotics Seminar, Massachusetts Institute of Technology
2023	The Robotics Institute, Carnegie Mellon University
2023	Stanford Center for AI safety, Stanford University
2023	The Aerospace Corporation
2023	University College London, UK
2023	Johns Hopkins University Applied Physics Laboratory
2023	NASA Jet Propulsion Laboratory
2022	Stanford Center for Positioning, Navigation and Time, Stanford University
2022	NASA Goddard Space Flight Center
2022	Department of Aerospace Engineering Sciences, University of Colorado Boulder
2022	Department of Aerospace Engineering, University of Michigan
2022	Department of Electrical and Computer Engineering, Cornell University
2021	Department of Aerospace Engineering and Mechanics, University of Minnesota

2021 Katherine Johnson Women in Aerospace Conference, Ann Arbor, MI  
 2021 Center for Automotive Research, Stanford University  
 2021 Stanford Center for AI safety, Stanford University  
 2020 Center for Automotive Research, Stanford University  
 2020 Stanford SystemX Symposium, Stanford University  
 2020 Robotics Seminar Series, West Virginia University  
 2020 Ford Autonomous Driving, CA  
 2018 Lawrence Livermore National Laboratory, Livermore, CA  
 2018 Department of Aeronautics and Astronautics, Stanford University  
 2017 Sibley School of Mechanical and Aerospace Engineering, Cornell University  
 2017 School of Aerospace Engineering, Georgia Institute of Technology  
 2017 Wright-Patterson Air Force Research Lab, Dayton, OH  
 2017 Kirtland Air Force Research Lab, Albuquerque, NM  
 2017 Robotics Seminar, Massachusetts Institute of Technology  
 2017 Department of Aerospace Engineering, University of Michigan  
 2017 Department of Mechanical and Aerospace Engineering, Illinois Institute of Technology  
 2016 US Army Communications-Electronics Research, Development and Engineering Center, (CERDEC), Aberdeen MD  
 2016 National Institute of Standards and Technology (NIST), Gaithersburg, MD  
 2016 Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign  
 2016 Field Robotics Center, Carnegie Mellon University  
 2016 InsideGNSS Magazine Webinar  
 2016 Engineering for Everyone, University of Illinois  
 2015 Autonomous Systems and Robotics Technical Area, NASA Ames  
 2015 GPS World Magazine Webinar  
 2015 The GPS Laboratory, Stanford University  
 2014 Illinois State Geological Survey  
 2014 Stanford Center for Position, Navigation and Time Symposium, Stanford University  
 2014 Illinois State Geological Survey  
 2014 Rockwell Collins, Inc. Cedar Rapids, IA  
 2014 Qualcomm Inc, San Diego, CA  
 2014 CyberGIS Center, University of Illinois at Urbana-Champaign  
 2013 Illinois Space Society, University of Illinois at Urbana-Champaign  
 2013 Quantitative Division, Dept. of Psychology, University of Illinois at Urbana-Champaign  
 2013 ION Dayton Section  
 2013 School of Aeronautics and Astronautics, Purdue University  
 2013 Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign  
 2012 Department of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin  
 2012 Sibley School of Mechanical and Aerospace Engineering, Cornell University  
 2012 Department of Aerospace Engineering, University of Illinois at Urbana-Champaign  
 2011 Department of Aerospace Engineering Sciences, University of Colorado Boulder  
 2011 U.S. NAE and Chinese CAE Joint Workshop on GNSS  
 2011 Department of Aeronautics and Astronautics, Stanford University  
 2011 Department of Aeronautics and Astronautics, , Massachusetts Institute of Technology  
 2010 German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt)  
 2009 Qualcomm Inc, Santa Clara, California

2008     Stanford Center for Positioning, Navigation and Time, Stanford University  
 2007     The MITRE Corporation  
 2007     German Aerospace Center  
 2007     University of the German Federal Armed Forces (Universität der Bundeswehr)  
 2007     University of Calgary, Canada

## Publications

Students supervised: **bold**; post-docs supervised: *italic*; Co-first authors: \*

Note: the customary practice in the field for order of authors on scholarly publications is that students are named first; faculty are named last.

## Journal Papers

[J55]. *Tara Mina*, **Alan Yang**, and Grace Gao, Designing Long GPS Memory Codes Using the Cross Entropy Method, Navigation: Journal of the Institute of Navigation. Submitted.

[J54]. **Alan Yang**, *Tara Mina*, and Grace Gao, Spreading Code Sequence Design via Mixed-Integer Convex Optimization, Navigation: Journal of the Institute of Navigation. Submitted.

