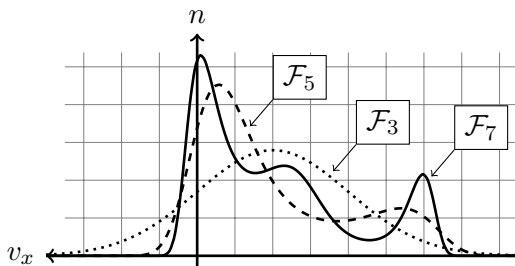


Dr. James Gerald M^cDonald

Mechanical Engineering, University of Ottawa
161 Louis Pasteur, Ottawa, ON, Canada, K1N 6N5
Work: 613-562-5800 x6249 Fax: 613-562-5177
James.McDonald@uOttawa.ca
www.drjamesmcdonald.ca



Current Position:

2013–present

Assistant Professor

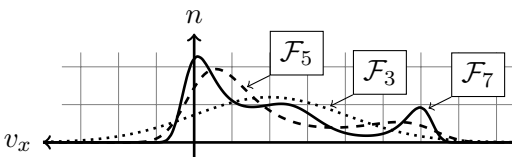
Department of Mechanical Engineering
University of Ottawa
161 Louis Pasteur,
Ottawa, Ontario, Canada, K1N 6N5

EDUCATION

- Ph. D.**, Aerospace Engineering, University of Toronto, Toronto, Canada 2011
- Adviser: Prof. Clinton P. T. Groth
 - Thesis title: *Extended Fluid-Dynamic Modelling for Numerical Solution of Micro-Scale Flows*
 - External Reviewer: Prof. David Levermore
Department of Mathematics and Institute for Physical Science and Technology, University of Maryland
- M.A.Sc.**, Aerospace Engineering, University of Toronto, Toronto, Canada 2005
- Adviser: Prof. Clinton P. T. Groth
 - Thesis title: *Numerical Modelling of Micron-Scale Flows Using the Gaussian Moment Closure*
- B.Eng.**, Mechanical Engineering, Dalhousie University, Halifax, Canada 2003
- Graduated with Sexton Distinction
- B.A.**, Dalhousie University, Halifax, Canada 2003
- Major in Music
 - Graduated with Distinction
- I was the first student to obtain simultaneously a B.Eng. and a B.A. from Dalhousie University.*
- Diploma in Engineering**, Dalhousie University, Halifax, Canada 2001

AWARDS AND HONOURS

- Post-Doctoral Fellowship** 2010
Natural Sciences and Engineering Research Council of Canada (NSERC)
- Currently held in the Center for Computational Engineering Science at the Rheinisch-Westfälische Technische Hochschule (RWTH), Aachen, Germany.
- Thomas Noakes Graduate Scholarship** 2007

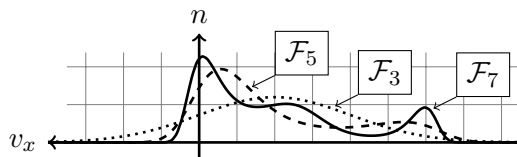


... awards and honours continued ...

CFD Society of Canada Graduate Scholarship Award	2006
Canadian Graduate Scholarship (Ph. D. level) Natural Sciences and Engineering Research Council of Canada (NSERC)	2005
Mary H. Beatty Fellowship (<i>declined to accept NSERC award</i>)	2005
Ontario Graduate Scholarship (<i>declined to accept NSERC award</i>)	2005
Canadian Graduate Scholarship (Master's level) Natural Sciences and Engineering Research Council of Canada (NSERC)	2003
Dalhousie In-Course Scholarship	2002, 2003
Alan D. Nickerson Memorial Scholarship	2003
Undergraduate Student Research Award Natural Sciences and Engineering Research Council of Canada (NSERC)	2002
Lorne C. Hubber Prize in Music	2000, 2001, 2002
J & A Campbell Music Department Scholarship	2001
Founders' Undergraduate Scholarship in Engineering	2001
Faculty of Engineering Scholarship	2001
Effie Mae Ross Scholarship in Music	2001
Dr. Edward Rhodes Engineering Scholarship	2001
National Association of Corrosion Engineers Scholarship	2000
James G. MacGregor Memorial Prize	1999
Dalhousie Entrance Guaranteed Scholarship	1999

