

Curriculum Vitae

Grace X. Gao

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315 Talbot Lab, 104 South Wright St. Urbana, IL 61801

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Academic Appointments

Assistant Professor

Oct. 2012–present

Dept. 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

Honors and Awards

Research Awards

- | | |
|-------------------|---|
| 2018 | National Science Foundation CAREER Award |
| 2018, 2017, 2016, | Best Paper/Presentation of the Session Award, <i>ION GNSS+ Conference</i> |
| 2015, 2014, 2013, | (12 times in total) |
| 2012, 2011, 2010, | |
| 2008, 2007 | |
| 2017 | Dean's Award for Excellence in Research,
<i>College of Engineering, University of Illinois at Urbana-Champaign</i> |
| 2017 | Fellow of Center for Advanced Study, <i>University of Illinois at Urbana-Champaign</i> |
| 2016 | Best Paper Award, <i>IEEE/ION PLANS Conference</i> |
| 2014 | Air Force Summer Faculty Fellow |
| 2009 | William E. Jackson Award (for outstanding Ph.D. thesis in aviation electronics and telecommunications, <i>Radio Technical Commission for Aeronautics (RTCA)</i>) |
| 2009 | 50 GNSS Leaders to Watch, <i>GPS World Magazine</i> |
| 2008 | Early Achievement Award, <i>Institute of Navigation</i> |
| 2007 | Student Paper Award, <i>ION GNSS Conference</i> |
| 2004 | Graduate Student Fellowship, <i>Dept. of Electrical Engineering, Stanford University</i> |
| 2003 | Excellent Master's Thesis Award, <i>Tsinghua University</i> |
| 2001 | Exceptional Graduate of Beijing, <i>Beijing City Government</i> |
| 2001 | Exceptional Graduate of Tsinghua University, <i>Tsinghua University</i> |
| 2001 | Excellent Undergraduate Thesis Award, <i>Tsinghua University</i> |

Teaching and Advising Awards

- 2018, 2017 Engineering Council Award for Excellence in Advising,
University of Illinois at Urbana-Champaign
- 2018, 2017, 2015, Teachers Ranked as Excellent,
2014 *University of Illinois at Urbana-Champaign*
- 2016 AIAA Teacher of the Year, *AIAA Illinois Chapter*
- 2015 Everitt Award for Teaching Excellence,
College of Engineering, University of Illinois at Urbana-Champaign

Research and Work Experience

Research Associate GPS Laboratory, Stanford University	Stanford, California 2008–2012
Research Assistant GPS Laboratory, Stanford University	Stanford, California 2005–2008
Research Intern SiRF Technology, Inc.	San Jose, California Summer 2006
R&D Engineer IBM China Research Laboratory	Beijing, China 2003–2004
Research Intern Microsoft Research Asia	Beijing, China 2002–2003

Publications

Students supervised: **bold**; post-docs supervised: *italic*

Journal Papers

1. **Ashwin Kanhere** and Grace X. Gao, “GPS/LiDAR Sensor Fusion Integrity: A Top-Down Approach,” *Navigation: Journal of the Institute of Navigation*. Submitted on 12/21/2018.
2. **Tara Mina**, **Sriramya Bhamidipati** and Grace X. Gao, “Detecting GPS Spoofing via a Multi-Receiver Hybrid Communication Network for Power Grid Timing Verification,” *Navigation: Journal of the Institute of Navigation*. Submitted on 12/7/2018.
3. **Arthur Chu** and Grace X. Gao, “Multi-Receiver Direct Position Estimation Tested on a Full-scale Fixed-wing Aircraft,” *IEEE Transactions on Aerospace and Electronic Systems*. Submitted on 9/16/2017; revision submitted on 8/17/2018.
4. **Akshay Shetty** and Grace X. Gao, “Adaptive Covariance Estimation of LiDAR-based Positioning Errors for UAVs,” *Navigation: Journal of the Institute of Navigation*. Accepted.
5. **Derek Chen** and Grace X. Gao, “Probabilistic Graphical Fusion of LiDAR, GPS, and 3D Building Maps for Urban UAV Navigation,” *Navigation: Journal of the Institute of Navigation*. Accepted.
6. **Cara Kataria**, Grace X. Gao and Jennifer Bernhard, “Design of a Compact Hemispherical GPS Antenna with Direction Estimation Capabilities,” *IEEE Transactions on Antennas and Propagation*. DOI: 10.1109/TAP.2019.2899009, Feb. 2019.
7. **Sriramya Bhamidipati** and Grace X. Gao, “Locating Multiple GPS Jammers Using Networked UAVs,” *IEEE Transactions on Internet of Things*. DOI: 10.1109/JIOT.2019.2896262, Jan. 2019.

