

# Nicholas Corbin

Email: [ncorbin@ucsd.edu](mailto:ncorbin@ucsd.edu)  
LinkedIn: [nick-corbin](https://www.linkedin.com/in/nick-corbin)  
Website: [cnick1.github.io](https://cnick1.github.io)  
GitHub: [github.com/cnick1](https://github.com/cnick1)

## EDUCATION

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### University of California San Diego

La Jolla, CA

Ph.D. in Mechanical and Aerospace Engineering, GPA: 3.95/4.00  
Specialization in Linear and Optimal Control

Fall 2021–Present

### Virginia Tech

Blacksburg, VA

M.S. in Engineering Mechanics, GPA: 3.92/4.00

2019–2021

Thesis: *Dispersion Curve Estimation for Longitudinal Rail Stress Measurement*

### Virginia Tech

Blacksburg, VA

B.S. in Engineering Science and Mechanics, GPA: 3.93/4.00

2015–2019

Minor in Mathematics

## RESEARCH AND WORK EXPERIENCE

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### Kramer Research Group

La Jolla, CA

Graduate Research Assistant

September 2021–Present

Advisor: Dr. Boris Kramer

- Nonlinear model reduction: developing scalable algorithms for implementing nonlinear balanced truncation model reduction.
- Nonlinear control: researching numerical approximations to optimal control laws based on Taylor series expansions.

### Vibrations, Adaptive Structures, and Testing Lab (VAST)

Blacksburg, VA

Graduate Research Assistant

May 2019–July 2021

Advisor: Dr. Pablo Tarazaga

- Dispersive wave propagation: researched structural health monitoring (SHM) technique using low-frequency dispersive flexural waves for non-destructive stress measurement for the Federal Railroad Administration.
- Data-driven modeling: investigated rational transfer function fitting for characterizing dispersion information and boundary conditions from modal test data.

### Pratt and Whitney

East Hartford, CT

Core Structures Intern

May 2018–August 2018

Mentor: Ben Hall

- Sub-idle modal parameter estimation: analyzed nonlinear vibrations using test data from airfoils in gas-turbine engines during startup to extract sub-idle modal parameters using Python.
- CFD validation streamlining: created scripts for automatic CFD vibratory stress prediction validation to accelerate transition of software from experimental to production usage.

### Mechanics of Thin Structures Group

Blacksburg, VA

Undergraduate Research Assistant

January 2016–August 2018

Advisor: Dr. James Hanna

- Ran experiments using tools including high speed imagery, particle image velocimetry, 3D-printing, and processed data using MATLAB, Mathematica, and FFMPEG.

## PUBLICATIONS

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1. **N. Corbin**, A. Sarkar, J. Scherpen, and B. Kramer, “Scalable computation of input-normal/output-diagonal balanced realization for control-affine polynomial systems”, submitted 2024.
2. **N. Corbin**, B. Kramer, “Computing solutions to the polynomial-polynomial regulator problem”, in 2024 63rd IEEE Conference on Decision and Control, Dec. 2024.
3. **N. Corbin**, B. Kramer, “Scalable computation of  $\mathcal{H}_\infty$  energy functions for polynomial drift nonlinear systems”, in 2024 American Control Conference, Jul. 2024, pp. 2506–2511.
4. **N. Corbin**, B. Kramer, “Scalable computation of  $\mathcal{H}_\infty$  energy functions for polynomial control-affine systems”, submitted, 2023.
5. **N. Corbin**, M. Albakri, P. Tarazaga, “Reference-free longitudinal rail stress and neutral temperature measurement utilizing multidirectional elastic waves”, Tech. Rep. submitted to the Federal Railroad Administration, 2021.
6. N. P. Bende, T. Yu, **N. Corbin**, M. A. Dias, C. D. Santangelo, J. A. Hanna, R. C. Hayward, “Overcurvature induced multistability of linked conical frusta: How a ‘bendy straw’ holds its shape”, *Soft Matter*, vol. 14, no. 42, pp. 8636–8642, 2018.
7. **N. Corbin**, J. A. Hanna, W. R. Royston, H. Singh, R. B. Warner, “Impact-induced acceleration by obstacles”, *New Journal of Physics*, vol. 20, no. 5, p. 053031, May 2018.

