Nicole Teresa Abaid

CONTACT INFORMATION	Department of Mathematics Virginia Polytechnic Institute and State University 548 McBryde Hall Blacksburg, VA 24061, USA	*Phone:* 540-231-5516 *Fax:* 540-231-5960 *E-mail:* nabaid@vt.edu

EDUCATION	Polytechnic Institute of New York University, Brooklyn, New York
	  Ph.D., Mechanical Engineering, May 2012
	
	University of Kansas, Lawrence, Kansas
	  M.A., Mathematics, May 2008
	
	University of North Carolina at Chapel Hill, Chapel Hill, North Carolina
	  B.Sc., Mathematics, May 2003

PROFESSIONAL APPOINTMENTS

Associate Professor, Virginia Polytechnic Institute and State University
Department of Mathematics, August 2019 - present,
Affiliate of the Interdisciplinary Center for Applied Mathematics, 2012 - present,
Affiliate of the Department of Mechanical Engineering, 2018 - present.
Affiliate of the Department of Biomedical Engineering and Mechanics, 2019 - present.

Assistant Professor, Virginia Polytechnic Institute and State University
Department of Biomedical Engineering and Mechanics, August 2012 - August 2019

Visiting Professor, "Sapienza" University of Rome
Department of Mechanical and Aerospace Engineering, March 2012 - August 2012

Research Assistant, Polytechnic Institute of New York University
Department of Mechanical and Aerospace Engineering, August 2008 - March 2012

GK12 Fellow, Polytechnic Institute of New York University
NSF GK12 Project: Applying Mechatronics to Promote Science, August 2008 - May 2011

Teaching Assistant, University of Kansas
Department of Mathematics, August 2005 - May 2008

RESEARCH INTERESTS

Bioinspired mathematical modeling, complex systems, control theory, data mining, dynamical systems, mechatronics, network theory, synchronization and consensus

HONORS AND AWARDS

As an assistant professor

- Invited semi-plenary speaker at the Modeling, Estimation, and Control Conference, Austin, Texas, USA and online, October 25-27, 2021
- Invited speaker at ICERM Workshop on Pedestrian Dynamics: Modeling, Validation and Calibration, Providence, Rhode Island, August 21-25, 2017
- Department of Biomedical Engineering and Mechanics "Leader in Research" Assistant Professor, Virginia Tech, May 2017
- Invited speaker at IEEE International Workshop on Complex Systems and Networks, Atlanta, Georgia, November 14-15, 2016
- Invited speaker at Virginia Tech TEDx event, November 19, 2015
- Invited speaker at the SPIE Smart Structures/NDE 2015: Bioinspiration, Biomimetics, and Bioreplication V, San Diego, California, USA, March 11, 2015

- Popular Science "Brilliant 10", 2014
- Scholar of the week, Office of the Vice President for Research, Virginia Tech, December 15, 2014
- Invited keynote speaker at the International Conference of Control, Dynamic Systems, and Robotics, Ottawa, Canada, May 2014
- Best Student Paper award in ASME Dynamic System and Control Conference, October 2011

JOURNAL
PUBLICATIONS

1. Biddle K.S., Welfare L.E., Abaid N., Upthegrove T., Queen R.M.: "An exploration of attunement in counselor education via an expressive arts intervention", submitted to *Journal of Creativity and Mental Health*.

2. McClure J.E., Abaid N.: "Effect of topology and geometric structure on collective motion in the Vicsek model", submitted to *Frontiers in Applied Mathematics and Statistics*.

3. Hashimoto A., Heintzman L., Koester R., Abaid N.: "An agent-based model reveals lost person behavior based on data from wilderness search and rescue", submitted to *Scientific Reports*.

4. Freeze S.R., Jahromi Shirazi M., Abaid N., Ford W.M., Silvis A., Hakkenberg D., 2021: "Effects of environmental clutter on synthesized chiropteran echolocation signals in an anechoic chamber", *Acoustics*, 3(2), 391-410.

5. Jahromi Shirazi M., Abaid N., 2021: "Eavesdropping like a bat: toward fusing active and passive sonar for a case study in SLAM", *IET Radar, Sonar & Navigation*, 15, 1151-1163.

6. Shaffer I., Abaid N., 2020: "Transfer entropy analysis of interactions between bats using position and echolocation data", *Entropy*, 22, 1176.

7. Lee H.R.L., Bhatia A., Brynjarsdóttir J., Abaid N., Barbaro A., Butail S., 2020: "Speed modulated social influence in evacuating pedestrian crowds", *Collective Dynamics*, 5, 1-24.

8. Qian F., Abaid N., Zuo L., 2020: "Multiple-scale analysis of a tunable bi-stable piezoelectric energy harvester", *ASME Letters in Dynamic Systems and Control*, 1, 021006.

9. Roy S., Jahromi Shirazi M., Jantzen B., Abaid N., 2019: "Effect of visual and auditory sensing cues on collective behavior in Vicsek models", *Physical Review E*, 100, 062415.