8. **Sriramya Bhamidipati** and Grace X. Gao, "GPS Multi-Receiver Joint Direct Time Estimation and Spoofer Localization," *IEEE Transactions on Aerospace and Electronic Systems*. DOI: 10.1109/TAES.2018.2879532, Nov. 2018.
9. **Yuting Ng** and Grace X. Gao, "GNSS Multi-Receiver Vector Tracking," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 53, no. 5, pp. 2583-2593, Oct. 2017.
10. **Liang Heng** and Grace X. 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, Oct. 2017.
11. **Liang Heng**, **Athindran Rakesh Kumar**, and Grace X. Gao, "Private proximity detection using partial GPS information," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 52, no. 6, pp. 2873-2885, December 2016.
12. Grace X. Gao, Matteo Sgammini, Mingquan Lu, and Nobuaki Kubo, "Protecting GNSS Receivers from Jamming," *the Proceedings of the IEEE*, vol. 104, no. 6, pp. 1327-1338, June 2016.
13. **Liang Heng**, Daniel B. Work, and Grace X. Gao, "GNSS Signal Authentication from Cooperative Peers," *IEEE Transactions on Intelligent Transportation Systems*, vol. 16, no. 4, pp. 1794-1805, August 2015.
14. **Liang Heng**, Todd Walter, Per Enge, and Grace X. 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.
15. Grace X. 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, issue 1, January 2013.
16. Grace X. 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.
17. **Liang Heng**, Grace X. Gao, Todd Walter, and Per Enge, "GPS Signal-in-Space Performance Evolution: Data Mining 400 Million Navigation Messages of the Last Decade from a Global Network of 360 receivers," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 48, no. 4, October 2012.
18. Patrick Henkel, Grace X. Gao, Todd Walter, and Christoph Günther, "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.
19. Grace X. 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, issue 4, pp. 599-612, 2009.
20. Zhe Xiang, Song Song, Jin Chen, Hao Wang, Jian Huang, and Grace X. Gao, "A Wireless LAN-based Indoor Positioning Technology," *IBM Journal of Research and Development*, vol. 48, no. 5-6, September-November 2004.

Books

1. Jade Morton, Frank van Diggelen, Bradford Parkinson, James Spilker, Jr., Sherman Lo, and **Grace X. Gao**, "Position, Navigation, and Timing Technologies in the 21st Century: Integrated Satellite Navigation, Sensor Systems, and Civil Applications," *Wiley*, to be published in 2019.
2. Lance Davis, Per Enge and **Grace X. 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.

Magazine Articles

1. **Akshay Shetty** and Grace X. Gao, “GPS-LiDAR Fusion with 3D City Models,” *GPS World Magazine*, September 2017.
2. **Sriramya Bhamidipati**, **Yuting Ng**, and Grace X. Gao, “Multi-Receiver GPS-Based Direct Time Estimation for PMUs,” *Inside GNSS Magazine*, January-February 2017.
3. *Liang Heng*, **Athindran Ramesh Kumar**, and Grace X. Gao, “GPS Confidential: Enabling Proximity Detection While Preserving Location Privacy,” *Inside GNSS Magazine*, September–October 2015.
4. **Eliot Wycoff**, **Yuting Ng**, and Grace X. Gao, “Python GNSS Receiver: An Object-Oriented Software Platform Suitable for Multiple Receivers,” *GPS World Magazine*, February 2015.
5. *Liang Heng*, Daniel B. Work, and Grace X. Gao, “Reliability from Unreliable Peers: Cooperative GNSS Authentication,” *Inside GNSS Magazine*, September–October 2013.
6. Sam Pullen, Grace X. Gao, “GNSS Jamming in the Name of Privacy: Potential Threat to GPS Aviation,” *Inside GNSS Magazine*, March–April 2011.
7. Grace X. Gao, Liang Heng, Todd Walter, and Per Enge, “Breaking the Ice: Navigation in the Arctic,” *Inside GNSS Magazine*, September–October 2011.
8. R. Eric Phelts, Grace X. Gao, Gabriel Wong, Liang Heng, Todd Walter, Per Enge, Stefan Erker, Steffen Thölert, and Michael Meurer, “Aviation Grade: New GPS Signals – Chips Off the Block IIF,” *Inside GNSS Magazine*, July–August 2010.
9. Steffen Thölert, Steffen Erker, Michael Meurer, Liang Heng, Eric Phelts, Grace X. Gao, Gabriel Wong, Todd Walter, and Per Enge, “On the Air: New Signals from the First GPS IIF Satellite,” *Inside GNSS Magazine*, July–August 2010.
10. Grace X. 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–June 2009.
11. Grace X. Gao, Dennis Akos, Todd Walter, and Per Enge, “GIOVE-B on the Air: Understanding Galileo’s New Signals,” *Inside GNSS Magazine*, May–June 2008.
12. Grace X. Gao, Alan Chen, Sherman Lo, David De Lorenzo, and Per Enge, “GNSS over China: the Compass MEO Satellite Codes,” *Inside GNSS Magazine*, July–August 2007.
13. Sherman Lo, Alan Chen, Per Enge, Grace X. 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–June 2006.