## CONFERENCE PRESENTATIONS

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1. **N. Corbin**, B. Kramer, “Progress Towards Scalable Nonlinear Balancing Algorithms”, *Model Reduction and Surrogate Modeling (MORe2024)*, September 2024.
2. **N. Corbin**, B. Kramer, “Scalable computation of  $\mathcal{H}_\infty$  energy functions for polynomial control-affine systems”, *American Control Conference (ACC)*, July 2024.
3. **N. Corbin**, B. Kramer, “Nonlinear balancing for quadratic-bilinear systems”, *SIAM Conference on Control and Its Applications*, July 2023.
4. **N. Corbin**, B. Kramer, “Nonlinear balancing for quadratic-bilinear systems”, *Nonlinear Model Reduction for Control Conference at Virginia Tech*, May 2023.
5. **N. Corbin**, M. Albakri, and P. Tarazaga, “Numerical evaluation of a low-frequency acoustoelastic technique for longitudinal rail stress measurement”, *38<sup>th</sup> International Modal Analysis Conference (IMAC)*, February 2020.
6. K. Mize, **N. Corbin**, and P. Tarazaga, “A mass-normalized projection approach to component testing”, *90<sup>th</sup> Shock and Vibrations Exchange (SAVE)*, November 2019.
7. **N. A. Corbin**, J. A. Hanna, W. R. Royston, H. Singh, and R. B. Warner, “V0022: Chain coiling and impinging”, *Gallery of Fluid Motion, 70<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics*, November 2017.

## TEACHING

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- **Graduate Teaching Assistant** at Virginia Tech Summer 2019  
*Dynamics I (ESM 2304)*

## RELEVANT COURSEWORK

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- Linear & Nonlinear Systems Theory
- Linear & Nonlinear Control Design
- Kalman Filtering
- Real & Functional Analysis
- Numerical Linear Algebra
- Model Reduction of Dynamical Systems

- Continuum Mechanics
- Lagrangian & Hamiltonian Mechanics
- Vibrations of Mechanical Systems

## COMPUTER SKILLS

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- **Coding languages:** MATLAB, Mathematica, Python, Bash, LaTeX, Git
- **Finite Element Analysis (FEA):** Abaqus, SOFA
- **Computer-aided Design (CAD):** Solidworks, Inventor

- Perturbation Methods
- Finite Element Analysis

## HANDS-ON SKILLS

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- **Vibration Testing:** Siemens LMS, Polytec
- **Manufacturing:** 3D-printing, laser cutting, woodworking, composite-layups
- **Certification:** National Association of Rocketry (NAR) Level 1 High Power Rocketry certified
- **Languages:** English, Italian

## DESIGN TEAMS

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### ESM Rocketry Senior Design, NASA USLI 2019

Payload Subteam Lead and Document Editor

Blacksburg, VA

January 2018–May 2019

- Co-founded and helped lead a team of 7 competing in NASA University Student Launch Initiative rocketry competition. The team designed and built a Level 2 high power rocket and deployable autonomous UAV payload system while adhering to NASA's rigorous schedule of technical reports and presentations.

### RockSat-X @ Virginia Tech

Team Lead

Blacksburg, VA

September 2017–August 2018

- Led team of 15 in the design and manufacturing of a 15-pound sounding rocket payload for launch with apogee of 90 miles from NASA Wallops Flight Facility in August each year.
- Flat-sat platform: developed deployment, power, and telemetry platform for ejecting several PCB-based experiments from the sounding rocket.

Mechanical Subteam Lead

September 2016–August 2017

- Software-defined radio (SDR): demonstrated capabilities of SDR in space applications by tracking boats and planes, transmitting data to two ground stations, and receiving commands from the ground.

## ENTREPRENEURSHIP

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### UpStream Services LLC

Startup Co-founder

Reston, VA

January 2020–September 2021

- Startup innovating in waste management, last-mile delivery, ecommerce, and green technologies.