— JOURNAL PUBLICATIONS —

- McDonald, J.**, Groth, C.P.T., Extended Fluid-Dynamic Model for Micron-Scale Flows Based on Regularized Gaussian Moment Closure. *Physics of Fluids* (in preparation)
- McDonald, J. G.**, Sachdev, J. S., Groth, C. P. T.. Application of Gaussian Moment Closure to Micro-Scale Flows with Moving and Embedded Boundaries. *American Institute of Aeronautics and Astronautics Journal*, (submitted)
- McDonald, J.**, Torrilhon, M., Affordable Robust Moment Closures for CFD based on the Maximum-Entropy Hierarchy. *Journal of Computational Physics*, Vol. 251, pp. 500-523, 2013.



...journal publications continued...

McDonald, J., Groth, C.P.T., Towards Realizable Hyperbolic Moment Closures for Viscous Heat-Conducting Gas Flows Based on a Maximum-Entropy Distribution. *Journal of Continuum Mechanics and Thermodynamics*, Vol. 25, pp. 573–603, 2013 .

Groth, C.P.T., **McDonald, J.** Towards Physically-Realizable and Hyperbolic Moment Closures for Kinetic Theory. *Journal of Continuum Mechanics and Thermodynamics*, Vol. 21, pp. 467–493, 2009.

Lai, Y., **McDonald, J.**, Kujath, M., and Hubbard, T. Force, Deflection and Power Measurements of Toggled Microthermal Actuators. *Journal of Micromechanics and Microengineering*. Vol 14, pp. 49–56, 2004.

CONFERENCE CONTRIBUTIONS

McDonald, J., and Torrilhon, M. Robust Hyperbolic Moment Closures for CFD. *28th International Symposium on Rarefied Gas Dynamics*, Zaragoza, Spain, July 9–13th, 2012.

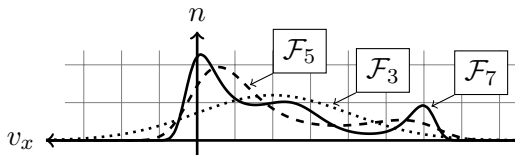
McDonald, J., and Groth, C.P.T. Numerical Solution of Maximum-Entropy-Based Hyperbolic Moment Closures for the Prediction of Viscous Heat-Conducting Gaseous Flows. *6th International Conference on Computational Fluid Dynamics, ICCFD6*, St. Petersburg, Russia, July 12–16th, 2010. Edited by A. Kuzmin, Springer-Verlag, Heidelberg, pp. 653–659, 2011.

McDonald, J., and Groth, C.P.T. Physically-Realizable Hyperbolic Moment Closures for Predicting Non-Equilibrium Gaseous Flows. *17th Annual Conference of the CFD Society of Canada*, May 3–5th, 2009, Ottawa, Canada.

McDonald, J., and Groth, C.P.T. Extended Fluid-Dynamic Model for Micron-Scale Flow Based on Gaussian Moment Closure. *46th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper 2008-691, January 7–10th, 2008, Reno, Nevada.

McDonald, J., Sachdev, J.S., and Groth, C.P.T. Use of the Gaussian Moment Closure for the Modelling of Continuum and Micron-Scale Flows with Moving Boundaries. *4th International Conference on Computational Fluid Dynamics, ICCFD4*, Ghent, Belgium, July 10–14th, 2006. Edited by H. Deconinck, E. Dick, Springer-Verlag, Heidelberg, pp. 783–788, 2009.

McDonald, J., and Groth, C.P.T. Numerical Modeling of Micron-Scale Flows Using the Gaussian Moment Closure. *35th AIAA Fluid Dynamics Conference and Exhibit*, AIAA Paper 2005-5035, June 6–9th, 2005, Toronto, Canada.



INVITED PRESENTATIONS

A Unified Method for the Prediction of Continuum and Transition-Regime Gas Flows, *keynote lecture*, **Workshop on Stochastic Modelling of Multiscale Systems**, Eindhoven, Netherlands, December 2nd–6th, 2013.

