Kristen Michaelson, Ph.D.

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EDUCATION

Ph.D. Aerospace Engineering, The University of Texas at Austin 2024
Dissertation: Recursive Measurement Updates for Particle and Ensemble Filtering

M.S.E. Aerospace Engineering, The University of Texas at Austin 2020
Master's Report: A Multiplicative Multi-State Constraint Kalman Filter

B.Sc. Mechanical Engineering, Brown University 2016

RESEARCH INTERESTS

time series forecasting, nonlinear estimation, Kalman filtering, space navigation, space tracking, particle filters, particle flow, ensemble filtering, data assimilation, multiple data assimilation

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RESEARCH EXPERIENCE

Postdoctoral Fellow January—July 2025
The University of Texas at Austin
Oden Institute for Computational Engineering & Sciences
Advisor: Renato Zanetti

- Investigated the use of machine learning/time series forecasting techniques for satellite conjunction assessment

Graduate Research Assistant 2018—2024
The University of Texas at Austin
Department of Aerospace Engineering & Engineering Mechanics
Advisor: Renato Zanetti

- Derived a recursive measurement update for extended Kalman filters (EKFs); extended to particle and ensemble filtering for estimation in highly nonlinear systems with non-Gaussian uncertainty
- Designed simulation studies to test the new filters, demonstrating promising results compared to baseline methods in applications such as radar-based cislunar tracking and tracking large-scale chaotic systems

- Designed and implemented a navigation filter for a neuromorphic terrain-relative navigation technique (NeuroGrid) under development in the Sandia Center for Computing Research
- Developed a LinCov-based cost metric for rapidly-exploring random trees (RRT*); the metric induces navigation-friendly behaviors by drawing agents into regions where informative measurements are available
- Mentored 3 junior graduate student researchers; met regularly, shared expertise on my dissertation topic, identified relevant resources in the literature, and helped devise new research directions

This work resulted in 8 first-author publications and was funded by Sandia National Laboratories, a UT Austin Graduate Fellowship, NASA Johnson Space Center, and the Air Force Office of Scientific Research (AFOSR).

PUBLICATIONS

Journal Articles

1. Renato Zanetti, Andrey Popov, **Kristen Michaelson**, Felipe Giraldo Grueso, Dalton Durant, Simone Servadio, and Uwe Hanebeck. A Survey of Nonlinear Estimation Filters. Accepted for publication in *Journal of Advances in Information Fusion*. September 2025.
2. Rachel Mamich, **Kristen Michaelson**, Andrey A. Popov, and Renato Zanetti. Particle Flow and the Kalman Filter. *Journal of Advances in Information Fusion*. Vol. 20, Issue 1. June 2025.
3. **Kristen Michaelson** and Renato Zanetti. Error Flow Filter. *IEEE Transactions on Aerospace and Electronic Systems*. Early Access. May 2025. https://doi.org/10.1109/TAES.2025.3572491.
4. **Kristen Michaelson**, Andrey A. Popov, and Renato Zanetti. Multiple Data Assimilation as an Approximate Maximum A Posteriori Estimator. *Computational Geosciences*. Vol. 29. April 2025. https://doi.org/10.1007/s10596-025-10355-9.
5. **Kristen Michaelson**, Felix Wang, and Renato Zanetti. Terrain-Relative Navigation with Neuro-Inspired Elevation Encoding. *IEEE Transactions on Aerospace and Electronic Systems*. Volume 60, Issue 3. June 2024. https://doi.org/10.1109/TAES.2024.3362760.

Conference Proceedings

1. Kyle J. DeMars, Maaninee Gupta, Renato Zanetti, and **Kristen Michaelson**. Bifidelity Uncertainty Propagation with Directional Splitting for Space Domain Awareness. 2025 IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems, College Station, TX. September 2-4, 2025. (Peer-reviewed)
2. Renato Zanetti, Kyle J. DeMars, Derek Tuggle, **Kristen Michaelson**, and Maaninee Gupta. Uncertainty Quantification Using Directional Splitting and Gaussian Mixture Models with Applications to Orbital Dynamics. AAS/AIAA Astrodynamics Specialist Conference, Boston, MA. August 10-14, 2025.
3. **Kristen Michaelson,** Manan Gandhi, and Renato Zanetti. Navigation-Aware Path Planning and Multi-Agent Coordination in Challenging Environments. Institute of Navigation Positioning, Localization, and Navigation Symposium, Salt Lake City, UT. April 28-May 1, 2025. (Peer-reviewed)

