

Robyn L. Macdonald

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RESEARCH INTERESTS

Hypersonic flows; chemical kinetics; thermochemical non-equilibrium; radiation modeling; computational fluid dynamics; turbulence modeling; large-eddy simulation (LES); wall-modeled LES.

EDUCATION

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| University of Illinois at Urbana-Champaign | Urbana, IL |
| Ph.D, Aerospace Engineering | May 2019 |
| Thesis: Reduced-order model framework for thermochemical non-equilibrium hypersonic flows | |
| University of Illinois at Urbana-Champaign | Urbana, IL |
| B.S., Aerospace Engineering | May 2013 |

PROFESSIONAL EXPERIENCE

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| University of Colorado Boulder | Boulder, CO |
| Smead Department of Aerospace Engineering Sciences | |
| Assistant Professor | January 2021 – Present |
| Visiting Assistant Professor | December 2019 – January 2021 |
| University of Minnesota | Minneapolis, MN |
| Department of Aerospace Engineering and Mechanics | |
| Postdoctoral Research Fellow | January 2019 – January 2021 |
| Affiliate Adjunct Researcher | January 2021 – Present |
| University of Illinois at Urbana-Champaign | Urbana, IL |
| Department of Aerospace Engineering | |
| Graduate Research Assistant | August 2013 – January 2019 |

PEER REVIEWED JOURNAL PUBLICATIONS

1. **R. L. Macdonald**, E. Torres, T. E. Schwartzentruber, M. Panesi, “State-to-State Master Equation and Direct Molecular Simulation Study of Energy Transfer and Dissociation for the N₂-N System.” *Journal of Physical Chemistry A*. **124**, 35, 6986–7000 (2020).
2. **R. L. Macdonald**, R. L. Jaffe, D. W. Schwenke, M. Panesi. “Construction of a Maximum Entropy Quasi-Classical Trajectory Method. I: Theory and Application to N₂-N₂ System.” *Journal of Chemical Physics*. **148**, 054309 (2018). *Editor’s Pick*.

3. **R. L. Macdonald**, M. Grover, T. E. Schwartzentruber, M. Panesi. “Construction of a Maximum Entropy Quasi-Classical Trajectory Method. II: Comparison against the Direct Molecular Simulation Method.” *Journal of Chemical Physics*. **148**, 054310 (2018).
4. **R. L. Macdonald**, A. Munafò, C. O. Johnston, M. Panesi. “Nonequilibrium radiation and dissociation of CO molecules in shock heated flows.” *Physical Review Fluids*. **1**, 043401 (2016).

PEER REVIEWED CONFERENCE PROCEEDINGS

1. **R. L. Macdonald**, R. L. Jaffe, M. Panesi. “Hybrid reduced order model for N₂-N₂ interactions for application to dissociation and energy transfer processes.” Proceedings of the 31st International Symposium on Rarefied Gas Dynamics, (2018). Glasgow, UK.

BOOK CHAPTERS

1. F. Esposito, **R. L. Macdonald**, I. D. Boyd, K. Neitzel, D. A. Andrienko, “Heavy Particle Elementary Processes in Hypersonic Flows,” in *Hypersonic Meteoroid Entry Physics*, edited by G. Colonna, M. Capitelli, and A. Laricchiuta. Institute of Physics (2019).

INVITED TALKS

1. **R. L. Macdonald**, “High-Fidelity and Reduced Order Modeling of Gas Phase Chemistry for Hypersonic Flows”, *Fluids, Structures and Materials Seminar Series*, Aerospace Engineering Sciences, University of Colorado Boulder, Boulder, CO, December 16, 2020.
2. **R. L. Macdonald**, “Reduced-Order Model Framework for Thermochemical Non-equilibrium Hypersonic Flows,” *Caltech’s Young Investigators Lecture Series in Engineering and Applied Science*, California Institute of Technology, Pasadena, CA, April 26, 2019.
3. **R. L. Macdonald**, “Reduced-order model framework for thermochemical non-equilibrium hypersonic flows,” *Department of Aerospace Engineering*, University of Michigan, Ann Arbor, MI, February 19, 2019.
4. **R. L. Macdonald**, “Reduced-order model framework for thermochemical non-equilibrium hypersonic flows,” *Department of Aerospace Engineering Sciences*, University of Colorado Boulder, Boulder, CO, February 11, 2019.
5. **R. L. Macdonald**, M. Panesi. “Reduced-order Modeling Approach to Enable Kinetic Simulations of Non-equilibrium Hypersonic Flows,” *2017 Annual Review for the AFOSR High Speed Aerodynamics Portfolio and the ONR Hypersonic Portfolio*, NASA Langley Research Center, Hampton VA, July 27, 2017.