Conference Papers

1. **Akshay Shetty** and Grace X. Gao, “UAV Pose Estimation Using Cross-view Geolocalization with Satellite Imagery,” *IEEE International Conference on Robotics and Automation (ICRA)*, Montreal, Canada, May 2019. Accepted.
2. **Ashwin Kanhere** and Grace X. Gao, “Integrity for GPS/LiDAR Fusion Utilizing a RAIM Framework,” *ION GNSS+ 2018*, Miami, FL, Sep 2018. **Best Presentation of the Session Award.**
3. **Siddharth Tanwar** and Grace X. Gao, “Decentralized Collaborative Localization in Urban Environments Using 3D-Mapping-Aided (3DMA) GNSS and Inter-Agent Ranging,” *ION GNSS+ 2018*, Miami, FL, Sep 2018.
4. **Sriramya Bhamidipati** and Grace X. Gao, “Multiple GPS Fault Detection and Isolation Using a Graph-SLAM Framework,” *ION GNSS+ 2018*, Miami, FL, Sep 2018.

5. **Tara Mina, Sriramya Bhamidipati** and Grace X. Gao, "Detecting GPS Spoofing via a Multi-Receiver Hybrid Communication Network for Power Grid Timing Verification," *ION GNSS+ 2018*, Miami, FL, Sep 2018.
6. **Siddharth Tanwar** and Grace X. Gao, "Decentralized Collaborative Localization with Deep GPS Coupling for UAVs," *IEEE/ION PLANS 2018*, Monterey, CA, Apr 2018.
7. **Arthur Chu** and Grace X. Gao, "Vertical Integrity Monitoring with Direct Positioning," *IEEE/ION PLANS 2018*, Monterey, CA, Apr 2018.
8. **Sriramya Bhamidipati** and Grace X. Gao, "Simultaneous Localization of Multiple Jammers and Receivers Using Probability Hypothesis Density," *IEEE/ION PLANS 2018*, Monterey, CA, Apr 2018.
9. **Sriramya Bhamidipati, Tara Mina** and Grace X. Gao, "GPS Time Authentication against Spoofing via a Network of Receivers for Power Systems," *IEEE/ION PLANS 2018*, Monterey, CA, Apr 2018.
10. **Sriramya Bhamidipati** and Grace X. Gao, "GPS Spoofer Localization Using Multi-Receiver Direct Time Estimation for PMUs," *ION GNSS+ 2017*, Portland OR, Sep 2017. **Best Presentation of the Session Award.**
11. **Akshay Shetty** and Grace X. Gao, "Covariance Estimation for GPS-LiDAR Sensor Fusion for UAVs," *ION GNSS+ 2017*, Portland OR, Sep 2017.
12. **Arthur Chu** and Grace X. Gao, "Multi-Receiver Direct Position Estimation Tested on a Full-Scale Fixed-wing Aircraft," *ION GNSS+ 2017*, Portland OR, Sep 2017.
13. **Shubhendra Chauhan** and Grace X. Gao, "Joint GPS Direct Positioning and Vision Estimation Using an Adaptive Filter," *ION GNSS+ 2017*, Portland OR, Sep 2017.
14. **Cara Kataria** and Grace X. Gao, "A Single Hemispiral Antenna for GNSS Interference Mitigation and Direction Estimation," *ION GNSS+ 2017*, Portland OR, Sep 2017.
15. **Sriramya Bhamidipati, Yuting Ng** and Grace X. Gao, "Multi-Receiver GPS-based Direct Time Estimation for PMUs," *ION GNSS+ 2016*, Portland OR, Sep 2016. **Best Presentation of the Session Award.**
16. **Yuting Ng** and Grace X. Gao, "Direct Position Estimation Utilizing Non-Line-of-Sight (NLOS) GPS Signals," *ION GNSS+ 2016*, Portland OR, Sep 2016.
17. **Yuting Ng** and Grace X. Gao, "Computationally Efficient Direct Position Estimation via Low Duty-Cycling," *ION GNSS+ 2016*, Portland OR, Sep 2016.
18. **Enyu Luo, Xin Hui Fang, Yuting Ng** and Grace X. Gao, "Bio-inspired Collective Robot Swarm Navigation Platform," *ION GNSS+ 2016*, Portland OR, Sep 2016.
19. **Yuting Ng** and Grace X. Gao, "Mitigating Jamming and Meaconing Attacks Using Direct GPS Positioning," *IEEE/ION PLANS 2016*, Savannah GA, Apr 2016. **Best Paper Award.**
20. **Yuting Ng** and Grace X. Gao, "Joint GPS and Vision Direct Position Estimation," *IEEE/ION PLANS 2016*, Savannah GA, Apr 2016.
21. **Yuting Ng** and Grace X. Gao, "Robust GPS-Based Direct Time Estimation for PMUs," *IEEE/ION PLANS 2016*, Savannah GA, Apr 2016.
22. **Yuting Ng** and Grace X. Gao, "Advanced Multi-Receiver Position-Information-Aided Vector Tracking for Robust GPS Time Transfer to PMUs," *ION GNSS+ 2015*, Tampa FL, Sep 2015. **Best Paper of the Session Award.**
23. **Yuting Ng** and Grace X. Gao, "Advanced Multi-Receiver Vector Tracking for Positioning a Land Vehicle," *ION GNSS+ 2015*, Tampa FL, Sep 2015.
24. **Akshay Shetty** and Grace X. Gao, "Vision-Aided Measurement Level Integration of Multiple GPS Receivers for UAVs," *ION GNSS+ 2015*, Tampa FL, Sep 2015.