4. **Kristen Michaelson,** Andrey A. Popov, Renato Zanetti, and Kyle J. DeMars. Particle Flow with a Continuous Formulation of the Nonlinear Measurement Update. 27th International Conference on Information Fusion, Venice, Italy. July 7-11, 2024. (Peer-reviewed)
5. Rachel Mamich, **Kristen Michaelson**, Andrey A. Popov, and Renato Zanetti. Burnished Flow Filter. In 27th International Conference on Information Fusion, Venice, Italy. July 7-11, 2024. (Peer-reviewed)
6. **Kristen Michaelson**, Andrey A. Popov, and Renato Zanetti. Ensemble Kalman Filter with Bayesian Recursive Update. In 26th International Conference on Information Fusion, Charleston, SC. June 27-30, 2023. (Peer-reviewed)
7. **Kristen Michaelson**, Felix Wang, and Renato Zanetti. Terrain-Relative Navigation with Neuro-Inspired Elevation Encoding. In IEEE/ION Position Location and Navigation Symposium (PLANS), Monterey, CA. April 24-27, 2023.
8. **Kristen A. Michaelson**, Andrey A. Popov, and Renato Zanetti. Recursive Update Filtering: A New Approach. In AAS/AIAA Astrodynamics Specialist Conference (AAS 23-321), Austin, TX. January 15-19, 2023.
9. Bryan Pogorelsky, **Kristen Michaelson**, and Renato Zanetti. Particle Filter with LMMSE Importance Sampling. In 25th International Conference on Information Fusion, Linköping, Sweden. July 4-7, 2022. (Peer-reviewed)

PRESENTATIONS

Oral Presentations

1. ION PLANS 2025, “Navigation-Aware Path Planning and Multi-Agent Coordination in Challenging Environments” (Salt Lake City, UT)
2. Fusion 2024, “Particle Flow with a Continuous Formulation of the Nonlinear Measurement Update” (Venice, Italy)
3. Fusion 2023, “Ensemble Kalman Filter with Bayesian Recursive Update” (Charleston, SC)
4. Sandia National Laboratories Autonomy for Hypersonics Field Day 2023, “Terrain-Relative Navigation with Neuro-Inspired Elevation Encoding” (Albuquerque, NM)
5. ION PLANS 2023, “Terrain-Relative Navigation with Neuro-Inspired Elevation Encoding” (Monterey, CA)
6. AAS Space Flight Mechanics Meeting 2023, “Recursive Update Filtering: A New Approach” (Austin, TX)
7. Sandia National Laboratories Autonomy for Hypersonics Field Day 2022, “Navigating with NeuroGrid: Incorporating a Novel, Bio-Inspired Measurement into a Navigation Filter” (Albuquerque, NM)

Poster Presentations

1. Kristen A. Michaelson and Renato Zanetti. Particle Flow for Cislunar Tracking Applications. CFIRE: Create the Future Independent Research Effort Annual Review Meeting (AFOSR). University of Colorado Boulder. Boulder, CO. August 16, 2024.

2. Kristen A. Michaelson, Felix Wang, and Renato Zanetti. Terrain-Relative Navigation with Neuro-Inspired Elevation Encoding. Sandia Day at The University of Texas at Austin. Austin, TX. March 9, 2023.
3. Kristen A. Michaelson, Felix Wang, and Renato Zanetti. NeuroGrid: Robust Autonomous Localization using Multi-Resolution Grid Codes. Sandia Day at The University of Texas at Austin. Austin, TX. March 31, 2022.

ACADEMIC SERVICE

Awards Co-Chair & Reviewer, International Conference On Multisensor Fusion And Integration 2025
Reviewer, International Conference on Intelligent Robots and Systems (IROS) 2025
Reviewer, Journal of Guidance, Control, and Dynamics (2x) 2024—2025
Reviewer, International Conference on Information Fusion 2024—2025
Reviewer, IEEE Access (3x) 2023—2024
Session Chair, *Space Navigation and Observation*, ION PLANS (Monterey, CA) 2023

FELLOWSHIPS AND AWARDS

Thrust 2000 — Kenneth F. and Sybil Ranfranz Wells Endowed Graduate Fellowship in Engineering
The University of Texas at Austin 2018—2022

- $36,000 award over 4 years

TEACHING EXPERIENCE

Teaching Assistant, The University of Texas at Austin Spring 2022
Introduction to Computer Programming

- Graded student assignments and held weekly office hours (80 students)

Teaching Assistant, The University of Texas at Austin Spring 2021
Aerial Robotics

- Graded student assignments and held weekly office hours (20 students)
- Facilitated annual course tournament in which student teams program quadcopters to complete an obstacle course; mentored students through development of full autonomy stack (MATLAB / C++ / ROS) including attitude control, state estimation, guidance, structure from motion, path planning
- Received overall “Excellent” TA rating of 5.0/5.0

Group Tutor, Brown University Spring 2015
Fluid Mechanics

- Prepared weekly lessons and exam review material in response to student requests

Teaching Assistant, Brown University Spring 2014

Introduction to Scientific Computing

- Graded student assignments, held weekly office hours, and hosted laboratory sessions for introductory programming course (~100 students)
- Assisted with development of laboratory exercises

PROFESSIONAL EXPERIENCE

TITANS Intern, Sandia National Laboratories 2019, 2022

R&D Engineer, Saint-Gobain Performance Plastics 2016—2018

Product Development Intern, Vecna Technologies, Inc. 2015