10. O'Bryan L., Abaid N., Nakayama S., Dey T., King A.J., Cowlishaw G., Rubenstein D., Garnier S., 2019: "Contact calls facilitate group contraction in free-ranging goats (*Capra aegagrus hircus*)", *Frontiers in Ecology and Evolution*, 7, 73.

11. Roy S., Howes K., Müller R., Butail S., Abaid N., 2019: "Extracting interactions between flying bat pairs using model-free methods", *Entropy*, 21(1), 42.

12. Jahromi Shirazi M., Abaid N., 2018: "Collective behavior in groups of self-propelled particles with active and passive sensing inspired by animal echolocation", *Physical Review E*, 98, 042404.

13. Beauchene C., Roy S., Moran R., Leonessa A., Abaid N., 2018: "Comparing brain connectivity metrics: a didactic tutorial with a toy model and experimental data", *Journal of Neural Engineering*, 15, 056031.

14. Müller R., Abaid N., Boreyko J.B., Fowlkes, C., Goel, A., Grimm, C., Jung, S., Kennedy, B., Murphy, S., Cushing, N., and Han, J.-P., 2018: "Biodiversifying bioinspiration", *Bioinspiration & Biomimetics*, 13(5), 053001.

15. Ahmadi S.F., Berrier A.S., Doty W.M., Greer P.G., Habibi M., Morgan H.A., Waterman J.H.C., Abaid N., and Boreyko J.B., 2017: "Latent heat of traffic moving from rest", *New Journal of Physics*, 19, 113034.

16. Roy S., <u>Abaid N.</u>, 2017: "Interactional dynamics of same-sex marriage legislation in the United States", *Royal Society Open Science*, 4, 170130.

17. Jaramillo Cienfuegos P., Shoemaker A., <u>Abaid N.</u>, Grange R. W., Leonessa A., 2017: "Classical and adaptive control of in vitro skeletal muscle contractions using functional electrical stimulation (FES)", *PLoS ONE*, 12(3), e0172761.

18. Beauchene C., <u>Abaid N.</u>, Moran R., Diana R. A., Leonessa A., 2017: "The effect of binaural beats on verbal working memory and cortical connectivity", *Journal of Neural Engineering*, 14, 026014.

19. Lin Y., <u>Abaid N.</u>, Müller R., 2016: "Bats adjust their pulse emission rates with swarm size in the field", *The Journal of the Acoustical Society of America*, 140(6), 4318-4325.

20. Roy S., <u>Abaid N.</u>, 2016: "On the effect of collaborative and antagonistic interactions on synchronization and consensus in networks of conspecific agents", *IEEE Transactions on Automatic Control*, 61(12), 4063-4068.

21. Beauchene C., <u>Abaid N.</u>, Moran R., Diana R. A., Leonessa A., 2016: "The effect of binaural beats on visuospatial working memory and cortical connectivity", *PLoS ONE*, 11(11), e0166630.

22. Roy S., <u>Abaid N.</u>, 2016: "Leader-follower consensus in numerosity-constrained networks with dynamic leadership", *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 26, 116309.

23. Orange N., <u>Abaid N.</u>, 2015: "A transfer entropy analysis of leader-follower interactions in flying bats", *European Physical Journal: Special Topics*, 224(17), 3279-3293.

24. <u>Abaid N.</u>, Butail S., Porfiri M., Spinello D. 2015: "Dynamics of animal systems", *European Physical Journal: Special Topics*, 224(17), 3108-3117.

25. Lin Y., <u>Abaid N.</u>, 2015: "Modeling perspectives on echolocation strategies inspired by bats flying in groups", *Journal of Theoretical Biology*, 387, 46-53.

26. <u>Abaid N.</u>, Macinko J., Silver D., Porfiri M., 2015: "The effect of geography and citizen behavior on motor vehicle deaths in the United States", *PLoS ONE*, 10(1371), e0123339.

27. Ford W.M., Evans A.M., Odom R.H., Rodrigue J.L., Kelly C.A., <u>Abaid N.</u>, Diggins C.A., Newcomb D., 2015: "Predictive habitat models derived from nest-box occupancy for the endangered Carolina northern flying squirrel in the Southern Appalachians", *Endangered Species Research*, 27, 131-140.

28. DeLellis P., Polverino G., Ustuner G., <u>Abaid N.</u>, Macri S., Bollt E.M., Porfiri M., 2014: "Collective behavior across animal species", *Scientific Reports*, 4, 3723.

29. Lin Y., <u>Abaid N.</u>, 2013: "Collective behavior and predation success in a predator-prey model inspired by hunting bats", *Physical Review E*, 88(6), 062724.

30. <u>Abaid N.</u>, Marras S., Fitzgibbons C., Porfiri M., 2013: "Modulation of risk-taking behaviour in golden shiners (*Notemigonus crysoleucas*) using robotic fish", *Behavioural Processes*, 100, 9-12.

31. <u>Abaid N.</u>, Cappa P., Palermo E., Petrarca M., Porfiri M., 2013: "Gait detection in children with and without hemiplegia using single-axis wearable gyroscopes", *PLoS ONE*, 8(9), e73152.

