

## **CV: Andrey Soloviev**

Dr. Andrey Soloviev is a Research Assistant Professor with the University of Florida Research and Education Engineering Facility (REEF). Previously he served as a Research Engineer and Senior Research Engineer at the Ohio University Avionics Engineering Center. He has received B.S. and M.S. degrees in Applied Mathematics and Physics from Moscow University of Physics and Technology and a Ph.D. degree in Electrical Engineering from Ohio University. His research includes various aspects of multi-sensor integration techniques, inertial navigation, GPS/laser radar (LADAR) integration, GPS/INS integration, GPS software receiver development, GPS carrier phase positioning, digital signal processing, and joint time-frequency data analysis.

With his dissertation, Dr. Soloviev investigated frequency domain processing of inertial measurement sensors, for which he received the “William E. Jackson Award” from RTCA, Inc. in 2003. Dr. Soloviev has served as the primary researcher for a deep GPS/IMU integration program that led to the first in-flight demonstration of continuous carrier phase tracking of a deeply-integrated GPS/IMU at carrier-to-noise ratios below 15 dB-Hz. Dr. Soloviev developed several novel techniques, including GPS tracking without knowledge of the navigation data bits, joint time/frequency domain tracking for mm/s velocity performance from GPS L1 and code-less L2, mitigation of cross-correlation errors using P Code measurements, high-update rate measurements (up to 1 kHz) that are statistically independent, statistically-independent L1/L2 measurements, deep GPS/IMU integration at the cm/s level with long lever arms (several meters) between the GPS antenna and the IMU, and in-flight re-acquisition of GPS signals below 15 dB-Hz. Recently, he has been involved with urban navigation technology, including LADAR, inertial, and augmented GPS.

He is an active member of the Institute of Navigation where he currently serves as Land Representative for the ION Council. He received the 2005 “Early Achievement Award” from the Institute of Navigation.

## **EDUCATION**

- Ph.D, Electrical Engineering, Ohio University, Athens, Ohio, USA, 2002
- Master of Science (with honors) in Applied Mathematics and Physics, Moscow University of Physics and Technology, Moscow, Russia, 1997
- Bachelor of Science (with honors) in Applied Mathematics and Physics, Moscow University of Physics and Technology, Moscow, Russia, 1995

## **PROFESSIONAL EXPERIENCE**

University of Florida, Research and Engineering Education Facility  
8/2008 – present      *Research Assistant Professor*

Ohio University, Avionics Engineering Center  
11/2005 – 7/2008      *Senior Research Engineer and Adjunct Assistant Professor*

Ohio University, Avionics Engineering Center  
1/2002 – 11/2005      *Research Engineer*

Ohio University, Avionics Engineering Center  
9/1998-12/2001      *Graduate Research Associate*

University of California Berkeley  
8/1997-11/1997      *Visiting Researcher*

10/1995 – 7/1997      *Research Collaborator with the Partners for Advanced Transportation Highway*

## **AWARDS**

- The Institute of Navigation (ION) Early Achievement Award, 2005

- The Radio Technical Commission for Aeronautics (RTCA) Inc. William E. Jackson Award, 2002
- ION Global Navigation Satellite Systems Conference (GNSS) Best in Session Paper Awards, 2004 and 2005
- ION GPS'96 Best Student Paper Award
- Avionics Engineering Center Director's Award, 2006
- Ohio University G.E. Smith and G.V. Smith Memorial Award, 2000

## PROFESSIONAL ACTIVITIES

### *Session Chair*

- ION GNSS 2008, Algorithms for Multi-Sensor Fusion
- IEEE/ION Position, Location, and Navigation Symposium 2008, Land Applications
- ION Annual Meeting 2007, Urban and Indoor Navigation
- IEEE/ION Position, Location, and Navigation Symposium 2006, Sensor Software and Signal Processing
- ION GNSS 2004, Inertial Navigation
- ION GNSS 2003, Inertial Navigation

### *Track Chair*

- ION GNSS 2007 Multi-Sensor Integration Track

### *Reviewer*

- Navigation, Journal of the Institute of Navigation
- IEEE Transactions on Aerospace and Electronic Systems
- AIAA Journal of Aircraft
- IEEE Transactions on Intelligent Transportation Systems