25. **Derek Chen** and Grace X. Gao, "Robust MAV State Estimation Using an M-Estimator Augmented Sensor Fusion Graphs," *ION GNSS+ 2015*, Tampa FL, Sep 2015.
26. **Daniel Chou, Yuting Ng**, and Grace X. Gao, "Robust GPS-Based Timing for PMUs Based on Multi-Receiver Position-Information-Aided Vector Tracking," *ION International Technical Meeting 2015*, Dana Point, CA, Jan 2015.
27. **Akshay Shetty** and Grace X. Gao, "Measurement Level Integration of Multiple Low-Cost GPS Receivers for UAVs," *ION International Technical Meeting 2015*, Dana Point, CA, Jan 2015.
28. **Derek Chen** and Grace X. Gao, "Simultaneous State Estimation of UAV Trajectory Using Probabilistic Graph Models," *ION International Technical Meeting 2015*, Dana Point, CA, Jan 2015.
29. **Yuting Ng** and Grace X. Gao, "Multi-Receiver Vector Tracking Based on a Python Platform," *ION International Technical Meeting 2015*, Dana Point, CA, Jan 2015.
30. **Daniel Chou, Liang Heng**, and Grace X. Gao, "Robust GPS-Based Timing for Phasor Measurement Units: A Position-Information-Aided Vector Tracking Approach," *ION GNSS+ 2014*, Tampa FL, Sep 2014. **Best Presentation of the Session Award.**
31. *Liang Heng, Daniel Chou*, and Grace X. Gao, "Cooperative GPS Signal Authentication from Unreliable Peers," *ION GNSS+ 2014*, Tampa FL, Sep 2014. **Best Presentation of the Session Award.**
32. **Athindran Ramesh Kumar, Liang Heng**, and Grace X. Gao, "GPS Privacy: Enabling Proximity-based Services While Keeping GPS Locations Private," *ION GNSS+ 2014*, Tampa FL, Sep 2014.
33. **Eliot Wycoff** and Grace X. Gao, "A Python Software Platform for Cooperatively Tracking Multiple GPS Receivers," *ION GNSS+ 2014*, Tampa FL, Sep 2014.
34. *Liang Heng* and Grace X. Gao, "Navigating Robot Swarms Using Collective Intelligence Learned from Golden Shiner Fish," *Collective Intelligence Conference (CI2014)*, Cambridge, MA, Jun 2014.
35. *Liang Heng, Jonathan Makela, Alejandro Dominguez-Garcia, Rakesh Bobba, William Sanders*, and Grace X. Gao, "Reliable GPS-based Timing for Power System Applications: A multi-Layered Multi-receiver Approach," *the 2014 IEEE Power and Energy Conference at Illinois (IEEE PECE 2014)*, Champaign, IL, Feb 2014.
36. *Liang Heng*, and Grace X. Gao, "Accuracy of Range-Based Localization Schemes in Random Sensor Networks: A Lower Bound Analysis," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IEEE/RSJ IROS 2013)*, Tokyo, Japan, Nov 2013.
37. **Derek Chen, Liang Heng, Dan Jia**, and Grace X. Gao, "Distributed Array of GPS Receivers for 3D Wind Profile Determination in Wind Farms," *ION GNSS+ 2013*, Nashville, TN, Sep 2013. **Best Presentation of the Session Award.**
38. Grace X. Gao and *Liang Heng*, "Networked GPS Approach to Tracking Marine Animal Schools," *ION GNSS+ 2013*, Nashville, TN, Sep 2013.
39. *Liang Heng, Todd Walter, Per Enge*, and Grace X. Gao, "Overcoming RFI with High Mask Angle Antennas and Multiple GNSS Constellations," *ION GNSS+ 2013*, Nashville, TN, Sep 2013.
40. Grace X. Gao, Kaz Gunning, Todd Walter, and Per Enge, "Mitigating Personal Privacy Device Interference for Aviation Users," *ION GNSS 2012*, Nashville, TN, Sep 2012.
41. *Liang Heng, Grace X. Gao, Todd Walter*, and Per Enge, "GLONASS signal-in-space anomalies since 2009," *ION GNSS 2012*, Nashville, TN, Sep 2012. **Best Presentation of the Session Award.**

