

Gary K. Nave, Jr.

Postdoctoral Scholar, Northwestern University

Gary.Nave@northwestern.edu
(804) 397-0700
garynave.com

Appointments

Postdoctoral Scholar, Northwestern University

2020-Present

Department of Engineering Science and Applied Mathematics

Advisor: Daniel Abrams

I am currently studying the time dynamics of reported pain by individuals with Sickle Cell Disease. The work involves data-driven mechanistic models as well as machine learning approaches to predict the changes in pain over time.

Postdoctoral Associate, University of Colorado Boulder

2018-2020

BioFrontiers Institute, Computer Science

Advisor: Orit Peleg

In this position, I studied the collective behavior of insects, both in honey bees and fire ants. The work involved both experimental research with honey bees and agent-based modeling methods to investigate the underlying decisions that lead to observed behaviors.

Graduate Research Assistant, Virginia Tech

2016-2018

Biological Transport (BioTrans) Program, Engineering Mechanics

Virginia Tech Graduate School-funded interdisciplinary research assistantship. With this support, I continued to work toward understanding the underlying mechanics of falling and gliding objects, such as animal gliders, as well as phase space structures that arise in such models.

Graduate Research Assistant

2014-2016

MultiScale Transport in Environmental and Physiological Systems (MultiSTEPS) Program, Virginia Tech

I began my Ph.D. supported by this NSF-funded training program, focused on material transport, at the disciplinary boundary between biology and engineering. The program involved 3 research rotations in the first year of the program with advisors in different fields, and coursework in engineering, biology, and interdisciplinary grant writing.

Director of Undergraduate Recruiting, Virginia Tech

2012-2014

College of Engineering

In this position, I coordinated all recruiting activities for the College of Engineering, leading the Dean's Team, a group of 38 undergraduate students who aid in recruiting activities. I also planned and coordinated the annual Engineering Open House for over 1,000 visitors each year. My team and I presented daily to prospective undergraduate students.

Education

Ph.D., Engineering Mechanics, Virginia Tech

2018

Dissertation: Nonlinear models and geometric structure of fluid forcing on moving bodies

Advisors: Shane Ross and Mark Stremler

Committee: Jake Socha, Nicole Abaid, and Craig Woolsey

Research focus: In my graduate work, I focused on flow-induced vibration of tandem cylinders and the dynamics of passive descent, including gliding animals. I also developed methods to detect regions of attraction and repulsion in dynamical systems and fluid flows.

Graduate certificate: Preparing the Future Professoriate

This program is designed to prepare graduate students for a faculty career. Features coursework on contemporary pedagogical practices and issues in higher education. Additionally, I visited 10 universities in Europe and Ecuador to gain a global perspective on higher education.

B.S., Engineering Science and Mechanics, Virginia Tech

2012

Senior Design: Dispersed sensing through chaotic motion

Minor: Mathematics

Teaching Experience

Guest Lectures

Dynamical Models in Biology, University of Colorado Boulder

Spring 2020

Undergraduate/graduate Computer Science course

6 class sessions designed and taught, helped plan course topics

I taught topics including Markov chains in cancer modeling, animal locomotion, cellular automata and pattern formation, and collective behavior.

Dynamical Models in Biology, University of Colorado Boulder

Spring 2020

Undergraduate/graduate Computer Science course

1 class session designed and taught

I provided an introduction to modeling with differential equations and phase space representations, using the example of the gliding behavior of flying snakes.

Advanced Dynamics, Virginia Tech

Spring 2017

PhD-level survey of advanced research topics in dynamical systems

2 class sessions designed and taught

I taught a two-lecture series which gave an introduction to topics from smooth manifolds, including the tangent bundle, Lie groups and Lie algebras, and their relevance to the study of dynamics.

Dynamics, Virginia Tech

Spring 2015

Second-year introductory engineering course

2 guest lectures designed and taught

I taught two guest lectures for a sophomore-level dynamics course. The first lecture was an introduction to the impulse-momentum equations and the dynamics of collisions. The second lecture was an introduction to rigid body rotation about a fixed axis and the parallel axis theorem.