32. <u>Abaid N.</u>, Bernhardt J., Frank J., Kapila V., Kimani D., Porfiri M., 2013: "Controlling a robotic fish with a smart phone", *Mechatronics*, 23(5), 491-496.

33. <u>Abaid N.</u>, Kopman V., Porfiri M., 2013: "The story of a Brooklyn outreach program on biomimetics, underwater robotics, and marine science for K-12 students", *IEEE Robotics and Automation Magazine*, 20(2), 31-39.

34. <u>Abaid N.</u>, Porfiri M., 2012: "Leader-follower consensus over numerosity-constrained random networks", *Automatica*, 48(8), 1845-1851.

35. <u>Abaid N.</u>, Bartolini T., Macri S., Porfiri M., 2012: "Zebrafish responds differentially to a robotic fish of varying aspect ratio, tail beat frequency, noise, and color", *Behavioural Brain Research*, 224(2), 545-553.

36. Polverino G., <u>Abaid N.</u>, Kopman V., Macri S., Porfiri M., 2012: "Zebrafish response to robotic fish: preference experiments on isolated individuals and small shoals", *Bioinspiration and Biomimetics*, 7(3), 036019.

37. <u>Abaid N.</u>, Spinello C., Laut J., Porfiri M., 2012: "Zebrafish (*Danio rerio*) responds to images animated by mathematical models of animal grouping", *Behavioural Brain Research*, 232(2), 406-410.

38. <u>Abaid N.</u>, Igel I., Porfiri M., 2012: "On the consensus protocol of conspecific agents", *Linear Algebra and Its Applications*, 437(1), 221-235.

39. <u>Abaid N.</u>, Bollt E.M., Porfiri M., 2012: "Topological analysis of complexity in multi-agent systems", *Physical Review E*, 85(4), 041907.

40. <u>Abaid N.</u>, Yuvienco C., Kapila V., Iskander M., 2011: "Mechatronics Mania at the Inaugural USA Science and Engineering Festival", *IEEE Control Systems Magazine*, 31(5), 105-124.

41. <u>Abaid N.</u>, Porfiri M., 2011: "Consensus over numerosity-constrained random networks", *IEEE Transactions on Automatic Control*, 56(4), 649-654.

42. <u>Abaid N.</u>, Porfiri M., 2010: "Fish in a ring: spatio-temporal pattern formation in one-dimensional animal groups", *Journal of the Royal Society Interface*, 7(51), 1441-1453.

43. <u>Abaid N.</u>, Eisenberg B., Liu W., 2008: "Asymptotic expansions of I-V relations via a Poisson-Nernst-Planck system", *SIAM Journal on Applied Dynamical Systems*, 7(4), 1507-1526.

44. <u>Abaid N.</u>, Adalsteinsson D., Agyapong A., McLaughlin R., 2004: "An internal splash: levitation of falling spheres in stratified fluids", *Physics of Fluids*, 16(5), 1567-1580.

JOURNAL EDITORSHIP

1. Editorial Board member, *Scientific Reports*, 2021-present

2. Guest editor of research topic "Modelling collective motion across scales" in *Frontiers in Applied Mathematics and Statistics* with R. Eftimie, A. Hutt, and L Van Veen.

3. Guest editor of invited special issue "Dynamics of animal systems" in *European Physical Journal: Special Topics*, 224(17), with S. Butail, D. Spinello, and M. Porfiri.

BOOK CHAPTERS

1. Silvis, A., <u>Abaid N.</u>, Ford, W.M., Britzke, E.R., 2016: "Responses of bat social groups to roost loss: More questions than answers", *Sociality in Bats*, Springer Verlag, Edited by J. Ortega, 261-280.

2. Butail, S., <u>Abaid N.</u>, Macri, S., Porfiri, M., 2015: "Fish-robot interactions: robot fish in animal behavioral studies", *Robot Fish- Bio-inspired Fishlike Underwater Robots*, Springer Verlag, Edited by R. Du, Z. Li, K. Youcef-Toumi, and P. Alvarado, 359-377.

3. <u>Abaid N.</u>, Porfiri M., 2012: "Synchronous dynamics over numerosity-constrained stochastic networks", *Applications of Chaos and Non-linear Dynamics in Engineering- Vol. 2*, Springer Verlag, Edited by S. Banerjee, L. Rondoni, and M. Mitra, 95-121.

CONFERENCE PAPERS

1. Heintzman L., Hashimoto A., <u>Abaid N.</u>, Williams R.: "Anticipatory planning and dynamic lost person models for human-robot search and rescue", IEEE International Conference on Robotics and Automation, May 30–June 5, 2021, Virtual/Online and Xi'an, China, Paper WeAT13.4.

2. Bradley A., Jahromi Shirazi M., <u>Abaid N.</u>: "Bearing-only localization of a quasi-static sound source with a binaural microphone array", ASME DSCC - Dynamic Systems and Control Conference, October 5–October 7, 2020, Virtual/Online, Paper DSCC2020-3235.

3. Qian F., <u>Abaid N.</u>, Zuo L.: "Multiple-scale analysis of a novel piezoelectric energy harvester with a tunable potential function", ASME DSCC - Dynamic Systems and Control Conference, October 8–October 11, 2019, Park City, Utah, USA, Paper DSCC2019-9091.

