

Curriculum Vitae

Jackson Crane

Assistant Professor

Department of Mechanical and Materials Engineering, Queen's University at Kingston

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Education and Academic Positions

2023-present	Queen's University	Assistant Professor, Mechanical and Materials Engineering
2021-2022	Queen's University	Postdoctoral Fellow, Chemical Engineering
2017-2021	Stanford University	Ph.D., Mechanical Engineering
2016-2018	Stanford University	M.S., Mechanical Engineering
2009-2013	MIT	B.S., Mechanical Engineering, Minor in Energy Studies

Awarded Research Funding (Total: \$503k)

2023-2024	National Science and Engineering Research Council	Alliance International Catalyst	\$25k
2023-2028	National Science and Engineering Research Council	Discovery Grant	\$197.5k
2023-2028	Canada Foundation for Innovation	John R. Evans Leaders Fund	\$80k
2023	Queen's University	Research Initiation Grant	\$100k
2023	Queen's University	Infrastructure Supplement	\$100k

Awards and Honors

2018-2021	Stanford Graduate Fellowship (\$138,169)
2016-2021	National Science Foundation Graduate Research Fellowship (\$138,000)
2013	Rhodes Scholar Finalist
2013	Marshall Scholar Finalist

Published or In Press Journal Articles (* corresponding author, † equal contribution)

- J1. [Crane, J.](#), Shi, X., Singh, A., Tao, Y., Wang, H. "Isolating the effect of induction length on detonation structure: Hydrogen-oxygen detonation promoted by ozone," *Combustion and Flame* 200 (2019): 44-52.
- J2. [Crane, J.*](#), Shi, X., Lipkowicz, J., Kempf, A., Wang, H. "Geometric modeling and analysis of detonation cellular stability," *Proceedings of the Combustion Institute* 38.3 (2021): 3585-3593.
- J3. Shi, X., [Crane, J.](#), Wang, H. "Detonation and its limit in small tubes with ozone sensitization," *Proceedings of the Combustion Institute* 38.3 (2021): 3547-3554.
- J4. Wang, C., Zhang, Y., Wang, H., Zhang, Y., Luo, J., Hu, X., Matios, E., [Crane, J.](#), Xu, R., Wang, H., Li, W. "Stable sodium-sulfur electrochemistry enabled by phosphorus-based complexation," *Proceedings of the National Academy of Sciences*, 118.49 (2021): e2116184118.
- J5. [Crane, J.](#), Shi, X., Xu, R., Wang, H. "Natural gas versus methane: ignition kinetics and detonation limit behavior in small tubes," *Combustion and Flame*, 237 (2022): 111719.
- J6. [Crane, J.](#), Dinh, C.T. "Strategies for decarbonizing natural gas with electrosynthesized methane," *Cell Reports Physical Science*, 3.9 (2022): 101027.
- J7. [Crane, J.*](#), Lipkowicz, T., Shi, X., Kempf, A., Wlokas, I., Wang, H. "Three-dimensional detonation structure and its response to confinement," *Proceedings of the Combustion Institute*, 39.3 (2023): 2915-2923.
- J8. Meagher, P., Shi, X., Santos, J., Muraleedharan, N., [Crane, J.](#), Poludnenko, A., Wang, H., Zhao, X. "Isolating gasdynamic and chemical effects on the detonation cellular structure: a combined experimental and computational study," *Proceedings of the Combustion Institute*, 39.3 (2023): 2865-2873.
- J9. Obasanjo, C.†, Gao, G.†, [Crane, J.†](#), Golovanova, V. García de Arquer, F.P., Dinh, C.T., "High-rate and selective conversion of CO₂ from aqueous solutions to hydrocarbons," *Nature Communications*, 14.1 (2023): 3176.
- J10. [Crane, J.](#), Dinh, C.T., "CO₂ Electroreduction: Moving beyond two-carbon products," *Nature Energy, News and Views*, 8.8 (2023), 785-786.