[J53]. **Marta Cortinovis**, **Keidai Iiyama**, and Grace Gao, Satellite Ephemeris Approximation Methods to Support Lunar Positioning, Navigation, and Timing Services, Navigation: Journal of the Institute of Navigation. Submitted.

[J52]. **Ashwin Kanhere** and Grace Gao, Fault-Robust GPS Spoofing Mitigation with Expectation-Maximization, Navigation: Journal of the Institute of Navigation. Submitted.

[J51]. **Adyasha Mohanty** and Grace Gao, A Survey of Machine Learning Techniques for Improving Global Navigation Satellite Systems, EURASIP Journal on Advances in Signal Processing. Submitted.

[J50]. **Alan Yang**, *Tara Mina*, and Grace Gao, Spreading Code Optimization for Low-Earth Orbit Satellites via Mixed-Integer Convex Programming, EURASIP Journal on Advances in Signal Processing. Submitted.

[J49]. **Adyasha Mohanty** and Grace Gao, Tightly Coupled Graph Neural Network and Kalman Filter for Smartphone Positioning, Navigation: Journal of the Institute of Navigation. Submitted.

[J48]. **Tara Mina**, **Ashwin Kanhere**, *Akshay Shetty*, and Grace Gao, GPS Spoofing-Resilient Filtering with Chimera and Self-Contained Odometry, Navigation: Journal of the Institute of Navigation. Accepted.

[J47]. **Keidai Iiyama**, *Sriramya Bhamidipati*, and Grace Gao, Precise Positioning and Timekeeping in Lunar Orbit via Terrestrial GPS Time-Differenced Carrier-Phase Measurements, Navigation: Journal of the Institute of Navigation. March 2024, 71(1); DOI: 10.33012/navi.635.

[J46]. **Adyasha Mohanty** and Grace Gao, Learning GNSS Positioning Corrections for Smartphones using Convolutional Neural Networks, Navigation: Journal of the Institute of Navigation, vol. 70, no. 4, December 2023; DOI: 10.33012/navi.622.

[J45]. *Sriramya Bhamidipati*, **Tara Mina**, **Alana Sanchez**, and Grace Gao, Satellite Constellation Design for a Lunar Navigation and Communication System, Navigation: Journal of the Institute of Navigation, vol. 70, no. 4, December 2023; DOI: 10.33012/navi.613.