### *Memberships*

- ION, IEEE, Sigma Xi

## PUBLICATIONS

### *Refereed Journal Articles*

1. **A. Soloviev**, S. Gunawardena, F. van Graas, "Deeply Integrated GPS/Low-Cost IMU for Low CNR Signal Processing: Concept Description and In-Flight Demonstration" NAVIGATION, Journal of the Institute of Navigation, Vol. 54, No. 1, 2008.
2. **A. Soloviev**, F. van Graas, "Batch Processing of Inertial Measurements for Mitigation of Sculling and Commutation Errors," NAVIGATION, Journal of the Institute of Navigation, Vol. 53, No. 4, 2007.
3. S. Gunawardena, **A. Soloviev**, F. van Graas, "Wideband Transform-Domain GPS Instrumentation Receiver for Signal Quality and Anomalous Event Monitoring," NAVIGATION, Journal of the Institute of Navigation, Vol. 53, No. 4, 2007.
4. **A. Soloviev**, D. Bates, F. van Graas, "Tight Coupling of Laser Scanner and Inertial Measurements for a Fully Autonomous Relative Navigation Solution," NAVIGATION, Journal of the Institute of Navigation, Vol. 53, No. 3, 2007.
5. A. Soloviev, F. van Graas, "Enhancement of Integrated GPS/INS Performance Utilizing Frequency Domain Implementation of INS Calibration" NAVIGATION, Journal of the Institute of Navigation, Vol. 54, No. 2, 2007.
6. F. van Graas, **A. Soloviev**, "Precise Velocity Estimation Using a Stand-Alone GPS Receiver," NAVIGATION, Journal of the Institute of Navigation, Vol. 51 No. 4, 2004.

7. **A. Soloviev**, S. Gunawardena, F. van Graas, "Decoding Navigation Data Messages from Weak GPS Signals" Accepted for publication in IEEE Transactions on Aerospace and Electronic Systems, January 2008.
8. **A. Soloviev**, M. Uijt de Haag , "An Autonomous Integrity Monitor for Detection and Isolation of Moving Features in Laser Scanner-Based Navigation," Accepted for publication in IEEE Transactions on Aerospace and Electronic Systems, July 2007.
9. **A. Soloviev**, M. Uijt de Haag, "Three-Dimensional Navigation of Autonomous Vehicle Using Scanning Laser Radars," Accepted for publication in IEEE Transactions on Aerospace and Electronic Systems, July 2007.

#### ***Professional Magazines***

1. **A. Soloviev**, "Benefits of Ladar/Inertial Integration," Inside GNSS, July/August 2007.
2. **A. Soloviev**, F. van Graas, "Combining Low-Cost Inertial Systems with GPS," GPS World, March 2004.

#### ***Patent Applications***

1. **A. Soloviev**, F. van Graas, "Methods and Apparatus for Using Multipath Signals in GPS Architecture," US patent application, submitted January 24, 2008.
2. F. van Graas, **A. Soloviev**, S. Gunawardena, "Systems and Methods for Acquisition and Tracking of Low CNR GPS Signals," US patent application, submitted September 22, 2005.
3. F. van Graas, **A. Soloviev**, S. Gunawardena, "Systems and Methods for Acquisition and Tracking of Low CNR GPS Signals," International patent application, submitted October 3, 2005.

#### ***Conference Papers***

1. **A. Soloviev**, "Tight Coupling of GPS, Laser Scanner, and Inertial Measurements for Navigation in Urban Environments," Proceedings of IEEE/ION Position Location and Navigation Symposium, May 5-8, 2008, Monterey, CA.
2. M. Uijt de Haag, D. Venable, **A. Soloviev**, "Implementation of a Flash-LADAR Aided Inertial Navigator," Proceedings of IEEE/ION Position Location and Navigation Symposium, May 5-8, 2008, Monterey, CA.
3. **A. Soloviev**, F. van Graas "Utilizing Multipath Reflections in Deeply Integrated GPS/INS Architecture for Navigation in Urban Environments," Proceedings of IEEE/ION Position Location and Navigation Symposium, May 5-8, 2008, Monterey, CA.
4. **A. Soloviev**, D. Bruckner, F. van Graas, "Characterization of GPS Signals in Urban Environments Using Deeply Integrated GPS/IMU," NATO Symposium on Military capabilities Enabled by Advances in Navigation Sensors, October 1-2, 2007, Antalya, Turkey.
5. N. Parikh, , **A. Soloviev**, F. van Graas "Implementation of a Least Mean Square Approach for a Low-Cost Short Baseline Attitude Determination," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, ION-GNSS-2007, September 25-28, 2007, Fort Worth, TX.
6. **A. Soloviev**, M. Uijt de Haag, "Utilizing Two-dimensional LADAR Images for Three-dimensional Navigation: Conceptual Exploration," Proceedings of the Institute of Navigation Annual Meeting, April 23-25, 2007, Cambridge, MA.
7. **A. Soloviev**, F. van Graas, "Influence of Local Area Augmentation System Decorrelation Errors on the Inertial Coasting Performance," Proceedings of the Institute of Navigation Annual Meeting, April 23-25, 2007, Cambridge, MA.