CONFERENCE PROCEEDINGS

1. **R. L. Macdonald**, G. V. Candler, “Evaluation of Wall Modeled Large Eddy Simulation of Cold Wall Hypersonic Boundary Layer.” AIAA SciTech 2021 Forum, (AIAA 2021-1844). Virtual Event.
2. **R. L. Macdonald**, E. Torres, T. E. Schwartzentruber, M. Panesi. “State-to-state and direct molecular simulation study of energy transfer and dissociation of nitrogen mixtures.” AIAA SciTech 2020 Forum, (AIAA 2020-1712). Orlando, FL.

3. **R. L. Macdonald**, M. S. Grover, T. E. Schwartzentruber, M. Panesi. “State-to-State and Direct Molecular Simulation Study of energy transfer and dissociation in nitrogen mixtures.” 2018 AIAA Aerospace Sciences Meeting, AIAA SciTech Forum, (AIAA 2018-0239). Kissimmee, FL.
4. **R. L. Macdonald**, M. Panesi. “Coarse Grain Model for Energy Transfer and Dissociation,” 2018 AIAA Aerospace Sciences Meeting, AIAA SciTech Forum, (AIAA 2018-1230). Kissimmee, FL.
5. **R. L. Macdonald**, M. Grover, T. E. Schwartzentruber, M. Panesi. “Coarse grain modeling and direct molecular simulation of nitrogen dissociation.” 47th AIAA Thermophysics Conference, AIAA Aviation Forum 2017 (AIAA 2017-3165). Denver, CO. *Weaver Thermophysics Best Student Paper*.
6. **R. L. Macdonald**, R. L. Jaffe, D. W. Schwenke, A. Munafò, M. Panesi. “Ab initio based rovibrational grouping model for $N_2(^1\Sigma_g^+)$ - $N_2(^1\Sigma_g^+)$ energy transfer and dissociation.” 47th AIAA Thermophysics Conference, AIAA Aviation Forum 2017 (AIAA 2017-3164). Denver, CO.
7. **R. L. Macdonald**, A. Munafò, M. Panesi. “Rovibrational grouping for $N_2(^1\Sigma_g^+)$ - $N_2(^1\Sigma_g^+)$ energy transfer using state-to-state model.” 46th AIAA Thermophysics Conference, AIAA Aviation Forum 2016 (AIAA 2016-4315). Washington, D.C.
8. **R. L. Macdonald**, A. Munafò, C. O. Johnston, M. Panesi. “Modeling of Non-equilibrium Radiation for CO_2 - N_2 Gas Mixtures.” 54th AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum 2016 (AIAA 2016-1728). San Diego, CA.
9. A. Munafò, S. Venturi, **R. Macdonald**, M. Panesi. “State-to-state and reduced-order models for recombination and energy transfer in aerothermal environments.” 54th AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum 2016 (AIAA 2016-0505). San Diego, CA.
10. **R. L. Macdonald**, A. Munafò, C. O. Johnston, M. Panesi. “State-to-State Modeling of CO for Mars Entry Applications,” 53rd AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum 2015 (AIAA 2015-0476). Kissimmee, FL.

AWARDS

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| University of Minnesota President’s Postdoctoral Fellowship | 2018-2019 |
| AE Faculty Outstanding Graduate Student Award (UIUC) | 2018 |
| Mavis Future Faculty Fellowship (UIUC) | 2016-2017 |
| National Defense Science and Engineering Graduate Fellowships (NDSEG) | Fall 2015 |
| NASA Space Technology Research Fellowship (Declined to accept NDSEG) | Fall 2015 |
| Honorable Mention NSF Graduate Research Fellowship | Fall 2015 |
| Zonta Amelia Earhart Fellowship (Declined to accept NDSEG) | Fall 2015 |
| Stillwell Fellowship (UIUC) | 2013-2014 |
| Illinois Space Grant Consortium Graduate Fellowship | Fall 2014 |

PROFESSIONAL AFFILIATIONS

American Institute of Aeronautics and Astronautics (Member)