- [J44]. *Sriramya Bhamidipati*, **Tara Mina** and Grace Gao, A Case Study Analysis for Designing a Lunar Navigation Satellite System with Time-Transfer from Earth-GPS, *Navigation: Journal of the Institute of Navigation*, vol. 70, no. 4, December 2023; DOI: 10.33012/navi.599.
- [J43]. **Tara Mina**, **Ashwin V. Kanhere**, *Shreyas Kousik* and Grace Gao, Continuous GPS Authentication with Chimera Using Stochastic Reachability Analysis, *Navigation: Journal of the Institute of Navigation*, vol. 70, no. 4, December 2023; DOI: 10.33012/navi.616.
- [J42]. **Shubh Gupta**, **Adyasha Mohanty**, and Grace Gao, Urban Localization using Robust Filtering at Multiple Linearization Points, *EURASIP Journal on Advances in Signal Processing*, October 2023; DOI: 10.1186/s13634-023-01062-7.
- [J41]. **Daniel Neamati**, *Sriramya Bhamidipati* and Grace Gao, Mosaic Zonotope Shadow Matching for Risk-Aware Autonomous Localization in Harsh Urban Environments, *Journal of Artificial Intelligence*, September 2023; DOI: 10.1016/j.artint.2023.104000.
- [J40]. **Sriramya Bhamidipati** and Grace Gao, Networked Timing Risk Analysis Against GPS Spoofing via Stochastic Reachability in PMUs, *Navigation: Journal of the Institute of Navigation*, vol. 70, no. 3, September 2023, DOI: 10.33012/navi.574.
- [J39]. **Alexandros Tzikas\***, **Derek Knowles\***, Grace Gao, and Mykel Kochenderfer, Multi-robot Navigation using Partially Observable Markov Decision Processes with Belief-based Rewards, *JAIS: Journal of Aerospace Information Systems*, June 2023; DOI: 10.2514/1.1011146.
- [J38]. *Shreyas Kousik*, **Adam Dai** and Grace Gao, Ellipsotopes: Combining Ellipsoids and Zonotopes for Reachability Analysis and Fault Detection, *IEEE Transactions on Automatic Control*, vol. 68, no. 6, pp. 3440-3452, June 2023; DOI: 10.1109/TAC.2022.3191750.
- [J37]. *Akshay Shetty*, **Timmy Hussain** and Grace Gao, Decentralized Connectivity Maintenance for Multi-robot Systems Under Motion and Sensing Uncertainties, *Navigation: Journal of the Institute of Navigation*, vol. 70, no. 1, March 2023; DOI: 10.33012/navi.552.
- [J36]. **Derek Knowles** and Grace Gao, Euclidean Distance Matrix-based Rapid Fault Detection and Exclusion, *Navigation: Journal of the Institute of Navigation*, vol. 70, no. 1, March 2023; DOI: 10.33012/navi.555.
- [J35]. **Ashwin V. Kanhere\***, **Shubh Gupta\***, *Akshay Shetty* and Grace Gao, Improving GNSS Positioning using Neural Network-based Corrections, *Navigation: Journal of the Institute of Navigation*, vol. 69, no. 4, December 2022; DOI: 10.33012/navi.548.
- [J34]. *Sriramya Bhamidipati*, *Shreyas Kousik* and Grace Gao, Set-Valued Shadow Matching Using Zonotopes for 3-D Map-Aided GNSS Localization, *Navigation: Journal of the Institute of Navigation*, vol. 69, no. 4, December 2022; DOI: 10.33012/navi.547.
- [J33]. Amr Alanwar, Mahmoud Selim, *Shreyas Kousik*, Grace Gao, Marco Pavone and Karl Johansson, Safe Reinforcement Learning Using Black-Box Reachability Analysis, *IEEE Robotics and Automation Letter*, vol. 7, no. 4, pp. 10665-10672, October 2022; DOI: 10.1109/LRA.2022.3192205.
- [J32]. *Sriramya Bhamidipati*, **Tara Mina** and Grace Gao, Time-Transfer from Earth-GPS for Designing a SmallSat-based Lunar Navigation Satellite System, *Navigation: Journal of the Institute of Navigation*, vol. 69, no. 3, September 2022; DOI: 10.33012/navi.535.
- [J31]. **David Stier**, **Asta Wu**, **Adyasha Mohanty** and Grace Gao, A Test Platform for UWB-Based Localization of Dynamic Multi-Agent Systems, *IEEE Robotics and Automation Letter*, vol.

7, no. 2, pp. 3773-3778, April. 2022; DOI: 10.1109/LRA.2022.3146609.

[J30]. **Adyasha Mohanty**, **Asta Wu**, *Sriramya Bhamidipati* and Grace Gao, Precise Relative Positioning via Tight Coupling of GPS Carrier Phase and Multiple UWBs, IEEE Robotics and Automation Letters, vol. 7, no. 2, pp. 5757-5762, April. 2022; DOI: 10.1109/LRA.2022.3145051.

[J29]. **Tara Mina** and Grace Gao, Designing Low-Correlation GPS Spreading Codes with a Natural Evolution Strategy Machine Learning Algorithm, Navigation: Journal of the Institute of Navigation, vol. 69, no. 1, March 2022; DOI: 10.33012/navi.506.

[J28]. **Sriramya Bhamidipati** and Grace Gao, Robust GPS-Vision Localization via Integrity-Driven Landmark Attention, Navigation: Journal of the Institute of Navigation, vol. 69, no. 1, March 2022; DOI: 10.33012/navi.501.

[J27]. **Adyasha Mohanty**, **Shubh Gupta** and Grace Gao, A Particle Filtering Framework for Integrity Risk of GNSS-Camera Sensor Fusion, Navigation: Journal of the Institute of Navigation, vol. 68, no. 4, pp. 709-726, December 2021; DOI: 10.1002/navi.455.

[J26]. **Shubh Gupta** and Grace Gao, Data-Driven Protection Levels for Camera and 3D Map-based Safe Urban Localization, Navigation: Journal of the Institute of Navigation, vol. 68, no. 3, pp. 643-660, September 2021; DOI: 10.1002/navi.445.

[J25]. **Akshay Shetty** and Grace Gao, Predicting State Uncertainty Bounds Using Non-linear Stochastic Reachability Analysis for Urban GNSS-based UAS Navigation, IEEE Intelligent Transportation Systems, vol. 22, no. 9, pp. 5952-5961, September 2021; DOI: 10.1109/TITS.2020.3040517.

