Daniel Floryan

University of Wisconsin–Madison
Chemical and Biological Engineering
1415 Engineering Drive
Madison, WI 53706

Phone: (609) 287-5370
Email: dfloryan@alumni.princeton.edu
Homepage: dfloryan.github.io

Education

Princeton University, Princeton, NJ 2016–2019
Doctor of Philosophy, Mechanical and Aerospace Engineering
Thesis: Hydromechanics and optimization of fast and efficient swimming
Advisors: Clarence Rowley and Alexander Smits

Princeton University, Princeton, NJ 2014–2016
Master of Arts, Mechanical and Aerospace Engineering

Cornell University, Ithaca, NY 2009–2014
Bachelor of Science, *summa cum laude*, Mechanical Engineering

Cornell University, Ithaca, NY 2009–2014
Bachelor of Arts, *with distinction in all subjects*, Economics with minor in Mathematics

Research Experience

University of Wisconsin–Madison, Madison, WI Aug. 2019–Present
Postdoctoral Research Associate, Advisor: Prof. Michael D. Graham
Fluid mechanics, nonlinear dynamics, and machine learning.

Princeton University, Princeton, NJ June 2019–Aug. 2019
Postdoctoral Research Associate, Advisors: Prof. Clarence W. Rowley and Prof. Alexander J. Smits
Numerical optimization of swimming gaits and experimental investigation of flexible swimmers.

Princeton University, Princeton, NJ Feb. 2015–May 2019
Graduate Research Assistant, Advisors: Prof. Clarence W. Rowley and Prof. Alexander J. Smits
Dissertation work on elucidating the physics responsible for fast and efficient fish swimming. A combined analytical, experimental, and numerical approach was used.

Awards and Honours

- Porter Ogden Jacobus Honourific Fellowship[1], 2018–2019 (Princeton University)
- School of Engineering and Applied Science Award for Excellence, 2017 (Princeton University)
- Brit and Eli Harari Post Generals Fellowship, 2017–2018 (Princeton University)
- Sayre Award for Academic Excellence, 2015 (Princeton University)
- Daniel and Florence Guggenheim Foundation Fellowship, 2015–2016 (Princeton University)
- Charles W. Lummis Scholarship, 2014–2015 (Princeton University)
- NSERC Canada Graduate Scholarship, 2014
- Ontario Graduate Scholarship, 2014 (declined)
- The Sibley Prize for highest standing in mechanical engineering program, 2014 (Cornell University)
- Frank O. Ellenwood Prize for highest standing in heat and power courses, 2014 (Cornell University)
- Dean's Honour List, all semesters (Cornell University)
- Killam Canadian Scholarship, 2013 (Cornell University)
- *Phi Beta Kappa* honour society, inducted as a junior, 2013 (Cornell University)
- *Omicron Delta Epsilon* economics honour society, 2013 (Cornell University)
- ELI Undergraduate Student Research Award, funded by Boeing, 2013 (Cornell University)
- ELI Undergraduate Student Research Award, funded by Boeing, 2012 (Cornell University)
- Undergraduate Student Research Grant, 2012 (Texas A&M University)
- NSERC Undergraduate Student Research Award, 2011
- S.T.A.R. Scholarship, 2009–2010 (Cornell University)
- Governor General's Academic Medal, 2009 (Government of Canada)

Publications

In Preparation

[1] D. Floryan and C.W. Rowley. Adjoint optimization of fish swimming.

[2] D. Floryan and A.J. Smits. Nonlinear damping in flexible swimmers.

[3] J.M. Floryan and D. Floryan. Pumping by thermal waves.

[4] D. Floryan and M.D. Graham. Charting dynamics on a manifold.

[1] The Porter Ogden Jacobus Fellowship is Princeton University's top honour for graduate students

Published

[1] D. Floryan and M.D. Graham. Discovering multiscale and self-similar structure with data-driven wavelets. *Proceedings of the National Academy of Sciences*, 118(1), e2021299118, 2021.

[2] M.D. Graham and D. Floryan. Exact coherent states and the nonlinear dynamics of wall-bounded turbulent flows. *Annual Review of Fluid Mechanics*, 53, 227–253, 2021 *(invited)*.

[3] T. Van Buren, D. Floryan, L. Ding, L.H.O. Hellström, and A.J. Smits. Turbulent pipe flow response to a step change in surface roughness. *Journal of Fluid Mechanics*, 904, A38, 2020.

[4] D. Floryan, T. Van Buren, and A.J. Smits. Swimmers' wake structures are not reliable indicators of swimming performance. *Bioinspiration and Biomimetics*, 15(2), 024001, 2020.

