Nathaniel Simon

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Research Interests

I am working to improve unmanned aerial vehicle (UAV) performance in the real world. In particular, my hypothesis is that the ability to directly measure airflow around the UAV will lead to significant improvements in performance, in settings such as extreme wind and gusts, ground effect, and proximity flight. I design, build, and test novel high-speed omnidirectional flow sensors for UAVs, as well as controllers which use them. In addition to this primary focus, I am interested in using our UAV platforms to conduct basic research in the atmosphere to improve climate models. I am also interested in applying computer vision techniques to improve the performance of micro UAVs. I sit both in the Intelligent Robot Motion (IRoM) Lab and the Fundamental and Applied Studies in Turbulence (FAST) Group.

Education

Princeton University, Princeton, NJ — 2020 - present
Ph.D. Candidate, Mechanical & Aerospace Engineering
Advisors: Anirudha Majumdar, Marcus Hultmark

Princeton University, Princeton, NJ — 2020 - 2022
Master of Arts, Mechanical & Aerospace Engineering
Advisors: Anirudha Majumdar, Marcus Hultmark

Stanford University, Stanford, CA — 2019 - 2020
Master of Science, Mechanical Engineering

Stanford University, Stanford, CA — 2015 - 2019
Bachelor of Science, Mechanical Engineering

Selected Awards and Honors

- **Crocco Award for Teaching Excellence** — 2023
  $1,000 award for teaching excellence in MAE 345/549: Introduction to Robotics.
- **Robotics and Automation Society Student Travel Grant** — 2023
  $1,300 for travel to the International Conference on Robotics and Automation in London, UK.

- **Outstanding Presentation Award, Princeton Research Day** 2023
  $1,500 prize for my video presentation: *Improving Drone Performance in Wind with Novel, Fast, Sensors*.
- **Guggenheim Second Year Fellowship, Princeton University** 2021
  Departmental fellowship for high performing second year students.
- **National Science Foundation Graduate Research Fellowship Program (NSF GRFP)** 2020
  "The five-year fellowship provides three years of financial support inclusive of an annual stipend of $37,000."

Publications

Peer-reviewed conference and journal publications

[4] **Nathaniel Simon** and Anirudha Majumdar, "'MonoNav: MAV Navigation via Monocular Depth Estimation and Reconstruction". *Under Review*, 2023.

[3] David Snyder, Meghan Booker, **Nathaniel Simon**, Wenhan Xia, Daniel Suo, Elad Hazan, and Anirudha Majumdar, "Online Learning for Obstacle Avoidance", *arXiv preprint arXiv:2306.08776*, (2023).

[2] **Nathaniel Simon**, Allen Z. Ren, Alexander Piqué, David Snyder, Daphne Barretto, Marcus Hultmark, and Anirudha Majumdar, "FlowDrone: Wind Estimation and Gust Rejection on UAVs Using Fast-Response Hot-Wire Flow Sensors", In *Proceedings of the IEEE International Conference on Robotics and Automation*, pages 5393–5399). IEEE, 2023.

[1] **Nathaniel Simon***, Alexander Piqué*, David Snyder, Kyle Ikuma, Anirudha Majumdar, and Marcus Hultmark, "Fast-Response Hot-wire Flow Sensors for Wind and Gust Estimation on UAVs", *Measurement Science and Technology (MST)*, 2022. (* Equal Contribution)

Work Experience

Somewear Labs, San Fracisco, CA May-Oct 2019
Product Manager Intern
Somewear Labs provides satellite communication solutions to hikers and remote workers. I led our Air Force business development and field testing of to improve off-grid situational awareness for rescue teams.

Redwood Materials, Milpitas, CA Oct-Dec 2018
Mechanical Engineering Intern
Redwood Materials, founded by JB Straubel, recycles lithium-ion batteries to accelerate electrification. As the first mechanical engineering intern, I modeled their early electrorefining system.

Aavid, Thermal Division of Boyd Corporation, San Jose, CA Jun-Aug 2018
Design Engineer Intern
Aavid is a thermal solutions consulting company. I designed and validated thermal systems (electronics cooling solutions) for customers, using Solidworks, ANSYS ICEPAK, and experimental tests.

Garmin International, Olathe, KS Jun-Aug 2017
Aviation Systems Engineer Intern
Garmin is a leading provider of avionics in general aviation and corporate aircraft. I developed an integrated test bench for the TXi™ family of touchscreen flight displays.

CentraleSupélec, Sceaux, France Jun-Aug 2017
France-Stanford Fellow
I researched nonthermal (glow) plasma generation at the Laboratoire Énergetique Moleculaire et Macroscopique, Combustion (EM2C), under the supervision of Prof. Christophe Laux.

Talks and Posters

"Fast-Response Hot-wire Flow Sensors for Wind and Gust Estimation on UAVs"

- **[Talk]** *Thousand Islands Fluid Dynamics Meeting*. Apr 2023
- **[Talk]** *American Physical Society, Division of Fluid Dynamics (APS DFD)*. Nov 2022
- **[Talk]** *Princeton MAE Research Day*. Sep 2022

"FlowDrone: Wind Estimation and Gust Rejection on UAVs Using Fast-Response Hot-Wire Flow Sensors"

- **[Poster]** *IEEE International Conference on Robotics and Automation (ICRA)*. Jun 2023
- **[Talk]** *Google AI Lab, Princeton*. Mar 2023
- **[Poster]** *Conference on Robot Learning (CoRL): Learning for Agile Robotics Workshop*. Dec 2022
- **[Poster]** *Dynamic Data Driven Applications Systems (DDDAS) Conference*. Oct 2022

Teaching Experience

Teaching Assistant

- Aircraft Design (MAE 332), Princeton MAE Spring 2023
- Introduction to Robotics (MAE 345/549), Princeton MAE Fall 2022
- Introduction to Engineering Dynamics (MAE 206), Princeton MAE Spring 2022
- Hacking for Defense (MS&E 297), Stanford MS&E Spring 2019, 2020
- Introductory Fluids Engineering, Stanford ME Winter 2020
- Technology and National Security, Stanford MS&E Fall 2019

Professional and Academic Service

Undergraduate Students Advised

- Skywalker Li (ECE) 2023
- Jimmy Tran (MAE) 2023
- Dylan Epsteingross (COS) 2023
- Daphne Barretto (COS) 2022, 2023

- David Fu (MAE) 2022
- John Wallace (MAE) 2022
- Kyle Ikuma (MAE) 2021

Reviewed for: Journals and Conferences

- Engineering Applications of Artificial Intelligence 2023
- Learning for Dynamics & Control Conference (L4DC) 2023
- Journal of Air Transportation 2022

Organizer

- Princeton Robotics Seminar 2022-2023
- **Workshop:** Bridging the Lab-to-Real Gap: Conversations with Academia, Industry, and Government. ICRA 2023.

Selected Press Coverage

- Molly Sharlach, "Small, efficient sensors help drones fly in high winds." *Princeton SEAS News*. Jan. 2022.
- "Student Research Improves Drone Stability." *Princeton Unmanned Aircraft Systems Blog*. May. 2023.

Personal Achievements

- **Private Pilot - Federal Aviation Administration**
  Glider 2014
  Single Engine Land 2015
  Remote Pilot (UAS) 2021
  Instrument Rating Airplane 2023

- **Eagle Scout** 2014