[J24]. **Shubhendra Chauhan** and Grace Gao, Spoofing Resilient State Estimation for the Power Grid Using an Extended Kalman Filter, IEEE Transactions on Smart Grid, vol. 12, no. 4, pp. 3404-3414, July 2021; DOI: 10.1109/TSG.2021.3051920.

[J23]. **Shubhendra Chauhan** and Grace Gao, Synchrophasor Data Under GPS Spoofing: Attack Detection and Mitigation Using Residuals, IEEE Transactions on Smart Grid, vol. 12, no. 4, pp. 3415-3424, July 2021; DOI: 10.1109/TSG.2021.3051926.

[J22]. **Cara Kataria**, Steven Franke, Grace Gao and Jennifer Bernhard, Secure Antenna Polarization Modulation Line-of-Sight Analysis and Demonstration, IEEE Transactions on Antennas and Propagation, vol. 69, no. 7, pp. 4100-4108, July 2021; DOI: 10.1109/TAP.2021.3060454.

[J21]. **Matthew Peretic** and Grace Gao, Design of a Parallelized Direct Position Estimation-Based GNSS Receiver, Navigation: Journal of the Institute of Navigation, vol. 68, no. 1, pp. 21-39, December 2020; DOI: 10.1002/navi.402.

[J20]. **Sriramya Bhamidipati** and Grace Gao, Integrity Monitoring of Graph-SLAM Using GPS and Fish-eye Camera, Navigation: Journal of the Institute of Navigation, vol. 67, no. 3, pp. 583-600, August 2020; DOI: 10.1002/navi.381.

[J19]. **Arthur Chu**, **Shubhendra Chauhan** and Grace Gao, GPS Multi-Receiver Direct Position Estimation for Aerial Applications, IEEE Transactions on Aerospace and Electronic Systems, vol. 56, no. 1, pp. 249-262, February 2020; DOI: 10.1109/TAES.2019.2915393.

[J18]. **Tara Mina**, **Sriramya Bhamidipati** and Grace Gao, GPS Spoofing Detection for the Power Grid Network using a Multi-Receiver Hierarchical Framework Architecture, Navigation: Journal of the Institute of Navigation, vol. 66, no. 4, pp. 857-875, December 2019; DOI: 10.1002/navi.341.

- [J17]. **Sriramya Bhamidipati** and Grace Gao, GPS Multi-Receiver Joint Direct Time Estimation and Spoofers Localization, *IEEE Transactions on Aerospace and Electronic Systems*, vol. 55, no. 4, pp. 1907-1919, August 2019; DOI: 10.1109/TAES.2018.2879532.
- [J16]. **Akshay Shetty** and Grace Gao, Adaptive Covariance Estimation of LiDAR-based Positioning Errors for UAVs, *Navigation: Journal of the Institute of Navigation*, vol. 66, no. 2, pp. 463-476, May 2019. DOI: 10.1002/navi.307.
- [J15]. **Cara Kataria**, Grace Gao and Jennifer Bernhard, Design of a Compact Hemispherical GPS Antenna with Direction Estimation Capabilities, *IEEE Transactions on Antennas and Propagation*, vol. 67, no. 5, pp. 2878-2885, May 2019; DOI: 10.1109/TAP.2019.2899009.
- [J14]. **Sriramya Bhamidipati** and Grace Gao, Locating Multiple GPS Jammers Using Networked UAVs, *IEEE Transactions on Internet of Things*, vol. 6, no. 2, pp. 1816-1828, April 2019; DOI: 10.1109/JIOT.2019.2896262.
- [J13]. **Derek Chen** and Grace Gao, Probabilistic Graphical Fusion of LiDAR, GPS, and 3D Building Maps for Urban UAV Navigation, *Navigation: Journal of the Institute of Navigation*, vol. 66, no. 1, pp. 151-168, March 2019; DOI: 10.1002/navi.298.
- [J12]. **Yuting Ng** and Grace Gao, GNSS Multi-Receiver Vector Tracking, *IEEE Transactions on Aerospace and Electronic Systems*, vol. 53, no. 5, pp. 2583-2593, October 2017; DOI: 10.1109/TAES.2017.2705338.
- [J11]. *Liang Heng* and Grace Gao, Accuracy of Range-Based Cooperative Positioning: A Lower Bound Analysis, *IEEE Transactions on Aerospace and Electronic Systems*, vol. 53, no. 5, pp. 2304-2316, October 2017; DOI: 10.1109/TAES.2017.2691921.
- [J10]. *Liang Heng*, **Athindran Rakesh Kumar** and Grace Gao, Location Hash: Private Proximity Detection Using Partial GPS Information, *IEEE Transactions on Aerospace and Electronic Systems*, vol. 52, no. 6, pp. 2873-2885, December 2016; DOI: 10.1109/TAES.2016.150301.
- [J9]. Grace Gao, Matteo Sgammmini, Mingquan Lu and Nobuaki Kubo, Protecting GNSS Receivers from Jamming, *Proceedings of the IEEE*, vol. 104, no. 6, pp. 1327-1338, June 2016; DOI: 10.1109/JPROC.2016.2525938.
- [J8]. *Liang Heng*, Daniel B. Work and Grace Gao, GNSS Signal Authentication from Cooperative Peers, *IEEE Intelligent Transportation Systems*, vol. 16, no. 4, pp. 1794-1805, August 2015; DOI: 10.1109/TITS.2014.2372000.
- [J7]. *Liang Heng*, Todd Walter, Per Enge and Grace Gao, GNSS Multipath and Jamming Mitigation Using High-Mask-Angle Antennas and Multiple Constellations, *IEEE Transactions on Intelligent Transportation Systems*, vol. 16, no. 2, pp. 741-750, April 2015; DOI: 10.1109/TITS.2014.2342200.
- [J6]. Grace Gao, Holmer Denks, Achim Steingassnd, Michael Meurer, Todd Walter and Per Enge, DME Interference Mitigation Based on Flight Test Data Over European Hot Spot, *GPS Solutions*, vol. 17, no. 1, January 2013.
- [J5]. Grace Gao and Per Enge, How Many GNSS Satellites Are Too Many? *IEEE Transactions on Aerospace and Electronic Systems*, vol. 48, no. 4, pp. 2865-2874, October 2012; DOI: 10.1109/TAES.2012.6324666.
- [J4]. *Liang Heng*, Grace Gao, Todd Walter and Per Enge, GPS Signal-in-Space Integrity Performance Evolution in the Last Decade, *IEEE Transactions on Aerospace and Electronic Systems*,