- J11. Gao, G., Obasanjo, C., Crane, J., Dinh, C.T., “Comparative analysis of electrolyzers for electrochemical carbon dioxide conversion,” *Catalysis Today*, (2023), 114284.
- J12. Obasanjo, C., Gao, G., Khiarak, B., Trong Huy, P., Crane, J., Dinh, C.T., “Progress and perspectives of pulse electrolysis for stable electrochemical carbon dioxide reduction,” *Energy & Fuels*, 37.18 (2023), 13601-13623.

Pending Journal Articles (* corresponding author, *italicized* supervised students)

- J13. *Paknahad, R., Lipkowicz, J.T., Gaffran, N., Wlokas, I., Kempf, A.M., Crane, J.*, Statistics of detonation confinement: 1D, 2D and 3D simulations in hydrogen-oxygen, *Proceedings of the Combustion Institute*, submitted.*

Conference and Other Publications

- C1. Crane, J., Lipkowicz, J.T., Shi, X., Wlokas, I., Kempf, A.M., Wang, H. “Detonation thermodynamic state statistics: 2D and 3D simulations in hydrogen-oxygen,” 29th International Colloquium on the Dynamics of Explosions and Reactive Systems, Siheung, Korea, July 2023.
- C2. Shi, X., Hencel, R., Crane, J., Fotia, M., Wang, H. “Detonation propagation in curved channels: A geometric modeling case study,” 2022 Western States Section of the Combustion Institute Spring Technical Meeting, Stanford, CA, March 2022.
- C3. Shi, X., Meagher, P., Santos, J., Muraleedharan, N., Crane, J., Poludnenko, A., Zhao, X., Wang, H. “Isolating gasdynamic and chemical effects on detonation cellular structure and regularity,” 2022 Western States Section of the Combustion Institute Spring Technical Meeting, Stanford, CA, March 2022.
- C4. Crane, J., Lipkowicz, J., Shi, X., Kempf, A., Wlokas, I., Wang, H. “Detonation structural response to multi-dimensional confinement,” 28th International Colloquium on the Dynamics of Explosions and Reactive Systems, Naples, Italy, June 2022.
- C5. Shi, X., Meagher, P., Crane, J., Dammati, S.S., Zhao, X., Poludnenko, A.Y., Wang, H. “On cellular multiplicity of detonations in confined channels,” 28th International Colloquium on the Dynamics of Explosions and Reactive Systems, Naples, Italy, June 2022.
- C6. Meagher, P., Shi, X., Crane, J., Zhao, X., Poludnenko, A.Y., Wang, H. “Forward Jetting Phenomenon in Detonations,” 28th International Colloquium on the Dynamics of Explosions and Reactive Systems, Naples, Italy, June 2022.
- C7. Meagher, P., Dammati, S., Zhao, X., Poludnenko, A., Shi, X., Crane, J., Wang, H., “Effects of grid resolution and boundary conditions on 2D simulations of single-headed hydrogen detonations,” 12th US National Combustion Meeting, Virtual, May 2021.
- C8. Dammati, S., Meagher, P., Poludnenko, A., Zhao, X., Shi, X., Crane, J., Xu, R., Wang, H., “Dynamics of gas-phase detonations in ethylene-air mixtures,” 12th US National Combustion Meeting, Virtual, May 2021.
- C9. Crane, J., Shi, X., Wang, H., “Detonation geometric model (detgem) as a test bed for propagation dynamics in engineering geometries,” AIAA SciTech Forum, Virtual, January 2021.
- C10. Shi, X., Crane, J., Wang, H., “Deflagration-to-detonation transition inside reactant-product mixing layers,” AIAA SciTech Forum, Virtual, January 2021.
- C11. Crane, J., Shi, X., Wang, H. “Geometric modeling of detonation cellular propagation,” 2020 Spring Meeting of the Western States Section of The Combustion Institute, Stanford, CA, March 2020, *cancelled*.
- C12. Shi, X., Crane, J., Wang, H. “Detonation limit behaviors of methane and natural gas,” 2020 Spring Meeting of the Western States Section of The Combustion Institute, Stanford, CA, March 2020, *cancelled*.
- C13. Crane, J., Shi, X., Wang, H., “A comparison of methane and natural gas detonation limit behaviors,” AIAA SciTech Forum, Orlando, FL, January 2020.
- C14. Crane, J., Shi, X., Wang, H. “Effect of boundary conditions on detonation simulations: A geometric model study,” 11th US National Combustion Meeting, Pasadena, CA, March 2019.
- C15. Shi, X., Crane, J., Wang, H. “Extension of detonation limits using ozone as an additive,” 11th US National Combustion Meeting, Pasadena, CA, March 2019.