4. Hashimoto A., <u>Abaid N.</u>: "An agent-based model of lost person dynamics for enabling wilderness search and rescue", ASME DSCC - Dynamic Systems and Control Conference, October 8–October 11, 2019, Park City, Utah, USA, Paper DSCC2019-9222.

5. Bradley A., Jahromi Shirazi M., <u>Abaid N.</u>: "Comparing collective foraging with interactions inspired by pheromones and sonar", ASME DSCC - Dynamic Systems and Control Conference, October 8–October 11, 2019, Park City, Utah, USA, Paper DSCC2019-9190.

6. Jahromi Shirazi M., <u>Abaid N.</u>: "Tracking a sound source with unknown dynamics using bearing-only measurements based on a priori information", American Control Conference, July 10–12, 2019, Philadelphia, Pennsylvania, USA, doi:10.23919/ACC.2019.8815232.

7. Hashimoto A., Shea-Blymyer C., Roy S., Jantzen B., <u>Abaid N.</u>: "Differentiation of collective behavior based on automated discovery of dynamical kinds", ASME DSCC - Dynamic Systems and Control Conference, September 30–October 2, 2018, Atlanta, Georgia, USA.

8. Jahromi Shirazi M., <u>Abaid N.</u>: "Exploring the optimality of a limited view angle in the two-dimensional Vicsek model", ASME DSCC - Dynamic Systems and Control Conference, September 30–October 2, 2018, Atlanta, Georgia, USA.

9. Beauchene C., Roy S.D., Simon J., Leonessa A., <u>Abaid N.</u>: "Closed-loop control of the frequency response of The Virtual Brain model", ASME DSCC - Dynamic Systems and Control Conference, October 11–13, 2017, Tysons Corner, Virginia, USA.

10. Jahromi Shirazi M., <u>Abaid N.</u>: "Comparing the effects of intrinsic and extrinsic noise on the Vicsek model in three dimensions", ASME DSCC - Dynamic Systems and Control Conference, October 11–13, 2017, Tysons Corner, Virginia, USA.

11. Jaramillo Cienfuegos P., Burks G., Leonessa A., <u>Abaid N.</u>: "Stimulation of extensor digitorum longus mouse muscle with a small scale two-coil system", ASME DSCC - Dynamic Systems and Control Conference, October 12–14, 2016, Minneapolis, Minnesota, USA.

12. Roy S., <u>Abaid N.</u>: "Consensus of conspecific agents via collaborative and antagonistic interactions", ASME DSCC - Dynamic Systems and Control Conference, October 28–30, 2015, Columbus, Ohio, USA.

13. Roy S., <u>Abaid N.</u>: "Leader-follower consensus modeling representative democracy", International Conference of Control, Dynamic Systems, and Robotics, May 7–8, 2015, Ottawa, Ontario, Canada.

14. Kepa K., <u>Abaid N.</u>: "Development of a frequency-modulated ultrasonic sensor inspired by bat echolocation", SPIE Bioinspiration, Biomimetics, and Bioreplication V, March 9–11, 2015, San Diego, California, USA.

15. Lin Y., <u>Abaid N.</u>: "Information sharing via active sensing in a multi-agent system inspired by echolocating bats", ASME DSCC - Dynamic Systems and Control Conference, October 22–24, 2014, San Antonio, Texas, USA.

16. Lin Y., <u>Abaid N.</u>: "Bats versus bugs: collective behavior of prey decreases predation in a biologically-inspired multi-agent system", ASME DSCC - Dynamic Systems and Control Conference, October 21–23, 2013, Palo Alto, California, USA.

17. <u>Abaid N.</u>, Marras S., Fitzgibbons C., Porfiri M.: "Individual differences in boldness affect the interactions between fish and robots", ASME DSCC - Dynamic Systems and Control Conference, October 17–19, 2012, Fort Lauderdale, Florida, USA.

18. <u>Abaid N.</u>, Bartolini T., Kopman V., Macri S., Polverino G., Porfiri M.: "And the zebrafish said: I like biomimetic robots", IEEE International Conference on Biomedical Robotics and Biomechatronics, June 24–28, 2012, Rome, Italy.

19. <u>Abaid N.</u>, Kopman V., Porfiri M.: "A miniature and low-cost robotic fish for ethorobotics research and engineering education II: STEM outreach", Proceedings of the ASME DSCC - Dynamic Systems and Control Conference, October 31–November 2, 2011, Arlington, Virginia, USA.

20. <u>Abaid N.</u>, Porfiri M.: "Influence of leaders on mean square consentability in biologically-inspired stochastic networks", Proceedings of the ASME DSCC - Dynamic Systems and Control Conference, October 31–November 2, 2011, Arlington, Virginia, USA.

21. <u>Abaid N.</u>: "Mean square consensus in biologically-inspired stochastic networks", ASME District A Student Professional Development Conference, April 1–2, 2011, Philadelphia, Pennsylvania, USA.