IEEE Transactions on Aerospace and Electronic Systems, vol. 48, no. 4, pp. 2932-2946, October 2012; DOI: 10.1109/TAES.2012.6324670.

[J3]. Patrick Henkel, Grace Gao, Todd Walter and Christoph Gunther, Robust Multi-Carrier, Multi-Satellite Vector Phase Locked Loop with Wideband Ionospheric Correction and Integrated Weighted RAIM, Journal of Italian Institute of Navigation, issue 190, December 2009.

[J2]. Grace Gao, Alan Chen, Sherman Lo, David De Lorenzo and Per Enge, Compass-M1 Broadcast Codes in E2, E5b and E6 Frequency Bands, IEEE Journal of Selected Topics in Signal Processing, Special Issue on Advanced Signal Processing for GNSS and Robust Navigation, vol. 3, no. 4, pp. 599-612, August 2009; DOI: 10.1109/JSTSP.2009.2025635.

[J1]. Zhe Xiang, Song Song, Jin Chen, Hao Wang, Jian Huang and Grace Gao, A Wireless LAN-based Indoor Positioning Technology, IBM Journal of Research and Development, vol. 48, no. 5, pp. 617-626, September 2004.

## Books

[B2]. Jade Morton, Frank van Diggelen, Bradford Parkinson, James Spilker, Jr., Sherman Lo, and Grace Gao, "Position, Navigation, and Timing Technologies in the 21st Century: Integrated Satellite Navigation, Sensor Systems, and Civil Applications, vol. 1 & 2" *John Wiley & Sons*, 2021.

[B1]. Lance Davis, Per Enge and Grace Gao, "Global Navigation Satellite Systems: Report of a Joint Workshop of the National Academy of Engineering and the Chinese Academy of Engineering," the National Academies Press, ISBN 13: 978-0-309-22275-4, 2012.

## Conference Papers

[C130]. **Marta Cortinovis**, *Tara Mina*, and Grace Gao, Assessment of Single Satellite-based Lunar Positioning for the NASA Endurance Mission, IEEE Aerospace Conference, Big Sky, MT, March 2024.

[C129]. **Keidai Iiyama\***, **Guillem Casadesus Vila\***, and Grace Gao, Contact Plan Optimization and Distributed State Estimation for Delay Tolerant Satellite Networks, IEEE Aerospace Conference, Big Sky, MT, March 2024.

[C128]. **Alan Yang**, *Tara Mina*, and Grace Gao, Fast Spreading Code Optimization Under Doppler Effects, ION International Technical Meeting (ION ITM 2024), Long Beach, CA, Jan 2024.