## MENTORSHIP AND OUTREACH

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### UCSD undergraduate research mentor

Student mentor

La Jolla, CA

June 2022–September 2022

- Mentored undergraduate researcher Antoinette Gautier under the supervision of Dr. Kramer. Worked with Antoinette to compile SOFA soft robotics finite element software in Linux and implement open- and closed-loop control in SOFA.

### Virginia Tech ESM senior design advisor

Team sponsor/advisor

Blacksburg, VA

August 2020–May 2021

- Sponsored and mentored a senior design team through UpStream Services LLC startup to develop innovative waste-measurement device.

## VAST undergraduate research mentor

Student mentor

Blacksburg, VA

September 2019–January 2020

- Helped mentor undergraduate researchers in the VAST lab under Dr. Tarazaga. Guided and worked with Kam Mize to develop alternative approach to projection methods for component testing, resulting in SAVE conference presentation. Guided Tyler Pugh in design and fabrication of a rotating unbalance device for de-icing of outdoor netted structure.

## Rocketry outreach

Floyd Elementary School Outreach

New River Valley, VA

February 2019

- Helped organize and run a day-long outreach event with Floyd Elementary School to expose 251 students (grades 1-5) to STEM and rocketry. Educated students with a short lesson relating their science class topics to rocketry, and subsequently helped students design and build their own “bubble rockets” powered by effervescent tablets as detailed in NASA’s “Build a Bubble-Powered Rocket” lesson plan.

Blacksburg High School FlatSat Project

January 2018–August 2018

- Mentored and worked with three student teams at Blacksburg High School to ideate, design, build, and test three deployable experiments to launch on our RockSat-X payload platform to space from NASA Wallops. The Virginia Tech team, under my leadership, designed and built a deployment, power, and telemetry platform for small, PCB-based deployable experiments. We then partnered with Blacksburg High School to have students build the experiments of their choice, which ultimately were 1) a reaction-control experiment to try to control the positioning of the deployables, 2) a Geiger counter to measure radiation in the thermosphere, and 3) a spectrometry experiment to measure the makeup of the thermosphere.

## FELLOWSHIPS AND AWARDS

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- UCSD Powell Fellowship 2021  
*This award is given to outstanding doctoral students in UCSD’s Jacobs School of Engineering.*
- Liviu Librescu Memorial Fellowship 2020  
*This award is given to Virginia Tech Engineering Mechanics graduate students with outstanding academic records and who have demonstrated strong leadership potential and commitment to professional or community service.*
- NSF GRFP Honorable Mention 2020  
*This award is given to meritorious applicants who do not receive GRFP Fellowship awards, and is considered a significant national academic achievement and provides access to cyberinfrastructure resources through the XSEDE.*
- James H. Sword Award 2019  
*This award is given to Virginia Tech Engineering Science and Mechanics students in recognition of an Outstanding Senior Project.*

## EXTRACURRICULAR ACTIVITIES

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- Honors Residential College at Virginia Tech 2015–2019  
*Held Apartment Fellow leadership role in the HRC Honors community at Virginia Tech.*
- Jazz Guitar 2007–Present

## REFERENCES

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Contact information for the professors whom I have asked to write recommendations for me:

- **Dr. Boris Kramer**, Assistant Professor at UC San Diego,  
Department of Mechanical & Aerospace Engineering bmkramer@ucsd.edu  
*Doctoral Advisor*

- **Dr. Pablo Tarazaga**, Professor at Texas A&M,  
Department of Mechanical Engineering  
*Master's Thesis Advisor* ptarazag@vt.edu
- **Dr. Roger Chang**, Instructor at Virginia Tech,  
Department of Biomedical Engineering and Mechanics  
*Mentor* tchang@vt.edu
- **Dr. James Hanna**, Associate Professor at University of Nevada Reno,  
Department of Mechanical Engineering  
*Undergraduate Research Advisor, Mentor* jhanna@unr.edu
- **Dr. Serkan Gugercin**, Professor at Virginia Tech,  
Department of Mathematics  
*Mentor* gugercin@vt.edu
- **Dr. Shane Ross**, Professor at Virginia Tech,  
Department of Aerospace Engineering  
*Master's Thesis Committee Member* sdross@vt.edu