22. <u>Abaid N.</u>, Porfiri M.: "Topological analysis of numerosity-constrained social networks", Proceedings of the ASME DSCC - Dynamic Systems and Control Conference, September 13–15, 2010, Cambridge, Massachusetts, USA.

23. <u>Abaid N.</u>, Porfiri M.: "Collective behavior of fish shoals in one-dimensional annular domains", Proceedings of the ACC - American Control Conference, June 30–July 2, 2010, Baltimore, Maryland, USA.

CONFERENCE PRESENTATIONS/WORKSHOPS/SEMINARS/POSTERS

1. <u>Abaid N.</u>: "Unlost in the woods: Modeling lost person behavior for wilderness search and rescue", Invited semi-plenary speaker at the Modeling, Estimation, and Control Conference, October 27, 2021, Austin, Texas, USA and online.

2. <u>Abaid N.</u>: "Eavesdropping like a bat: fusing active and passive sonar for simultaneous localization and mapping", Virginia Tech Engineering Mechanics Symposium, April 21, 2021, Blacksburg, VA, USA.

3. <u>Abaid N.</u>: "Learning How to Act Like a Bat: Bio-inspired Multi-Agent Systems with Active Sensing", University of California, Santa Barbara, Department of Mechanical Engineering seminar, April 5, 2021, online.

4. <u>Abaid N.</u>: "Learning How to Act Like a Bat: Bio-inspired Multi-Agent Systems with Active Sensing", Northeastern University, Department of Mechanical and Industrial Engineering seminar, March 4, 2021, online.

5. Jahromi Shirazi M., <u>Abaid N.</u>: "Flocking in three dimensions with eavesdropped sensing", ASME DSCC - Dynamic Systems and Control Conference, October 8–October 11, 2019, Park City, Utah, USA, Poster DSCC2019-9274.

6. <u>Abaid N.</u>, Hashimoto A.: "Modeling lost person dynamics for wilderness search and rescue", SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 19-23, 2019.

7. <u>Abaid N.</u>: "Passive and active sensing in the Vicsek model", Soft Matter Seminar, Blacksburg, Virginia, USA, April 12, 2019.

8. O'Bryan L. R., <u>Abaid N.</u>, Nakayama S., Dey T., Rubenstein D., King A., Cowlishaw G., Garnier S.: "The role of contact calls in facilitating the reunion of separated group members", International Bio-Logging Science Symposium, Lake Constance, Germany, September 25-29, 2017.

9. Invited to participate in the Statistical and Applied Mathematical Sciences Institute's workshop on "Data-Driven Modeling of Collective Behavior" funded by the National Science Foundation, Research Triangle Park, North Carolina, USA, June 5-7, 2017.

10. <u>Abaid N.</u>, Roy S.: "Extracting information flow between animals in the wild ", SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 21-25, 2017.

11. Roy S., <u>Abaid N.</u>: "Interactional dynamics of same-sex marriage legislation in the United States", SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 21-25, 2017.

12. Shirazi M. J., Hakkenberg D., <u>Abaid N.</u>, Ford W. M., Silvis A.: "Relationship of environmental structure to echolocation pulse quality", Southeastern Bat Diversity Network Annual Meeting, Asheville, North Carolina, USA, February 16-17, 2017.

13. Hakkenberg D., Shirazi M. J., <u>Abaid N.</u>, Ford W. M., Silvis A.: "Experimental testing of the impact of environmental clutter on the acoustic detection of bats", Southeastern Bat Diversity Network Annual Meeting, Asheville, North Carolina, USA, February 16-17, 2017. (Poster presentation)

14. <u>Abaid N.</u>: "Safety in numbers: Collective behavior strategies for prey survival", IEEE International Workshop on Complex Systems and Networks, Atlanta, Georgia, USA, November 14, 2016. (Invited talk)

15. Roy S., <u>Abaid N.</u>: "Data-based method for extracting navigational leadership between two bats", International Congress on Theoretical and Applied Mechanics, Montreal, Quebec, Canada, August 22-26, 2016.

16. Shirazi M.J., <u>Abaid N.</u>: "Passive localization inspired by bats in silent flight", International Congress on Theoretical and Applied Mechanics, Montreal, Quebec, Canada, August 22-26, 2016.

17. <u>Abaid N.</u>: "Collective behavior in systems with active sensing", SIAM Conference on the Life Sciences, Boston, Massachusetts, USA, July 11-14, 2016.

18. <u>Abaid N.</u>: "Information transfer in multi-agent systems with active sensing", Mechanical and Aerospace Engineering departmental seminar, New York University, Brooklyn, New York, USA, July 7, 2016. (Invited seminar)

19. <u>Abaid N.</u>: "Bat-inspired multi-agent systems: modeling and experiments", Mechanical Engineering departmental seminar, UNC Charlotte, Charlotte, North Carolina, USA, May 3, 2016. (Invited seminar)

20. <u>Abaid N.</u>: "Bat-inspired multi-agent systems: modeling and experiments", Mechanical Engineering departmental seminar, Penn State, State College, Pennsylvania, USA, September 22, 2015. (Invited seminar)

21. Roy S., <u>Abaid N.</u>: "Synchronization over networks inspired by echolocating bats", SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 17-21, 2015.