[C127]. **Adyasha Mohanty** and Grace Gao, Fusing GNN Enhanced GNSS with Neural Radiance Fields for UAV Navigation, ION International Technical Meeting (ION ITM 2024), Long Beach, CA, Jan 2024.

[C126]. **Marta Cortinovis**, **Keidai Iiyama**, and Grace Gao, Satellite Ephemeris Approximation Methods to Support Lunar Positioning, Navigation, and Timing Services, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

[C126]. **Daniel Neamati**, **Shubh Gupta**, **Adyasha Mohanty**, and Grace Gao, Neural City Maps for GNSS NLOS Prediction, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

[C124]. **Adyasha Mohanty**, and Grace Gao, Tightly Coupled Graph Neural Network and Kalman Filter for Improving Smartphone GNSS Positioning, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

[C123]. **Mira Partha, Shubh Gupta**, and Grace Gao, Neural City Maps: A Case for 3D Urban Environment Representations Based on Radiance Fields, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

[C122]. **Asta Wu, Adyasha Mohanty, Anonto Zaman**, and Grace Gao, Bounding GPS-Based Positioning and Navigation Uncertainty for Autonomous Drifting via Reachability, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

[C121]. **Derek Knowles** and Grace Gao, Detection and Exclusion of Multiple Faults using Euclidean Distance Matrices, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

[C120]. **Ashwin Kanhere** and Grace Gao, Fault-Robust GPS Spoofing Mitigation with Expectation-Maximization, Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, Sep 2023. *Best Presentation of the Session Award*.

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[M13]. *Liang Heng*, **Athindran Ramesh Kumar** and Grace Gao, GPS Confidential: Enabling Proximity Detection While Preserving Location Privacy, Inside GNSS Magazine, Sep-Oct 2015.

[M12]. **Eliot Wycoff**, **Yuting Ng** and Grace Gao, Python GNSS Receiver: An Object-Oriented Software Platform Suitable for Multiple Receivers, GPS World Magazine, Feb 2015.

[M11]. *Liang Heng*, **Daniel Chou** and Grace Gao, Reliable GPS-Based Timing for Power Systems: A Multi-Layered, Multi-Receiver Architecture, Inside GNSS Magazine, Nov-Dec 2014.

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[M9]. Sam Pullen and Grace Gao, GNSS Jamming in the Name of Privacy: Potential Threat to GPS Aviation, Inside GNSS Magazine, Mar-Apr 2012.

[M8]. Liang Heng, Grace Gao, Todd Walter and Per Enge, Digging into GPS integrity: Charting the evolution of signal-in-space performance by data mining 400,000,000 navigation messages, GPS World, vol. 22, no. 11, pp. 4449, Nov 2011.

[M7]. Grace Gao, Liang Heng, Todd Walter and Per Enge, Breaking the Ice: Navigation in the Arctic, Inside GNSS Magazine, Sep-Oct 2011.

[M6]. R. Eric Phelts, Grace Gao, Gabriel Wong, Liang Heng, Todd Walter, Per Enge, Stefan Erker, Steffen Thoenert and Michael Meurer, Aviation Grade, New GPS Signals Chips Off the Block IIF, Inside GNSS Magazine, Jul-Aug 2010.

[M5]. Steffen Thoenert, Steffen Erker, Michael Meurer, Liang Heng, Eric Phelts, Grace Gao, Gabriel Wong, Todd Walter and Per Enge, On the Air, New Signals from the First GPS IIF Satellite, Inside GNSS Magazine, Jul-Aug 2010. Cover Story.

[M4]. Grace Gao, Liang Heng, David De Lorenzo, Sherman Lo, Dennis Akos, Alan Chen, Todd Walter, Per Enge and Bradford Parkinson, Modernization Milestone: Observing the First GPS Satellite with an L5 Payload, Inside GNSS Magazine, May-Jun 2009.

[M3]. Grace Gao, Dennis Akos, Todd Walter and Per Enge, GIOVE-B on the Air: Understanding Galileo's New Signals, Inside GNSS Magazine, May-Jun 2008.

[M2]. Grace Gao, Alan Chen, Sherman Lo, David De Lorenzo and Per Enge, GNSS over China: the Compass MEO Satellite Codes, Inside GNSS Magazine, Jul-Aug 2007. Cover Story.

[M1]. Sherman Lo, Alan Chen, Per Enge, Grace Gao, Dennis Akos, Jean-Luc Issler, Lionel Ries, Thomas Grelier and Joel Dantepal, GNSS Album: Images and Spectral Signatures of the New GNSS Signals, Inside GNSS Magazine, May-Jun 2006. Cover Story.