Robust Hyperbolic Moment Closures for Continuum and Non-Equilibrium Gas-Flow Prediction **Von Kármán Institute for Fluid Dynamics (VKI)**, Brussels, Belgium, January 24th, 2013.

Extended Fluid-Dynamic Models for Micron-Scale Flows, **Eidgenössische Technische Hochschule (ETH)**, Zürich, Switzerland, March 18th, 2008.

WORKSHOP CONTRIBUTIONS

McDonald, J., and Groth, C.P.T. Realizable Hyperbolic Moment Closures for Gaseous Flows. *Workshop on Computational Methods for Hyperbolic Problems*, University of Waterloo, April 20–22th, 2009.

Groth, C.P.T., **McDonald, J.** Towards Physically-Realizable and Hyperbolic Moment Closures for Kinetic Theory. *Workshop on Moment Methods in Kinetic Theory*, Eidgenössische Technische Hochschule (ETH), Zürich, Switzerland, November 6–8th, 2008.

OTHER PUBLICATIONS

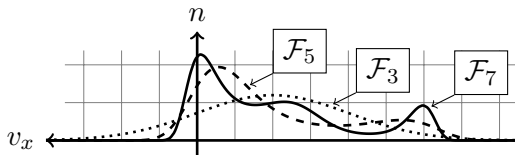
J. G. McDonald, *Extended Fluid-Dynamic Modelling for Numerical Solution of Micro-Scale Flows*, Ph. D. Thesis, University of Toronto Institute for Aerospace Studies, 2011.

J. G. McDonald, *Numerical Modelling of Micron-Scale Flows Using the Gaussian Moment Closure*, Master's Thesis, University of Toronto Institute for Aerospace Studies, 2005.

REFEREEING ACTIVITIES

I have served as a reviewer for articles submitted to the following journals

- *Journal of Computational Physics*
- *Journal of Continuum Mechanics and Thermodynamics*
- *Communications in Mathematical Sciences*
- *Physics Letters A*



 RESEARCH EXPERIENCE

Post-Doctoral Fellow

2010–Present

Mathematics (Center for Computational Engineering Science)

Rheinisch-Westfälische Technische Hochschule (RWTH), Aachen, Germany

- My host professor is Prof. Dr. Manuel Torrilhon.
- I am currently researching my goal of developing hyperbolic moment equations for the prediction of viscous heat-conducting gas flows in and out of local equilibrium for application to practical engineering problems.

Master's and Ph. D. Studies

2003–2010

CFD and Propulsion Group, University of Toronto Institute for Aerospace Studies.

- I studied under the advisement of Prof. Clinton Groth.
- I was the first person to carry out a thorough numerical investigation of the predictive capabilities for maximum-entropy moment closures for non-equilibrium gas flows.
- I developed and extended flow-solver software that efficiently runs on massive distributed-memory computers.
- I proposed several new closures for the prediction of continuum and non-equilibrium gases, including a regularized ten-moment closure and an affordable one-dimensional hyperbolic closure based on a fitting technique and maximum-entropy assumption.
- I was able to discover, develop, and implement creative physical models and numerical techniques in a very independent manner.

Research Assistant

2002

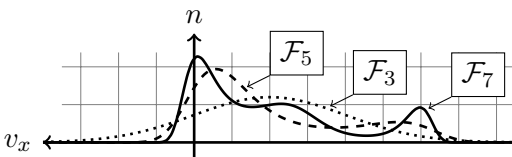
Micro-Electro-Mechanical Systems (MEMS) Lab,

Mechanical Engineering, Dalhousie University, Halifax, Canada

- I assisted graduate students in their research by determining force and deflection characteristics of several MEMS actuator designs through experimental measurement.

 COMPUTATIONAL SKILLS

I am experienced in developing and evaluating flow solvers for a variety of equations including the Euler equations, Navier-Stokes equations, the Boltzmann equations, and many moment closures. These solvers have varied from simple one-dimensional codes to large-scale codes designed to efficiently run on modern massive parallel distributed-memory computational facilities.



... computational skills continued ...