22. Roy S., <u>Abaid N.</u>: "Consensus and synchronization over biologically-inspired networks: From collaboration to antagonism", SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 17-21, 2015. (Poster presentation)

23. <u>Abaid N.</u>: "Bat swarms and the role of active sensing: models and experimental framework", KI-Net Conference Collective dynamics and model verification: Connecting kinetic modeling to data, Phoenix, Arizona, USA, April 17-19, 2015.

24. Roy S., <u>Abaid N.</u>: "Consensus and synchronization over biologically-inspired networks: From collaboration to antagonism", KI-Net Conference Collective dynamics and model verification: Connecting kinetic modeling to data, Phoenix, Arizona, USA, April 17-19, 2015. (Poster presentation)

25. <u>Abaid N.</u>: "Multi-agent system model inspired by echolocating bat swarms", US National Congress on Theoretical and Applied Mechanics, East Lansing, Michigan, USA, June 15-20, 2014.

26. <u>Abaid N.</u>: "Multi-agent system modeling inspired by bat swarms", International Conference of Control, Dynamic Systems, and Robotics, Ottawa, Canada, May 15-16, 2014. (Invited keynote lecture)

27. Macri S., <u>Abaid N.</u>, Laut J., Polverino G., Bartolini T., Kopman V., Spinello C., Porfiri M.: "Fish 'n CHIPS: use of robots to modulate behaviour", European Winter Conference on Brain Research, Brides-les-Bains, France, March 18, 2014.

28. <u>Abaid N.</u>, Laut J., Polverino G., Kopman V., Porfiri M.: "Fish 'n CHIPS round trip: use of live stimuli to modulate robotsâ€™ behaviour and vice versa", European Winter Conference on Brain Research, Brides-les-Bains, France, March 18, 2014.

29. Lin Y., <u>Abaid N.</u>: "A novel model for collective behavior in groups of predators", SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 21, 2013.

30. <u>Abaid N.</u>: "Modeling collective behavior in bat swarms", AmeriMech 2012, Blacksburg, Virginia, USA, December 10, 2012.

31. <u>Abaid N.</u>: "Biologically-inspired mathematical modeling of fish schools", Virginia Tech SIAM student chapter meeting, Blacksburg, Virginia, USA, October 30, 2012.

32. <u>Abaid N.</u>: "What zebrafish want: response to a robotic fish of varying aspect ratio, tail beat frequency, noise, and color", Section of Behavioral Neuroscience, Istituto Superiore di Sanita, Rome, Italy, June 4, 2012.

33. <u>Abaid N.</u>: "Un pesce robotico per interagire con gli animali", Arduino Day, Rome, Italy, April 20, 2012.

34. <u>Abaid N.</u>, Mamasheva E.: "STEM education with LEGOs in elementary schools", Teaching STEM With Robotics Symposium, Pace University, New York, New York, USA, May 14, 2011.

35. <u>Abaid N.</u>: "Network modeling of collective behavior", National Control Engineering Students Workshop Poster Session, University of Maryland, College Park, Maryland, USA, April 28 – May 1, 2011.

36. <u>Abaid N.</u>, Polverino G.: "Fish and chips: behavioral response of zebrafish (Danio rerio) to a biomimetic robot", Graduate Students Seminar Series, Department of Mechanical and Aerospace Engineering, Polytechnic Institute of New York University, Brooklyn, New York, USA, March 4, 2011.

37. <u>Abaid N.</u>: "Cyborg schools: fish and robots", Rachel Carson High School seminar series at the New York Aquarium, Brooklyn, New York, USA, Fall 2010 and Winter 2011.

38. <u>Abaid N.</u>: "Collective behavior of fish shoals in one-dimensional domains", Graduate Students Seminar Series, Department of Mechanical and Aerospace Engineering, Polytechnic Institute of New York University, Brooklyn, New York, USA, April 16, 2010.

39. Williams K., <u>Abaid N.</u>, Khazron P.: "Engineering partnership to enrich STEM education", College Board National Forum: Education and the American Future, New York, New York, USA, October 23, 2009.

40. <u>Abaid N.</u>: "Mathematical modeling of fish in a ring", Graduate Students Seminar Series, Department of Mechanical and Aerospace Engineering, Polytechnic Institute of New York University, Brooklyn, New York, USA, May 1, 2009.

41. Williams K., Irving D., Hernandez M., <u>Abaid N.</u>, Haghpanah J., Khazron P.: "Applying Mechatronics to Promote Science", National Science Foundation GK-12 Annual Meeting, Washington D.C., USA, March 29, 2009.

42. <u>Abaid N.</u>: "Asymptotic expansions of the PNP system for the ion channel problem", Computational and Applied Mathematics Seminar, University of Kansas, Lawrence, Kansas, USA, May 2, 2007.

ORGANIZED CONFERENCE SESSIONS

1. "Collective behaviors in complex systems with noise and delays" for the SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 19-23, 2019. With Giovanni Russo.

2. "Data-driven analysis and modeling of real-world dynamical systems" for the SIAM Conference on Applications in Dynamical Systems, Snowbird, Utah, USA, May 21-25, 2017. With Sachit Butail.