## Patents

[P2]. Grace Gao and David Varodayan, "Method and Apparatus for Processing Signals," United States Patent 12/912,878.

[P1]. Hao Wang, Rongyao Fu, Song Song, Grace Gao, Zhe Xiang, and Jian Huang, "Apparatus and Method for Detecting Asset Position," United States Patent 200707309.

## Teaching

<b>Instructor</b> , AA 275: <i>Navigation for Autonomous Systems</i> Stanford University	<b>Winter 2024, Fall 2022, Fall 2021, Fall 2020</b>
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<b>Instructor</b> , AA 173: <i>Flight Mechanics and Controls</i> Stanford University	<b>Spring 2024, Spring 2022, Spring 2021, Spring 2020</b>
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<b>Instructor</b> , AA 272: <i>Global Positioning Systems</i> Stanford University	<b>Fall &amp; Winter 2023, Winter 2022, Winter 2021, Winter 2020</b>
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<b>Instructor</b> , AE 483: <i>UAV Navigation and Control</i> University of Illinois at Urbana-Champaign	<b>Fall 2018, Fall 2015</b>
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<b>Instructor</b> , AE 598ANS: <i>Advanced Navigation Systems</i> University of Illinois at Urbana-Champaign	<b>Spring 2019, Spring 2018 Spring 2017, Spring 2016, Spring 2015</b>
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<b>Instructor</b> , AE/ECE 456: <i>Global Navigation Satellite Systems</i> University of Illinois at Urbana-Champaign	<b>Fall 2016, Fall 2014, Spring &amp; Fall 2013</b>
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## PhD/Postdoc Advising

### Current PhD Students

Kaila Coimbra

Guillem Casadesus Vila  
Marta Cortinovis  
Daniel Neamati  
Mira Partha  
Keidai Iiyama  
Asta Wu  
Adam Dai  
Derek Knowles  
Adyasha Mohanty  
Ashwin Kanhere  
Alan Yang (Co-advised with Prof. Stephen Boyd)

#### **Current Postdocs**

Shubh Gupta  
Tara Mina

#### **Graduated PhD Students**

Shubh Gupta (2023, Postdoc at Stanford University)  
Tara Mina (2023, Postdoc at Stanford University)  
Sriramya Bhamidipati (2021, NASA Jet Propulsion Laboratory)  
Akshay Shetty (2021, Supernal, Hyundai Motor Group)  
Shubhendra Chauhan (2020, Ford Motor Company)  
Cara Kataria (2020, co-advised with Prof. Jennifer Bernhard, MIT Lincoln Laboratory)

#### **Past Postdocs**

Sriramya Bhamidipati (2022, NASA Jet Propulsion Laboratory)  
Akshay Shetty (2022, Supernal, Hyundai Motor Group)  
Shreyas Kousik (2021, Assistant Professor, Georgia Institute of Technology)  
Heng Liang (2013, co-founder and CTO, Roadstar.ai)

#### **Service**

##### **Professional Service**

##### **Conference and Workshop Organizing**

2024	Co-organizer, <i>Bay Area Robotics Symposium</i>
2024	Panel organizer and facilitator, <i>ION GNSS+ Conference</i>
2024	Organizing committee member, Future Leaders in Aerospace Symposium, Stanford University
2023	Co-organizer, <i>Workshop on Closing the Loop on Localization, IROS 2023 Conference</i>
2023, 2016, 2015, 2012, 2011	Session Chair, <i>ION ITM Conference</i>
2022	Session chair, <i>IROS 2022 Conference</i>
2022	Program committee member, <i>National Science Foundation CPS PI Meeting</i>
2022, 2017, 2015, 2012, 2011, 2008	Session chair, <i>ION GNSS+ Conference</i>
2022	Session chair, <i>ICRA 2022 Conference</i>
2021	Organizer, <i>3rd NorCal Control Workshop</i>
2021	Program committee member, <i>1st Workshop on AI for Space, CVPR 2021</i>
2018, 2016, 2013	Track chair, <i>ION GNSS+ Conference</i>
2018, 2016	Session chair, <i>IEEE/ION PLANS Conference</i>

### **Journal Editorial Activities**

2016-2018 Associate Editor, *IEEE Transactions on Aerospace and Electronic Systems*

### **Memberships**

2015-present IEEE Senior member  
2006-present Institute of Navigation (ION) member