I have experience with numerical techniques including:

- Godunov-type finite-volume methods
- Finite-difference methods
- Finite-element methods such as discontinuous-Galerkin
- Explicit, point-implicit, and fully implicit time-marching methods
- Adaptive mesh refinement
- Mesh-adjustment schemes for embedded moving boundaries

I am also proficient with programming languages and computational techniques such as:

- C and C++
- Parallelization through OpenMP and MPI
- GPU acceleration and CUDA
- Linux and Unix
- Various other computational tools such as Git, Maple, LAPACK, GSL, Eigen, and L^AT_EX

TEACHING EXPERIENCE

Project Leader RWTH Undergraduate Research Opportunities Program (UROP) 2011

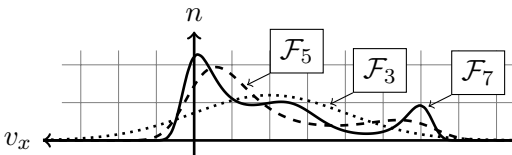
- The RWTH UROP program allows researchers in Aachen to submit projects that are open to applications from undergraduate engineering students in the United States and Canada. I submitted a project and accepted an applicant from Princeton University.
- I designed a project wherein a student would implement a flux function corresponding to a recently proposed moment closure in my existing flow software. I taught the student the basics of gaskinetic theory, moment closures, and upwind finite-volume-based flow solvers.
- This student was very successful in his project and was one of two students in the program asked to present his work at the closing ceremony.

Teaching Assistant — Mathematics IV (second-year calculus) 2011–2012
 Rheinisch-Westfälische Technische Hochschule (RWTH), Aachen, Germany

- I prepared weekly assignments and led weekly tutorials.
- I aided in preparing, administering, and marking the final exam.
- I always recieved excellent reviews from students

Teaching Assistant — Second-year fluid mechanics 2004–2009
 University of Toronto, Toronto, Canada

- I prepared and led weekly tutorials and problem sessions.
- I administered and marked monthly tests.
- I always recieved excellent reviews from students



OTHER EMPLOYMENT

- Member of the Band of the Ceremonial Guard** 1999–2001
- I played trombone for the daily Changing-of-the-Guard Ceremony on Parliament Hill in Ottawa, Canada.
 - I was a member of the Canadian-Forces Reserves during this time.

VOLUNTEER ACTIVITIES

- Low-Brass Musical Instructor** 2000–2010
- I have volunteered as an instrumental music teacher for many low-brass sectionals and clinics at various junior-high and high schools in Halifax and Toronto.

- Social Coordinator** 2005–2007
Aerospace Student Association, University of Toronto, Canada
- I was responsible for organizing various student events and outings such as dinner-dance evenings, lunch-time holiday parties, and outings to local sporting events.

- Member of Various Aerospace Departmental Committees** 2005–2010
At various times while at the University of Toronto, I was a member of the following committees:
- Aerospace Seminar Committee
 - Student-Experience Committee
 - Student-Appeals Committee
 - Library Committee

LANGUAGES

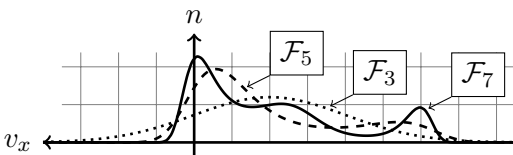
My mother tongue is English

I am bilingual in French

- I obtained a **bilingual high-school diploma** from a French-immersion high school.

I am currently studying German

- I have completed German level A.1 in the Common European Framework of Reference for Languages.
- I am currently studying for level A.2.



H O B B I E S A N D I N T E R E S T S

Classical Music

- I have studied and played trombone for twenty years.
- I have been a member of many university and community bands and orchestras.
- I have taught private and group low-brass lessons, both as a volunteer and on a for-pay basis.
- I am very interested in orchestral music and opera and actively attend live performances.

Photography

- I am an amateur photographer.
- I most enjoy macro photography and candid photography of my family.

Sports and Outdoor Activities

- In the winter I enjoy snowboarding and in the summer I enjoy wakeboarding.
- I participated in the departmental softball and ultimate-frisbee leagues at university.
- I enjoy many outdoor activities such as fishing, camping, canoeing, kayaking.
- While I was a Ph. D. student, I organized several canoeing back-country camping trips for the members of our research group.

P E R S O N A L D E T A I L S

Date of Birth: March 14th, 1980
 Place of Birth: Calgary, Alberta, Canada
 Nationality: Canadian