42. Liang Heng, Grace X. Gao, Todd Walter, and Per Enge, "Automated Verification of Potential GPS Signal-In-Space Anomalies Using Ground Observation Data," *IEEE/ION PLANS 2012*, Myrtle Beach, SC, Apr 2012.
43. Sam Pullen, Grace X. Gao, Carmen Tedeschi, and John Warburton, "The Impact of Uninformed RF Interference on GBAS and Potential Mitigations," *ION ITM Conference 2012*, Newport Beach, California, 2012.
44. Liang Heng, Grace X. Gao, Todd Walter, and Per Enge, "Statistical Characterization of GLONASS Broadcast Clock Errors and Signal-In-Space Errors," *ION ITM Conference 2012*, Newport Beach, California, 2012.
45. Grace X. Gao, Liang Heng, Todd Walter, and Per Enge, "Breaking the Ice: Navigating in the Arctic," *ION GNSS Conference 2011*, Portland, Oregon, September 2011. **Best Presentation of the Session Award.**
46. Liang Heng, Grace X. Gao, Todd Walter, and Per Enge, "Statistical Characterization of GLONASS Signal-In-Space Errors," *ION GNSS Conference 2011*, Portland, Oregon, September 2011.
47. Myungjun Choi, Juan Blanch, Dennis Akos, Liang Heng, Grace X. Gao, Todd Walter, and Per Enge, "Demonstrations of Multi-constellation Advanced RAIM for Vertical Guidance Using GPS and GLONASS Signals," *ION GNSS Conference 2011*, Portland, Oregon, September 2011.
48. Steffen Thöler, Stefan Erker, Johann Furthner, Michael Meurer, Grace X. Gao, Liang Heng, Todd Walter, and Per Enge, "GLONASS K First in Orbit Signal in Space Analysis of Russia's New Satellite Generation," *ION GNSS Conference 2011*, Portland, Oregon, September 2011.
49. Liang Heng, Grace X. Gao, Todd Walter, and Per Enge, "Statistical Characterization of GPS Signal-In-Space Errors," *ION ITM 2011*, San Diego, California, January 2011.
50. Patryk Jurkowski, Patrick Henkel, Grace X. Gao, and Christoph Günther, "Integer Ambiguity Resolution with Tight and Soft Baseline Constraints for Freight Stabilization at Helicopters and Cranes," *ION ITM 2011*, San Diego, California, January 2011.
51. David Varodayan and Grace X. Gao, "Redundant Metering for Integrity with Information-Theoretic Confidentiality," *IEEE International Conference on Smart Grid Communications, SGC 2010*, Gaithersburg, Maryland, October 2010.
52. Grace X. Gao, Liang Heng, Gabriel Wong, Eric Phelts, Juan Blanch, Todd Walter, Per Enge, Stefan Erker, Steffen Thöler, and Michael Meurer, "GPS in Mid-life with an International Team of Doctors: Analyzing IIF-1 Satellite Performance and Backward-Compatibility," *ION GNSS Conference 2010*, Portland, Oregon, September 2010. **Best Presentation of the Session Award.**
53. Liang Heng, Grace X. Gao, Todd Walter, and Per Enge, "GPS Signal-in-Space Anomalies in the Last Decade: Data Mining of 400,000,000 GPS Navigation Messages," *ION GNSS 2010*, Portland, Oregon, September 2010.
54. Grace X. Gao, Haochen Tang, Juan Blanch, Jiyun Lee, Todd Walter, and Per Enge, "Methodology and Case Studies of Signal-in-Space Error Calculation: Top-down Meets Bottom-up," *ION GNSS Conference 2009*, Savannah, Georgia, September 2009.
55. Patrick Henkel, Grace X. Gao, Todd Walter, and Christoph Günther, "Robust Multi-Carrier, Multi-Satellite Vector Phase Locked Loop with Wideband Ionospheric Correction and Integrated Weighted RAIM," *European Navigation Conference on Global Navigation Satellite Systems 2009*, Naples, Italy, May 2009.