Foundations of Engineering, Virginia Tech

Fall 2014

First year general engineering course

1 guest lecture designed and taught twice

I gave guest lectures on two occasions, discussing the Engineering Science and Mechanics major at Virginia Tech and my own research, highlighting potential opportunities in engineering for undergraduate students.

Workshops Taught

Introduction to Agent-Based Modeling with Python, BioFrontiers Institute

Spring 2020

Developed a workshop to provide a basic introduction to agent-based modeling in Python for the Quantitative Exploration and Discussion Supergroup. Available at github.com/gknave/Python_Intro.

Intermediate Python, Postdoctoral Association of Colorado *Fall 2019*
Developed a workshop to introduce fellow postdocs to practical tools for scientific research using Python.
Materials available at github.com/gknavel/Python_Intro.

Introduction to Python, Postdoctoral Association of Colorado *Spring/Fall 2019*
Developed a workshop to provide a basic introduction to programming in Python for fellow postdocs. Available at github.com/gknavel/Python_Intro.

LaTeX Workshop, Graduate Engineering Mechanics Society, Virginia Tech *Spring/Fall 2017*
Developed a workshop, offered twice, to provide fellow graduate students with an introduction to LaTeX, a document preparation software.

Publications

Submitted, Preprint Available

Clustering of pain dynamics in sickle cell disease from sparse, uneven samples
GK Nave Jr, S Padhee, A Alambo, T Banerjee, N Shah, and DM Abrams
arXiv preprint, arXiv:2108.13963, **2021**

Peer-Reviewed Journal Articles

Wind dispersal of natural and biomimetic artificial samaras
GK Nave Jr, N Hall, K Somers, B Davis, H Gruszecki, C Powers, M Collver, DG Schmale III, SD Ross
Biomimetics, Vol 6.2: 23, **2021**

Attraction, dynamics, and phase transitions in fire ant tower-building
GK Nave Jr, NT Mitchell, JA Chan-Dick, T Schuessler, JA Lagarrigue, and O Peleg
Frontiers in Robotics and AI, Vol 7, <https://doi.org/10.3389/frobt.2020.00025>, **2020**

Global phase space structures in a model of passive descent
GK Nave Jr and SD Ross
Communications in Nonlinear Science and Numerical Simulation, Vol 77: 54-80, **2019**

Trajectory-free approximation of phase space structures using the trajectory divergence rate
GK Nave Jr, PJ Nolan, and SD Ross
Nonlinear Dynamics, Vol 96(1): 685-702, **2019**

Drop formation from a wettable nozzle
B Chang, GK Nave Jr, and S Jung
Communications in Nonlinear Science and Numerical Simulation, Vol 17.5: 2045-2051, **2012**

Peer-Reviewed Conference Articles

Pain intensity assessment in sickle cell disease patients using vital signs during hospital visits
S Padhee, A Alambo, T Banerjee, A Subramaniam, DM Abrams, GK Nave Jr, and N Shah
Pattern Recognition, 12662: 77-85, **2021**

Global perspectives: graduate students' experiences with global higher education
GK Nave Jr, AL Hermundstad, M Stewart, MR Waters, E Garner, M Seyam, CR Corkins, DP DePauw
American Society of Engineering Education, 2017 Annual Meeting, **2017**

In Preparation

Wake stiffness as a nonlinear spring

GK Nave Jr and MA Stremler

Dynamics of honey bee swarm formation

GK Nave Jr, O Shishkov, and O Peleg

The surface tension of honey bee swarms

GK Nave Jr, Raphael Sarfati, and Orit Peleg

Presentations

Invited Talks

The College of New Jersey , Mathematical Biology	<i>Nov. 2020</i>
Northwestern University , Engineering Sciences and Applied Mathematics	<i>June 2020</i>
University of Pittsburgh , Applied Math Seminar	<i>Apr. 2019</i>
University of Colorado Boulder , Complex/Dynamical Systems Seminar	<i>Oct. 2018</i>
Virginia Tech , Math Biology Seminar	<i>Sept. 2017</i>