3. "Animal Dynamics" for the US National Congress on Theoretical and Applied Mechanics, June 15–20, 2014, East Lansing, Michigan, USA. With Maurizio Porfiri.

4. "Behaviour meets psychology meets biology meets engineering" for the European Winter Conference on Brain Research, March 15–22, 2014, Brides les Bains, France. With Simone Macri.

5. "Biologically-inspired control and its applications" for ASME DSCC - Dynamic Systems and Control Conference, October 21–23, 2013, Palo Alto, California, USA. With Maurizio Porfiri.

FUNDED RESEARCH PROJECTS

External

- "NRI: INT: Balancing collaboration and autonomy for multi-robot multi-human search and rescue", (Co-PI, with Ryan Williams (PI, VT Dept of Electrical and Computer Engineering), Nathan Lau (Co-PI, VT Dept of Industrial and Systems Engineering, and James McClure (VT Advanced Research Computing). Support: National Science Foundation, $1.5M, 10/18-09/22)

- "CAREER: Collective behavior in multi-agent systems with active sensing", (PI. Support: National Science Foundation, $500K, 03/18-02/23)

- "EAGER: Model-free classification of collective behavior based on automated detection of symmetry from video data", (PI, with Benjamin Jantzen (VT Dept of Philosophy). Support: National Science Foundation, $124K, 09/17-08/21) (With no-cost extension)

- "EEG-based control of working memory maintenance using closed loop binaural stimulation", (PI, with Alexander Leonessa (VT Dept of Mechanical Engineering) and Rosalyn Moran (Kings College London). Support: National Science Foundation, $330K, 08/15-07/21) (With no-cost extension)

- "Northern long-eared bat survey pre-hibernation assessment needs in the post-WNS environment", (Subcontract, with W. Mark Ford (VT Dept of Fish and Wildlife Conservation). Support: US Geological Survey, $8K, 04/16-10/16)

- "BRIGE: Developing a model of collective behavior in bat swarms using acoustic communication and applications in robotic systems", (PI. Support: National Science Foundation, $173K, 09/13-08/17) (With no-cost extension)

Internal

- "Automated discovery of brain states from noninvasive EEG data", (Co-PI with with PI Benjamin Jantzen (VT Dept of Philosophy) and Alexander Leonessa (VT Dept of Mechanical Engineering). Support: Institute for Critical Technology and Applied Science at Virginia Tech, $25K, 11/17-06/18)

- "Numerical modeling of human crowd dynamics", (PI with Jonathan Boreyko (VT Dept of Biomedical Eng and Mechanics). Support: Institute for Creativity, Arts, and Technology at Virginia Tech, $1K, 12/14-05/15)

- "Bat swarming as a model system for novel air traffic control", (PI, with Rolf Mueller (VT Dept of Mechanical Engineering). Support: Institute for Critical Technology and Applied Science at Virginia Tech, $120K, 09/13-08/15)

MENTORING

- Current graduate students: R. Ansari (ME Ph.D. expected 2023, co-advised with Alex Leonessa), E. Aung (EM Ph.D. expected 2024), A. Bradley (EM Ph.D. expected 2023), A. Hashimoto (EM Ph.D. expected 2022), M. Mikel-Stites (Math M.S. expected 2020)

- Previous graduate students: C. Beauchene (ME Ph.D. 2018, co-advised with Alex Leonessa), Y. Lin (EM Ph.D. 2016, co-advised with Rolf Mueller), N. Orange (EM M.S. 2015), S. Roy (EM Ph.D. 2017), I. Shaffer (EM M.S. 2020), M. Shirazi (EM Ph.D. 2020)

- Previous undergraduate student researchers: E. Anderson (2014-2016), S. Anderson (2018), M. Badger (Summer 2021 NSF REU), K. Bitikofer (2013-2014), M. Brennan (2013-2014), N. Capella (2014), C. Champion (2014-2015), W. Doty (2012), B. Gater

(2012), K. Howes (2014-2016), N. Kellner (2021), J. Luehr (2012), M. Masters (2014-2015), E. McCarthy (2021), A. Mohanty (2020), L. Mun (2019-2020), Z. Miller (2016), J. Simon (2016-2017), R. Spangler (2014-2015), S. Ziv (2017)

- Undergraduate senior design teams: K. Bitikofer, J. Castellano, D. Farmer, B. Fleming, A. Friedman, "Variable Inertia Flywheel (VIF) Analysis for Energy Storage in a Bicycle" (2012-2013); K. Dragon, J. Mason, N. Orange, A. Strickland, A. Zadnik, "Human crowd dynamics" (2013-2014); W. Doty, P. Greer, H. Morgan, J. Waterman, "Human crowd dynamics" (2014-2015); J. Aviles, S. Blease, A. Nichols, A. Remmers, "ReCAPD: Rehabilitation Continuous Active and Passive Device" (2014-2015); E. Anderson, A. Clark, J. Loviza, R. Petillo, T. Salzman, J. Stringfellow, "C.H.A.D.: Continuous Hand Actuation Device" (2015-2016); R. Cunningham, V. Garcia, E. Ham, T. Magelinski, A. McSharry, B. Shaw, R. Villaroman, "Controlling crowds through human-robot interactions" (2016-2017); D. Cusumano, B. Finn, A. Marino, S. Ruffin, C. Spohn, "Jawsdropping crowd dynamics" (2017-2018)