56. Grace X. Gao, Dennis Akos, Todd Walter, and Per Enge, "Understanding the GIOVE-B Broadcast Codes of the Galileo System," *IEEE Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, California, October 2008. **Invited Paper.**

57. Shankar Ramakrishnan, Grace X. Gao, David De Lorenzo, Todd Walter, Dennis Akos, and Per Enge, "Performance Analysis of a Dual-Frequency Reconfigurable L1/L5 GNSS Receiver subject to DME/TACAN Interference," *ION GNSS Conference 2008*, Savannah, Georgia, September 2008. **Best Presentation of the Session Award.**
58. Grace X. Gao, Alan Chen, Sherman Lo, David De Lorenzo, and Per Enge, "Compass-M1 Broadcast Codes and their Application to Acquisition and Tracking," *ION NTM 2008*, San Diego, California, January 2008.
59. Grace X. Gao, "DME/TACAN Interference and its Mitigation in L5/E5 Bands," *ION GNSS Conference 2007*, Fort Worth, Texas, September 2007. **Best Presentation of the Session Award and Student Paper Award.**
60. Grace X. Gao, David De Lorenzo, Todd Walter, and Per Enge, "Acquisition and Tracking of GIOVE-A Broadcast L1/E5/E6 Signals and Analysis of DME/TACAN Interference on Receiver Design," *European Navigation Conference on Global Navigation Satellite Systems 2007*, Geneva, Switzerland, May 2007.
61. Grace X. Gao, Seebany Datta-Barua, Todd Walter, and Per Enge, "Ionosphere Effects for Wideband GNSS Signals," *ION Annual Meeting 2007*, Cambridge, Massachusetts, April 2007.
62. Grace X. Gao, David De Lorenzo, Alan Chen, Sherman Lo, Dennis Akos, Todd Walter, and Per Enge, "Galileo GIOVE-A Broadcast E5 Codes and their Application to Acquisition and Tracking," *ION NTM 2007*, San Diego, California, January 2007.
63. Grace X. Gao, Jim Spilker Jr., Todd Walter, Per Enge, and Anthony Pratt, "Code Generation Scheme and Property Analysis of Broadcast Galileo L1 and E6 Signals," *ION GNSS Conference 2006*, Fort Worth, Texas, September 2006.
64. Grace X. Gao, Zhe Xiang, Hao Wang, Jun Shen, Jian Huang, and Song Song, "An Approach to Security and Privacy of RFID System for Supply Chain," *IEEE International Conference on e-Commerce Technology for Dynamic e-Business 2004*, Beijing, China, September 2004.
65. Grace X. Gao, Richard Yao, and Zhenming Feng, "Hadamard Coded Multi-band UWB," *IEEE Semiannual Vehicular Technology Conference (VTC) 2003*, Orlando, Florida, October 2003.
66. Richard Yao, Grace X. Gao, Zhengqi Chen, and Wenwu Zhu, "UWB Multipath Channel Model Based on Time-Domain UTD Technique," *IEEE Global Communications Conference GLOBECOM 2003*, San Francisco, California, December 2003.
67. Grace X. Gao, Lu Mingquan, and Feng Zhenming, "Asymmetric Hexagonal QAM Based OFDM System," *IEEE International Conference on Communications, Circuits and Systems and West Sino Expositions 2002*, Xi'an, China, June 2002.
68. Grace X. Gao, Lu Mingquan, and Feng Zhenming, "Optimal Wavelet Packet Based Multi-carrier Modulation over Multipath Wireless Channels," *IEEE International Conference on Communications, Circuits and Systems and West Sino Expositions 2002*, Xi'an, China, June 2002.