- C16. Shi, X., Crane, J., Singh, A., Wang, H. “Sensitizing H₂/O₂ Detonations Using Ozone,” Poster presented at: *37th International Symposium on Combustion*; 2018 Jul 29-Aug 3; Dublin, Ireland.
- C17. Crane, J., Rucks, G. “A Consortium Approach to Transit Data Interoperability,” 2016 Rocky Mountain Institute Report.
- C18. Crane, J. “Data Interoperability Enables Mobility as a Service,” Rocky Mountain Institute Outlet, 2016.
- C19. Johnstone, E., Crane, J. “How Park-and-Rides Can Move Transit Forward,” Rocky Mountain Institute Outlet, 2016.
- C20. Crane, J., Jones, R., et. al., “A semi-empirical model for ductile jet impingement erosion using nondimensional techniques,” Poster Presented at: *2015 International Conference on Wear of Materials*; 2015 Apr 12-16, Toronto, Canada.
- C21. Jones, R., Ligon, T., Crane, J., et. al., “Experimental study of jet impingement erosion wear rates on ductile material,” Poster Presented at: *2015 International Conference on Wear of Materials*; 2015 Apr 12-16, Toronto, Canada.
- C22. Crane, J., “Radial Parallel Plate Flow with Mechanical Agitation,” Undergraduate Thesis, Massachusetts Institute of Technology, June 2013.

Patents

- P1. Crane, J., Shi, X., Spells, B., Wang, H., Zhang, Y., inventors; The Board of Trustees of the Leland Stanford Junior University, assignee. Automobile powertrain learning and optimization. US provisional patent. Nov. 18, 2020.

Invited Talks

- I1. “How to deliver an effective research presentation,” Queen’s University Mechanical Engineering Graduate Seminar, Kingston, ON, Nov. 16, 2023.
- I2. “Detonation kinetics and control,” University of Central Florida Mechanical and Aerospace Engineering Department Seminar, Orlando, FL, USA, Oct. 20, 2023.
- I3. “Good bot bad bot: Is robotics helping or hindering progress on UN Sustainable Development Goals?” Queen’s University Ingenuity Labs Robotics and AI Symposium, Kingston, ON, Oct. 12, 2023.
- I4. “The Detonation Cell Cycle: Theory and Simulation in Hydrogen,” Young Researchers’ Forum on Detonation, Virtual, Apr. 5, 2023.
- I5. “Dimensionality and confinement in detonation,” Multi-Agency Coordination Committee for Combustion Research (MACCCR) Meeting, Sandia National Labs, Livermore, CA, USA, Mar. 2, 2023.
- I6. “Powering next generation aircraft and gas turbines: Detonation dynamics, chemistry, and control,” University of Ottawa Mechanical Engineering Departmental Seminar, Ottawa, ON, Oct. 25, 2022.
- I7. “Decarbonizing power generation and aviation: Engine efficiency and alternative fuels,” Queen’s University Faculty of Engineering and Applied Science Research Symposium, Kingston, ON, Oct. 12, 2022.
- I8. “Strategies for decarbonizing natural gas with electrosynthesized methane,” Queen’s Postdoc Research Showcase, Kingston, ON, Sept. 20, 2022.
- I9. “Challenges and Opportunities for Pressure Gain Combustion,” AIAA SciTech Forum Technical Panel, Orlando, FL, Jan. 8, 2020.
- I10. “The effect of ignition promoters on detonation stability and structure,” High Temperature Gas Dynamics Seminar, Stanford, CA, Dec. 16, 2017.
- I11. “The Internet of Traffic: Using Big Data to Alleviate Congestion,” VERGE, Santa Clara, CA, Sept. 19-22 2016.
- I12. “A Consortium Approach to Interoperable Transit Data,” Transportation Camp Colorado, Boulder, CO, May 15, 2016.