Conference Presentations

Analysis of the internal structure of honeybee swarms with x-ray CT O Shishkov, <u>GK Nave Jr</u> , and O Peleg <i>American Physical Society March Meeting</i> , Remote	<i>Mar. 2021</i>
Internal structure of honey bee swarms O Shishkov, <u>GK Nave Jr</u> , and O Peleg <i>Society for Integrative and Comparative Biology Annual Meeting</i> , Remote	<i>Jan. 2021</i>
Modeling decision-making in fire ant tower and honey bee swarm formation <u>GK Nave Jr</u> , H Tallackson, and O Peleg <i>Joint Math Meetings</i> , Denver, CO	<i>Jan. 2020</i>
The formation of honey bee swarms <u>GK Nave Jr</u> , H Tallackson, and O Peleg <i>Society for Integrative and Comparative Biology Annual Meeting</i> , Austin, TX	<i>Jan. 2020</i>
Coming together to climb higher: agent-based modeling of fire ant tower building <u>GK Nave Jr</u> and O Peleg <i>American Chemical Society Colloids and Surface Science Meeting</i> , Atlanta, GA	<i>June 2019</i>
Aerial dispersal devices inspired by autorotating plant seeds SD Ross, <u>GK Nave Jr</u> , K Somers, B Davis, H Gruszewski, N Hall, C Powers, and DG Schmale III <i>Society for Integrative and Comparative Biology Annual Meeting</i> , Tampa, FL	<i>Jan. 2019</i>

The surface tension of honey bee swarms GK Nave Jr and O Peleg <i>Social Insects in the Northeast Regions</i> , Philadelphia, PA	<i>Dec. 2018</i>
Slow manifolds in the aerodynamic descent of animals and plants GK Nave Jr and SD Ross <i>Dynamics Days</i> , Denver, CO	<i>Jan. 2018</i>
Understanding gliding flight with the terminal velocity manifold GK Nave Jr <i>Southeast regional Society of Integrative and Comparative Biology Meeting</i> , Blacksburg, VA	<i>Nov. 2017</i>
Phase space structures in velocity space for gliding and falling bodies GK Nave Jr and SD Ross <i>Society for Industrial and Applied Mathematics Dynamical Systems Meeting</i> , Snowbird, UT	<i>May 2017</i>
Wake Stiffness and its Application: Tethered Cylinders and Flying Snakes GK Nave Jr, MA Stremler, and SD Ross <i>XXIV International Congress of Theoretical and Applied Mechanics</i> , Montreal, CA	<i>Aug. 2016</i>
Snakes in a Cube: high-resolution kinematics of gliding in flying snakes IJ Yeaton, GA Baumgardner, TM Weiss, GK Nave Jr, SD Ross, and JJ Socha <i>Society for Integrative and Comparative Biology Annual Meeting</i> , Portland, OR	<i>Jan. 2016</i>
Regimes of flow-induced vibration for tandem, tethered cylinders GK Nave Jr and MA Stremler <i>American Physical Society Division of Fluid Dynamics Meeting</i> , Boston, MA	<i>Nov. 2015</i>
What's its wave? A 3D analysis of flying snake locomotion IJ Yeaton, GA Baumgardner, TM Weiss, GK Nave Jr, SD Ross, and JJ Socha <i>American Physical Society Division of Fluid Dynamics Meeting</i> , Boston, MA	<i>Nov. 2015</i>
GK Nave Jr, T Michael, P Vlachos, and MA Stremler Flow-induced oscillations of tandem, tethered cylinders in a channel flow <i>American Physical Society Division of Fluid Dynamics Meeting</i> , San Fransisco, CA	<i>Nov. 2014</i>

Professional Development

Evidence-Based Introduction to Teaching *2019*
Boulder, CO

This week-long workshop was offered by the Center for the Integration of Research, Teaching, and Learning. In the course, participants learned about active teaching techniques, discussed discipline-based education research, and put new ideas into practice by developing a microteaching module.