[5] D. Floryan and C.W. Rowley. Distributed flexibility in inertial swimmers. *Journal of Fluid Mechanics*, 888, A24, 2020.

[6] A. Goza, D. Floryan, and C.W. Rowley. Connections between resonance and nonlinearity in swimming performance of a flexible heaving plate. *Journal of Fluid Mechanics*, 888, A30, 2020.

[7] D. Floryan, T. Van Buren, and A.J. Smits. Large-amplitude oscillations of foils for efficient propulsion. *Physical Review Fluids*, 4(9), 093102, 2019.

[8] T. Van Buren, D. Floryan, and A.J. Smits. Scaling and performance of simultaneously heaving and pitching foils. *AIAA Journal*, 57(9), 3666–3677, 2019 *(invited)*.

[9] D. Floryan and C.W. Rowley. Clarifying the relationship between efficiency and resonance for flexible inertial swimmers. *Journal of Fluid Mechanics*, 853, 271–300, 2018.

[10] D. Floryan, T. Van Buren, and A.J. Smits. Efficient cruising for swimming and flying animals is dictated by fluid drag. *Proceedings of the National Academy of Sciences*, 115(32), 8116–8118, 2018 *(from the cover)*.

- Commentary: G.K. Taylor. Simple scaling law predicts peak efficiency in oscillatory propulsion. *Proceedings of the National Academy of Sciences*, 115(32), 8063–8065, 2018.

[11] T. Van Buren, D. Floryan, N. Wei, and A.J. Smits. Flow speed has little impact on propulsive characteristics of oscillating foils. *Physical Review Fluids*, 3(1), 013103, 2018.

[12] D. Floryan, T. Van Buren, and A.J. Smits. Forces and energetics of intermittent swimming. *Acta Mechanica Sinica*, 33(4), 725–732, 2017 *(invited)*.

[13] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Scaling the propulsive performance of heaving and pitching foils. *Journal of Fluid Mechanics*, 822, 386–397, 2017.

[14] T. Van Buren, D. Floryan, D. Quinn, and A.J. Smits. Non-sinusoidal gaits for unsteady propulsion. *Physical Review Fluids*, 2(5), 053101, 2017.

[15] T. Van Buren, D. Floryan, D. Brunner, U. Senturk, and A.J. Smits. Impact of trailing edge shape on the wake and propulsive performance of pitching panels. *Physical Review Fluids*, 2(1), 014702, 2017.

[16] S.T.M. Dawson, M.S. Hemati, D. Floryan, and C.W. Rowley. Lift Enhancement of High Angle of Attack Airfoils Using Periodic Pitching. AIAA Paper 2016–2069.

[17] D. Floryan and J.M. Floryan. Drag reduction in heated channels. *Journal of Fluid Mechanics*, 765, 353–395, 2015.

[18] J.W. Hofferth, R.A. Humble, D. Floryan, and W.S. Saric. High-Bandwidth Optical Measurements of the Second-Mode Instability in a Mach 6 Quiet Tunnel. AIAA Paper 2013-0378.

[19] M.Z. Hossain, D. Floryan, and J.M. Floryan. Drag reduction due to spatial thermal modulations. *Journal of Fluid Mechanics*, 713, 398–419, 2012.

Book Chapters

[1] T. Van Buren, D. Floryan, and A.J. Smits. "Bioinspired underwater propulsors," in *Bioinspired Structures and Design*, editors L. Daniel and W. Soboyejo. Cambridge University Press, 2020.

Presentations

Invited Talks

[1] Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC, USA, October 28, 2020.

[2] Department of Mechanical and Aerospace Engineering, University of California, Irvine, Irvine, CA, USA, March 10, 2020.

[3] Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, USA, January 27, 2020.

[4] Department of Power and Aeronautical Engineering, Warsaw University of Technology, Warsaw, Poland, November 8, 2019.

[5] Department of Mechanical Engineering and Computer Science, Częstochowa University of Technology, Częstochowa, Poland, November 7, 2019.

[6] Applied and Computational Mathematics Seminar, Department of Mathematics, University of Wisconsin-Madison, Madison, WI, USA, September 13, 2019.

[7] Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA, USA, February 21, 2019.

[8] Department of Chemical and Biological Engineering, University of Wisconsin–Madison, Madison, WI, USA, January 31, 2019.

[9] 47th AIAA Fluid Dynamics Conference, Denver, CO, USA, June 5–9, 2017.