8. **A. Soloviev**, D. Bruckner, F. van Graas, L. Marti, "Assessment of GPS Signal Quality in Urban Environments Using Deeply Integrated GPS/IMU," Proceedings of the Institute of Navigation National Technical Meeting, January 22-24, 2007, San Diego, CA.
9. **A. Soloviev**, D. Bates, F. van Graas, "Tight Coupling of Laser Scanner and Inertial Measurements for a Fully Autonomous Relative Navigation Solution," Proceedings of the Institute of Navigation National Technical Meeting, January 22-24, 2007, San Diego, CA.
10. **A. Soloviev**, S. Gunawardena, F. van Graas, "Development of High Performance High Update Rate Reference GPS Receiver," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, ION-GNSS-2005, September 13-16, 2005, Long Beach, CA.
11. F. van Graas, **A. Soloviev**, M. Uijt de Haag, S. Gunawardena, M. Braasch, "Comparison of Two Approaches for GNSS Receiver Algorithms: Batch Processing and Sequential Processing Considerations," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, ION-GNSS 2005, September 13-16, 2005, Long Beach, CA.
12. S. Gunawardena, **A. Soloviev**, F. van Graas, "Wideband Dual-Frequency Transform-Domain GPS Instrumentation Receiver for Signal Quality and Anomalous Event Monitoring," Proceedings of the 61<sup>st</sup> Annual Meeting of the Institute of Navigation, June 27-29, 2005, Cambridge, MA.
13. **A. Soloviev**, S. Gunawardena, F. van Graas, "Deeply Integrated GPS/Low-Cost IMU for Low CNR Signal Processing: Flight Test Results and Real Time Implementation," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, September 21-24, ION-GNSS 2004, 2004, Long Beach, CA.
14. S. Gunawardena, **A. Soloviev**, F. van Graas, "Real Time Implementation of Deeply Integrated Software GPS Receiver and Low Cost IMU for Processing Low-CNR GPS Signals," Proceedings of the 60<sup>th</sup> Annual Meeting of the Institute of Navigation, June 7-9, 2004, Dayton, OH.
15. **A. Soloviev**, F. van Graas, S. Gunawardena, "Implementation of Deeply Integrated GPS/Low-Cost IMU for Reacquisition and Tracking of Low CNR GPS Signals," Proceedings of the Institute of Navigation National Technical Meeting, January 26-28, 2004, San Diego, CA.
16. S. Gunawardena, F. van Graas, **A. Soloviev**, "Real Time Block Processing Engine for Software GNSS Receivers," Proceedings of the Institute of Navigation National Technical Meeting, January 26-28, 2004, San Diego, CA.
17. **A. Soloviev**, F. van Graas, "Review of Potential Applications of Low-Cost GPS/INS for General Aviation," Proceedings of the Satellite Division of the Institute of Navigation National Technical Meeting, January 22-24, 2003, Anaheim, CA.
18. F. van Graas, **A. Soloviev**, "Precise Velocity Estimation Using a Stand-Alone GPS Receiver," Proceedings of the Satellite Division of the Institute of Navigation National Technical Meeting, January 22-24, 2003, Anaheim, CA.
19. **A. Soloviev**, F. van Graas, "Investigation into Performance Characteristics of Frequency Domain INS Calibration Procedure under Noisy GPS Environments," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, ION-GPS 2002, September 24-27, 2002, Portland, OR.
20. **A. Soloviev**, F. van Graas, "Mitigation of Commutation and Sculling Errors by Frequency Domain Development of INS Algorithmic Part," Proceedings of the Satellite Division of the Institute of Navigation National Technical Meeting, January 28-30, 2002, San Diego, CA.

21. **A. Soloviev**, F. van Graas, "Enhancement of GPS/INS Integrated System Performance Utilizing Frequency Domain Realization of INS Algorithms," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, ION GPS-2000, September 19-22, 2000, Salt Lake City, UT.
22. K. Mostov, A. N. Soloviev, **A. Soloviev**, "Development of Broad Class of Integrated Navigation Systems Based on Gyro-Free INS," Proceedings of the Satellite Division of the Institute of Navigation National Technical Meeting, January 21-23, 1998, Long Beach, CA.
23. K. Mostov, **A. Soloviev**, T. J. Koo, "Accelerometer Based Gyro-Free Multi-Sensor Generic Inertial Device for Automotive Applications," IEEE Conference on Intelligent Transportation Systems, November 9-12, 1997, Boston, MA.
24. K. Mostov, **A. Soloviev**, and T. J. Koo, "Initial Attitude Determination and Correction of Gyro-Free INS Angular Orientation on the Basis of GPS Linear Navigation Parameters," in Proceedings of IEEE Conference on Intelligent Transportation Systems, November 9-12, 1997, Boston, MA.
25. K. Mostov, **A. Soloviev**, "Fuzzy Adaptive Stabilization of Higher Order Kalman Filters in Application to Precision Kinematic GPS," Proceedings of the International Technical Meeting of the Institute of Navigation Satellite Division, ION GPS-96, September 17-20, 1996, Kansas City, MO.