- Collaboration with K-12 teachers: T. Collins (Summer 2014 NSF RET), T. Cooke (2013), D. Hakkenberg (Summer 2016 NSF RET)

TEACHING

- Intermediate Algebra (KU/MATH 101): Fall 2005, Spring 2006
- Calculus I (KU/MATH 115): Fall 2006, Spring 2007
- Calculus II (KU/MATH 116): Fall 2007, Spring 2008
- Nonlinear Systems (VT/ESM 5414): Spring 2013, Spring 2017, Spring 2018
- Introduction to Perturbation Methods (VT/ESM 5754): Fall 2013, Fall 2014, Fall 2015, Fall 2016, Fall 2017, Fall 2018
- Vibrations and Control (VT/ESM 3134): Spring 2014, Spring 2015
- Team mentor for Creative Design (VT/ESM 4016): Academic years 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017
- Team mentor for Special Study: Frontiers in Dynamical Systems (VT/ESM 6984): Spring 2013, Spring 2014
- Introduction to Differential Equations (VT/Math 2214): Fall 2019, Fall 2021
- Mathematical Modeling I (VT/CMDA 3605): Spring 2020

DEPARTMENTAL AND COLLEGE SERVICE

- Member of the Mathematics Graduate Program committee: Fall 2019-present
- Member of the College of Science dean's search committee: Summer 2021-present
- Member of the Engineering Mechanics Vision Task Force: Fall 2019-Spring 2020
- Member of the Biomedical Engineering and Mechanics diversity committee: Fall 2018
- Member of the Mechanical Engineering faculty search committee: Fall 2017-Spring 2018
- Member of the Biomedical Engineering and Mechanics faculty search committee: Fall 2014-Spring 2015
- Member of the Engineering Mechanics graduate curriculum committee: Fall 2012-Spring 2014, Fall 2017-Fall 2018

OUTREACH ACTIVITIES	• Organizer and presenter for bat and robotics-themed summer camp activity with SEEDS (Seek Education, Explore, Discover) at the Price House Nature Center, Blacksburg, Virginia, Summers 2014-2019
	• Organizer and presenter for bat and robotics-themed activity at Tall Oaks Montessori School, Blacksburg, Virginia, Spring 2019
	• Organizer for an exhibit on EEG and working memory research at the New River Valley Agency on Aging's Annual Caregiver's Conference, Dublin, VA, March 2019.
	• Organizer and coach for girls' Lego robotics team "The Peanuts" in Blacksburg, Virginia, Spring-Fall 2014. (Won first place for research project in Roanoke FIRST LEGO League regional qualifier)
	• Presenter for various Virginia Tech outreach activities, including STEMAbility, Kids' Tech University, CEED Slush Rush, and C-Tech2, Spring and Summer 2013
	• Co-mentor for Lego robotics club at Tall Oaks Elementary, Spring 2013
	• Helped organize activities at the New York Aquarium in June 2010 and June 2011, including hosting two public school classes per year on an aquarium tour and interactive activity on bioinspired design of caudal fins for robotic fish
	• Assisted exhibit development for the World Science Festival in June 2011
	• Designed and presented robotic fish activity at Mechatronics Mania exhibit in the USA Science and Engineering Expo in Washington, D.C. in October 2010

PROFESSIONAL AFFILIATIONS	American Society of Mechanical Engineers: 2009-present
	Institute of Electrical and Electronics Engineers: 2009-present
	Society for Industrial and Applied Mathematics: 2009-present

OTHER	Journal Reviewer for: *ASME Journal of Dynamic Systems, Measurement and Control*, *Automatica*, *Chaos, Solitons, and Fractals*, *European Physical Journal E*, *Journal of Applied Mathematics*, *Journal of Autonomous Agents and Multi-Agent Systems*, *IEEE Robotics and Automation Letters*, *IEEE Transactions on Automatic Control*, *IEEE Transactions on Circuits and Systems*, *IEEE Transactions on Control of Network Systems*, *IEEE Transactions on Neural Networks and Learning Systems*, *IEEE Transactions on Signal Processing*, *Physica D*, *PLoS ONE*, *Scientific Reports*, *Sensors*, *Systems & Control Letters*
	Conference Reviewer for: *American Control Conference 2011, 2012, 2013*, *ASME Dynamic Systems and Control Conference 2010, 2011*, *ASME International Mechanical Engineering Congress and Exposition 2015*, *Conference on Decision and Control 2010, 2011*, *International Conference on Information Society and Technology 2011, 2012*, *ASME International Conference on Ocean, Offshore and Arctic Engineering 2011*, *IEEE International Conference on Robotics and Automation 2011, 2014*
	Co-Producer on Film Submission, American Physical Society Gallery of Fluid Motion, November 2003

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