Conference Presentations

[1] D. Floryan and M.D. Graham. Revealing self-similar turbulent structure with a data-driven wavelet decomposition. Proceedings of the 73rd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, Chicago, IL, USA, November 22–24, 2020.

[2] D. Floryan and M.D. Graham. Discovering multiscale structure using data-driven wavelets. Computing in Engineering Forum, Madison, WI, USA, September 29–October 1, 2020.

[3] D. Floryan, X. An, and C.W. Rowley. Efficient optimization of swimming gaits. Proceedings of the 72nd Annual Meeting of the American Physical Society, Division of Fluid Dynamics, Seattle, WA, USA, November 23–26, 2019.

[4] D. Floryan, T. Van Buren, and A.J. Smits. Performance and scaling of flexible inertial swimmers. Proceedings of the 11th International Symposium for Turbulence and Shear Flow Phenomena, Southampton, UK, July 30–August 2, 2019.

[5] D. Floryan and C.W. Rowley. Distributed flexibility in inertial swimmers. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Princeton, NJ, USA, April 2–3, 2019.

[6] D. Floryan, T. Van Buren, and A.J. Smits. Large-amplitude oscillations of foils for efficient propulsion. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Princeton, NJ, USA, April 2–3, 2019.

[7] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Big and slow: large-amplitude motions for highly efficient swimming. Proceedings of the 71st Annual Meeting of the American Physical Society, Division of Fluid Dynamics, Atlanta, GA, USA, November 18–20, 2018.

[8] D. Floryan and C.W. Rowley. Resonance in linear inviscid swimmers. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Bethlehem, PA, USA, September 27–28, 2018.

[9] D. Floryan and C.W. Rowley. Optimal stiffness distributions in linear inviscid swimmers. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Bethlehem, PA, USA, September 27–28, 2018.

[10] D. Floryan, T. Van Buren, and A.J. Smits. The birds and the bees (and the fish). Thousand Islands Fluid Dynamics Meeting, Gananoque, ON, Canada, April 27–29, 2018.

[11] D. Floryan, C.W. Rowley, and A.J. Smits. Distributed flexibility in inertial swimmers. Proceedings of the 70th Annual Meeting of the American Physical Society, Division of Fluid Dynamics, Denver, CO, USA, November 19–21, 2017.

[12] D. Floryan and C.W. Rowley. A framework for distributed flexibility in swimmers. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Boston, MA, USA, September 19–20, 2017.

[13] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Scaling laws for the performance of rigid propulsors intended for underwater locomotion. Proceedings of the 10th International Symposium for Turbulence and Shear Flow Phenomena, Chicago, IL, USA, July 6–9, 2017.

[14] D. Floryan, T. Van Buren, and A.J. Smits. Effects of combining heave, pitch, and flexibility on swimming performance. 47th AIAA Fluid Dynamics Conference, Denver, CO, USA, June 5–9, 2017.

[15] D. Floryan, C.W. Rowley, and A.J. Smits. Adjoint-based optimization of fish swimming gaits. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Charlottesville, VA, USA, March 9–10, 2017.

[16] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Scaling propulsive performance. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Charlottesville, VA, USA, March 9–10, 2017.

[17] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Scaling the propulsive performance of fish-like swimming. Sixth Annual Winter Workshop on Neuromechanics and Dynamics of Locomotion, New Orleans, LA, USA, January 19–20, 2017.

[18] D. Floryan, C.W. Rowley, and A.J. Smits. Adjoint-based optimization of fish swimming gaits. Proceedings of the 69th Annual Meeting of the American Physical Society, Division of Fluid Dynamics, Portland, OR, USA, November 20–22, 2016.

[19] D. Floryan, C.W. Rowley, and A.J. Smits. Towards adjoint-based optimization of fish swimming gaits. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Princeton, NJ, USA, September 29–30, 2016.

[20] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Fundamental analysis for pitch and heave motions. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Princeton, NJ, USA, September 29–30, 2016.

[21] D. Floryan, C.W. Rowley, and A.J. Smits. Thrust enhancement of oscillating foils. Complex Motion in Fluids Summer School, Zenderen, Netherlands, June 19–24, 2016.

[22] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Thrust enhancement of an oscillating foil. Thousand Islands Fluid Dynamics Meeting, Gananoque, ON, Canada, April 22–24, 2016.

[23] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Propulsive performance of complex swimming gaits. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, West Chester, PA, USA, March 8–9, 2016.

[24] D. Floryan, T. Van Buren, C.W. Rowley, and A.J. Smits. Effects of actuation waveform shape on the performance of pitching and heaving panels. Proceedings of the 68th Annual Meeting of the American Physical Society, Division of Fluid Dynamics, Boston, MA, USA, November 22–24, 2015.