Critical Transitions in Complex Systems Winter School: Mathematical Theory and Applications *2018*
Wöltingerode, Germany

This event is part of the activities of the “Critical Transitions in Complex Systems” Marie Curie Initial Training Network bringing together scientists and mathematicians to progress the understanding of critical transitions in complex systems ranging from ecology and climate to economic theory. Discussions covered slow-fast systems, stochastic differential equations, and equation-free detection of attracting manifolds.

SHIFT 21st Century Faculty Institute**2017***Blacksburg, VA*

Helped organize and participated in a week-long faculty development program at Virginia Tech with visiting faculty members from Universidad San Francisco de Quito.

Global Perspectives Program**2016***Ecuador*

The global perspectives program is a selective program run by Dean DePauw of the graduate school at Virginia Tech. Through this program, I was selected as one of five Virginia Tech graduate students to visit Universidad San Francisco de Quito and Escuela Politecnica Nacional to help form partnerships with these universities.

Global Perspectives Program**2016***Switzerland, France, and Italy*

The global perspectives program is a selective program run by Dean DePauw of the graduate school at Virginia Tech. The program consists of two weeks of visiting higher education institutions primarily in Switzerland. Our group visited a total of 8 universities of varying size and emphasis and had a number of conversations with students, staff, and faculty about the future of higher education in Europe and around the world.

VTKnowledgeWorks Tech Transfer Challenge**2014***Blacksburg, VA**Finalist*

Led a team pitching “Hydrokinetic Energy Systems” that was a finalist in the Tech Transfer Challenge, an entrepreneurial pitch competition for technology transfer from the research lab to the market.

ACC Clean Energy Challenge**2014***College Park, MD**Semi-finalist*

Led a team selected as a semi-finalist in the ACC Clean Energy Challenge, a competition for schools across the Southeast United States. Our project was entitled “enVIV: Energy from Vortex Induced Vibration”

Ambassador Leadership Forum**2013***Eastman Chemical Company, Kingsport, TN*

Facilitated a collaborative partnership between the Virginia Tech College of Engineering and Eastman Chemical Company. As a result of this collaboration, Eastman invited myself and a group of student ambassadors under my supervision to participate in this leadership development forum.

Research Advising and Mentoring

M.Eng. Students*Nathaniel Hall***Senior Design Teams***Optimization of spacing for wake energy harvesting (2019-2020)**Flow-induced vibration energy harvester (2014-2015)***High School Teachers***Michael Collver***Undergraduate Students***Emily Walker*

Aubrey Kroger
Hadley Tallackson
Brock Davis
Katrina Somers
Doug Stepp
Josam Waterman
Billy Ermlick

CU Science Discovery program

Mentored a team of 3 high school students to experimentally study the movement of individual honey bees under different temperature conditions. Helped the students conduct, analyze, and visualize experiments.

Service

Leadership positions held

Advisory Board Member Postdoctoral Association of Colorado (PAC) Boulder	<i>2019-2020</i>
Founder and President Virginia Tech Graduate Engineering Mechanics Society	<i>2016-2018</i>
Director of Programs Graduate Student Assembly, Virginia Tech	<i>2017</i>
Funding Programs Chair Graduate Student Assembly, Virginia Tech	<i>2016</i>
Member GSA Committee on Graduate Inclusion and Diversity Policies, Virginia Tech	<i>2015-2016</i>
Delegate Graduate Student Assembly, Virginia Tech	<i>2014-2016</i>
Member Virginia Tech Graduate Student of the Year Selection Committee	<i>2015</i>

One-on-one mentoring programs

Mentor Virginia Tech Early Engineering Mentoring Program	<i>2016-2017</i>
Mentor Graduate Undergraduate Mentoring Program, Virginia Tech	<i>2015-2017</i>
Mentor Student Transition to Engineering Program, Virginia Tech	<i>2012-2016</i>