Teaching Experience

2023 Course Instructor Queen’s Applied Thermodynamics II (MECH 330)

2019	Teaching Assistant	Stanford	Numerical Methods for Engineering (ME 300C/CME 206)
2017	Course Assistant	Stanford	Engineering Thermodynamics (ENGR 30)
2012	Teaching Assistant	MIT	Toy Product Design (2.00b)

Supervision

2023	Supervisor	Queen's	Reza Paknahad, PhD student
2023	Supervisor	Queen's	Tye Dougherty, Engineering Physics Thesis
2023	Supervisor	Queen's	Noah Gaffran, USRA Undergraduate Researcher
2016	Supervisor	Rocky Mountain Institute	Eleanor Johnstone, Summer Intern
2015	Supervisor	Dominion Engineering	Sam Roewer, Summer Intern

Professional Experience

2016-2017 Consultant Rocky Mountain Institute, Interoperable transit data
 Authored governance documents, convened stakeholders, and gave talks which resulted in the formation of MobilityData, now a multi-million dollar non-profit, which is the national authority on best practices around data sharing and publication for public transportation.

2015-2016 Associate Rocky Mountain Institute, Transportation team
 Developed alternative commuting solution for three major employers in downtown Austin, TX. Final product included complex GIS analysis, direct employer engagement, and multi-vendor negotiations. A complete shuttle service with on-demand solutions implemented, with many employees using service.
 Authored reports on transportation data best practices and public transit authority parking strategies.

2013-2015 Associate Engineer Dominion Engineering, Inc.
 Developed a semi-empirical model to predict submerged jet-impingement slurry jet wear. Designed a novel nondimensional analysis for wear analysis to allow the usage of scaled experiments for nuclear waste processing facilities. In addition to producing calculations and reports for our client, presented results in the International Conference of Wear of Materials in April 2015.
 Designed equipment for the support of fuel cleaning in nuclear power plants. Traveled to Florida, Spain, and Sweden for nuclear fuel cleaning site support.
 Performed economic analysis and report for the construction of a novel pebble-bed nuclear power plant. Included both thermodynamic sizing and engineering costing calculations.

2012	Global R&D Intern	SunEdison
2010	Intern	LightSail Energy

Industry Collaboration

2022-present Innoveering, LLC
 Licensed the geometric model to Innoveering, LLC to aid in the development of rotating detonation engines via detonation propagation prediction in various geometries and combustible mixtures.

Research Experience

2021-2022	Postdoctoral Fellow	Queen's	Refuel@Queen's, Prof. Cao-Thang Dinh
2017-2021	Research Assistant	Stanford	NanoEnergy Lab, Prof. Hai Wang
2012-2013	Undergraduate RA	MIT	Cryogenic Research Lab, Prof. John Brisson
2011	Undergraduate RA	MIT	Heat and Mass Transfer Lab, Prof. Gang Chen
2011	Intern	Poly. U. of Madrid	Instituto de Energía Solar, Prof. Antonio Martí
2007-2008	Intern	Salk Institute	Molecular and Cell Bio. Lab, Dr. Tony Hunter

Membership

2019-Present	Member	American Institute for Aeronautics and Astronautics
2017-Present	Member	Combustion Institute

Peer Review

2020	Grant Review	US Air Force Office of Scientific Research YIP
2022-24	Journal Reviewer	Proceedings of the Combustion Institute
2022-23	Journal Reviewer	Flow, Turbulence and Combustion
2022-23	Journal Reviewer	Shock Waves
2022-23	Journal Reviewer	Combustion and Flame
2023	Journal Reviewer	Journal of Fluid Mechanics
2023	Journal Reviewer	Nature Catalysis