[25] D. Floryan, C.W. Rowley, and A.J. Smits. Optimizing gaits for fish swimming. ONR MURI Review Meeting, Program Manager: Robert Brizzolara, Bethlehem, PA, USA, September 21–22, 2015.

[26] D. Floryan, T. Van Buren, D.B. Quinn, C.W. Rowley, and A.J. Smits. Effects of actuation waveform shape on the performance of a pitching foil. Thousand Islands Fluid Dynamics Meeting, Gananoque, ON, Canada, May 1–3, 2015.

[27] D. Floryan and J.M. Floryan. Pressure Losses in Heated Channels. Proceedings of The Canadian Society for Mechanical Engineering International Congress 2014, Toronto, ON, Canada, June 1–4, 2014.

[28] D. Floryan and J.M. Floryan. Use of distributed heating for drag reduction. Thousand Islands Fluid Dynamics Meeting, Gananoque, ON, Canada, May 30–June 1, 2014.

Teaching Experience

Princeton University, Princeton, NJ — Spring 2017
Assistant in Instruction, Mechanics of Fluids (MAE 222)
Introductory fluid mechanics course for mechanical engineers.

Princeton University, Princeton, NJ — Spring 2016
Assistant in Instruction, Automatic Control Systems (MAE 433)
Lab component of classical/modern controls course for mechanical engineers.

Cornell University, Ithaca, NY — Fall 2012
Teaching Assistant, Introductory Fluid Mechanics (MAE 3230)
Introductory fluid mechanics course for mechanical engineers.

Cornell University, Ithaca, NY — Fall 2010–Spring 2011
AEW Facilitator, Multivariable Calculus and Differential Equations
Academic Excellence Workshops in multivariable calculus and differential equations.

Outreach and Service

University and Departmental

- **CBE Computing Seminar Committee** 2020–Present
  Organizer and host of the Chemical and Biological Engineering department's weekly seminar focused on computing
- **GSG MAE Representative** 2016–2019
  The Mechanical and Aerospace Engineering department's representative for the Graduate Student Government
- **MAE Graduate Student Committee** 2016–2019
  Member of the Mechanical and Aerospace Engineering department's graduate student committee, serving as a liaison between graduate students and the department
- **SEAS Orientation on Advising** 2016
  Guided new graduate students in the School of Applied and Engineering Science on navigating the advisor-advisee relationship
- **MAE Committee on Climate and Inclusion** 2015–2019
  Founding member of a committee whose goal is to assess the department's climate for underrepresented groups and make recommendations in the spirit of finding best practices that ensure all members of the department feel respected, included and supported by our community
- **Harlem Prep to Princeton** 2015–2019
  Organizer of an annual trip for Harlem Prep 4th graders in which students participate in lab demos in the Mechanical and Aerospace Engineering department
- **Gas Dynamics Lab Demos** 2015
  Organizer of an annual trip for Chinese middle school- and high school-aged students in which students participate in fluid dynamics lab demos

Professional

Membership:

- American Institute of Aeronautics and Astronautics
- American Physical Society

Session chair:

- American Physical Society DFD Meeting (2017)

Reviewing

- AIAA Journal
- Bioinspiration and Biomimetics
- Fluid Dynamics Research
- Integrative and Comparative Biology
- International Journal of Heat and Fluid Flow

- International Journal of Robotics Research
- Journal of Fluid Mechanics
- Journal of Fluids and Structures
- Physical Review Fluids
- Physical Review Letters
- Physics of Fluids
- PLOS One
- Science Advances
- Scientific Reports

Mentorship

Doctoral students

- Alec Linot (UW–Madison), nonlinear dynamics of turbulence 2019–Present
- Carlos Perez De Jesus (UW–Madison), machine learning for turbulence 2019–Present
- Eric Yu (UW–Madison), fluid-structure interaction at small scales 2019–Present
- Kevin Zeng (UW–Madison), control of turbulence 2019–Present

Master's students

- Rodrigo Lisazo (ISAE-SUPAERO), body effects in fish swimming 2015

Undergraduate students

- Hoang Le (Princeton '22), energy harvesting using fluid-structure interactions Summer 2019
- Nick Chen (Princeton '20), energy harvesting using fluid-structure interactions Summer 2017
- Nathan Wei (Princeton '17), cyber-physical fluids facility 2016–2017
- Devon Hartsough (Princeton '18), robotic swimmers Summer 2015
- Emile Oshima (Princeton '17), robotic swimmers Summer 2015

Last updated: January 10, 2021