Patents

1. **Grace X. Gao** and David Varodayan, "Method and Apparatus for Processing Signals," United States Patent 12/912,878.
2. Hao Wang, Rongyao Fu, Song Song, **Grace X. Gao**, Zhe Xiang, and Jian Huang, "Apparatus and Method for Detecting Asset Position," United States Patent 200707309.

Invited Talks

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, MIT
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 Dept. 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 Dept. of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign
2012 Dept. of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin
2012 Sibley School of Mechanical and Aerospace Engineering, Cornell University
2012 Dept. of Aerospace Engineering, University of Illinois at Urbana-Champaign
2011 Dept. of Aerospace Engineering Sciences, University of Colorado Boulder
2011 U.S. NAE and Chinese CAE Joint Workshop on GNSS
2011 Dept. of Aeronautics and Astronautics, Stanford University
2011 Dept. of Aeronautics and Astronautics, MIT
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

Teaching

Instructor, AE 483: *UAV Navigation and Control*
University of Illinois at Urbana-Champaign

Fall 2018, Fall 2015

Instructor, AE 598ANS: *Advanced Navigation Systems*
University of Illinois at Urbana-Champaign

Spring 2019, Spring 2018

Spring 2017, Spring 2016, Spring 2015

Instructor, AE/ECE 456: *Global Navigation Satellite Systems*

University of Illinois at Urbana-Champaign

Fall 2016, Fall 2014, Spring & Fall 2013

Teaching Assistant, AA272C: *Global Positioning System*
Stanford University

Winter 2007

Service

Professional Service

2016-2018 Associate Editor, *IEEE Transactions on Aerospace and Electronic Systems*
2018, 2016, 2013 Session Chair, *Institute of Navigation (ION) GNSS+ Conference*
2017 Founding member, *National UAS Standardized Testing and Rating Board*
2017, 2016, 2015 Review panelist, *National Science Foundation*
2017, 2015, 2012, Track Chair, *ION GNSS+ Conference*
2011, 2008
2018, 2016 Session Chair, *IEEE/ION PLANS Conference*
2016, 2015, Session Chair, *ION ITM Conference*
2012, 2011
2016, 2015 Reviewer for NASA Postdoctoral Program
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

Senior Member, IEEE; Member, ION; Member, AIAA

University Service

2019 Aerospace Engineering department head search committee, College of Engineering
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

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

2018, 2017, 2016 Faculty advisor of UIUC team for NASA Micro-g NExT competition
2015 (The student teams were selected all three 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

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	Workshop for Girls Learning Electrical Engineering (GLEE) Summer Camp
2017	Lecture and demo for Girls Learning Air and Space Science (GLASS) held by the Aerospace Engineering department
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