### **Affiliations**

2020 - present Reviewer, NASA Space Technology Graduate Research Opportunity Program  
2022 - present, Reviewer, NASA Postdoctoral Program  
2016, 2015  
2019, 2017, Review panelist, *National Science Foundation*  
2016, 2015  
2017 Founding member, *National UAS Standardized Testing and Rating Board*  
2015, 2014 Treasurer, Satellite Division, *ION*  
2013, 2012 Elected Officer (Air Representative), *ION*  
2011, 2010 Judging Panel, Fulbright Scholar Program, Stanford University  
2010 Judging Panel, GNSS USA Challenge

### **University and Departmental Service**

#### **University Service**

*at Stanford University*

2022-present Co-director, Stanford AI Safety Center  
2020-present Co-lead, Stanford SystemX Alliance Robotics Area

*at University of Illinois at Urbana-Champaign*

2019 Aerospace Engineering department head search committee  
2019 Faculty search committee, Department of Computer Science  
2019, 2018, Coordinated Sciences Lab (CSL) advisory committee  
2016, 2015  
2018, 2017 CSL staff award committee  
2017 Information Trust Institute (ITI) search committee for CREDC Managing Director  
2017 Committee for implementing a new degree program in  
Innovation, Leadership and Engineering Entrepreneurship (ILEE)  
2016 CSL search committee for a Robotics Institute technical engineer

#### **Department Service**

*at Stanford University*

2020-present Founding co-chair (2020-2022) and member of diversity, equity and inclusion committee  
2021-present Lead of Dynamics, Guidance, Navigation, Control, and Autonomy cluster  
2019-2022 Graduate admission committee  
2021 Selection committee member, Aero Astro Community Research Experience (AACREs)  
2020 New direct PhD program committee

*at University of Illinois at Urbana-Champaign*

2018-2019	Aerospace Engineering (AE) faculty search committee
2018-2019	AE graduate program committee
2016-2019	AE department awards committee
2017, 2016	Chair of AE department undergrad curriculum committee (Passed a major undergrad curriculum change)
2016, 2015	AE department advisory committee
2016, 2015	Chair of AE faculty meeting
2016, 2015	AE department undergrad curriculum committee
2015, 2014	AE graduate admission committee
2015, 2014	Secretary of AE department faculty meeting
2015, 2014	Chair of Engineering Open House
2013	AE faculty search committee

### Student Service

#### *at Stanford University*

2021 - present	Faculty mentor, Enhancing Diversity in Graduate Education (EDGE) Fellows
2019 - present	Faculty advisor, Women in Aeronautics and Astronautics (WIAA)
2019 - present	Summer Undergraduate Research Fellowship (SURF)
2019 - present	Aero/Astro undergrad advisor
2022, 2021	Faculty panelist, Summer First Program
2022, 2021	Faculty panelist, Summer Undergraduate Research Fellowship (SURF)
2021	Faculty advisor for Aero Astro Community Research Experience (AACREs)
2021	Faculty advisor for Research Experience for Undergraduate (REU) students
2021	Faculty advisor for Inclusion, Diversity, and Equity in a Learning Environment (IDEAL)

#### *at University of Illinois at Urbana-Champaign*

2018, 2017, 2016,	Faculty advisor of UIUC team for NASA Micro-g NExT competition
2015	(The student teams were selected all four years.)
2016, 2015	Faculty advisor for UIUC Engineering Open House projects
2015	Faculty advisor for Boeing IT Case Competition (The student team won the 2nd place, and was invited to Boeing headquarters for the award ceremony.)

### Outreach

2023	Faculty panelist, Future Leaders in Aerospace Workshop at Massachusetts Institute of Technology
2020	Faculty panelist, Mechanical Engineering Rising Star Workshop at Stanford University
2019, 2017	Workshop for Girls Learning Electrical Engineering (GLEE) Summer Camp
2019	Workshop for Catalyzing Inclusive STEM Experiences All Year Round (CIS-TEME365)
2013-2019	Showcase research projects in UIUC Engineering Open House
2018	Lecture and demo for Girls Adventures in Mathematics, Engineering, and Science (GAMES) Summer Camp

2017	Lecture and demo for Girls Learning Air and Space Science (GLASS)
2017, 2016, 2015	Panelist at Women in PNT Event at ION GNSS+ Conferences
2017 - 2013	Outreach through DoE CREDC Center
2016	Lecture for "Saturday Engineering for Everyone"
2015	Lectures and demo at Hobbico E-fest
2008, 2007	Workshop at Sally Ride Science Festival