Jonathan F. MacArt

CONTACT INFORMATION

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EXPERIENCE

University of Notre Dame, Notre Dame, Indiana, USA

Assistant Professor — Starting Jan. 2020
Department of Aerospace and Mechanical Engineering

University of Illinois, Urbana, Illinois, USA

Postdoctoral Research Associate — July 2018–present
Center for Exascale Simulation of Plasma-Coupled Combustion (XPACC)

EDUCATION

Princeton University, Princeton, New Jersey, USA

Ph.D., Mechanical and Aerospace Engineering, June 2018

- Dissertation: *Computational Simulation and Modeling of Heat Release Effects on Turbulence in Turbulent Reacting Flow*
- Advisor: Michael E. Mueller
- Readers: Clancy Rowley, Luc Deike

M.A., Mechanical and Aerospace Engineering, September 2015

University of Notre Dame, Notre Dame, Indiana, USA

B.S., Aerospace Engineering, May 2013 (*magna cum laude*; with honors thesis)

- Thesis: *Modeling of Heterogeneous Material Under Small-Strain Thermo-Mechanical Loading*
- Advisor: Karel Matouš

HONORS AND AWARDS

Graduate School Teaching Award, Princeton University, 2017

Crocco Award for Teaching Excellence, Princeton University, 2016

Sydney Kelsey Excellence Prize in Structural Mechanics, University of Notre Dame, 2013

National Science Foundation Research Experiences for Undergraduates Fellowship, 2012

PEER-REVIEWED PUBLICATIONS

1. J.F. MacArt, T. Grenga, M.E. Mueller, Combustion mode effects and Reynolds number scaling of velocity and scalar statistics in turbulent nonpremixed and premixed jet flames, *Combustion and Flame* (2019), in preparation

2. T. Grenga, J.F. MacArt, M.E. Mueller, Dynamic mode decomposition of turbulent premixed jet flames at varying Karlovitz number, *Combustion and Flame* (2019), in preparation

3. J.F. MacArt, T. Grenga, M.E. Mueller, Evolution of flame-conditioned velocity statistics in turbulent premixed jet flames at low and high Karlovitz numbers, *Proceedings of the Combustion Institute* (2019), 2503-2510

4. T. Grenga, J.F. MacArt, M.E. Mueller, Dynamic Mode Decomposition of a Direct Numerical Simulation of a Turbulent Premixed Planar Jet Flame: Convergence of the Modes, *Combustion Theory and Modelling* 22 (2018), p. 795–811

5. J.F. MacArt, T. Grenga, M.E. Mueller, Effects of combustion heat release on velocity and scalar statistics in turbulent premixed jet flames at low and high Karlovitz numbers, *Combustion and Flame* 191 (2018), p. 468–485

6. J.F. MacArt, M.E. Mueller, Semi-implicit iterative methods for low Mach number turbulent reacting flows: Operator splitting versus approximate factorization, *Journal of Computational Physics* 326 (2016), p. 569–595

Technical Reports

1. J.F. MacArt, M.E. Mueller, Scaling and modeling of heat-release effects on subfilter turbulence in premixed combustion, *Center for Turbulence Research Proceedings of the Summer Program* (2018), 299-308

Invited Seminars and Presentations

1. M.E. Mueller, J.F. MacArt, Large Eddy Simulation Subfilter Modeling of Combustion-Affected Turbulence in Turbulent Premixed Combustion, 71$^{\text{st}}$ Annual Meeting of the APS Division of Fluid Dynamics, Atlanta, GA, November 18–20, 2018

2. J.F. MacArt, Turbulent Combustion: Multiscale, Multiphysical Interactions and the Challenge of High-Fidelity Simulation, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, September 7, 2018

3. J.F. MacArt, Simulation and Modeling of Heat Release Effects on Turbulence in Turbulent Combustion, Design Physics Division, Lawrence Livermore National Laboratory, Livermore, CA, March 2, 2018

4. J.F. MacArt, Simulation and Modeling of Heat Release Effects on Turbulence in Turbulent Combustion, Department of Aerospace and Mechanical Engineering, University of Notre Dame, Notre Dame, IN, February 17, 2018

5. J.F. MacArt, Simulation and Modeling of Heat Release Effects on Turbulence in Turbulent Premixed Combustion, Center for Exascale Simulation of Plasma-Coupled Combustion, University of Illinois at Urbana-Champaign, Urbana, IL, January 23, 2018

Conference Presentations

C.P. Byers, J.F. MacArt, M.E. Mueller, M. Hultmark, Similarity Constraints in Decaying Isotropic Turbulence, 11$^{\text{th}}$ International Symposium on Turbulence and Shear Flow Phenomena, Southampton, UK, July 30–August 2, 2019

J.F. MacArt, J.A. Sirignano, D.A. Buchta, J.B. Freund, Data-driven subfilter turbulence models and analysis in turbulent combustion, 17$^{\text{th}}$ International Conference on Numerical Combustion, Aachen, Germany, May 6–8, 2019

M.E. Mueller, B.A. Perry, A.C. Nunno, J.F. MacArt, L. Berger, Integrating data-based tools into physics-based model development for turbulent combustion, 17$^{\text{th}}$ International Conference on Numerical Combustion, Aachen, Germany, May 6–8, 2019

A.C. Nunno, B.A. Perry, J.F. MacArt, M.E. Mueller, Data-driven dimension reduction in turbulent combustion: Utility and limitations, AIAA SciTech 2018, San Diego, CA, January 7–11, 2019

A.C. Nunno, B.A. Perry, J.F. MacArt, M.E. Mueller, A comparison of physics-based and data-based methods of dimension reduction in turbulent combustion, 71$^{\text{st}}$ Annual Meeting of the APS Division of Fluid Dynamics, Atlanta, GA, November 18–20, 2018

C.P. Byers, J.F. MacArt, M.E. Mueller, M. Hultmark, Similarity in decaying isotropic turbulence: Functional forms, constraints in single- and two-time evolution, and DNS results, 71$^{\text{st}}$ Annual Meeting of the APS Division of Fluid Dynamics, Atlanta, GA, November 18–20, 2018

J.F. MacArt, T. Grenga, M.E. Mueller, Evolution of flame-conditioned velocity statistics in turbulent premixed jet flames at varying Karlovitz number, 37$^{\text{th}}$ International Symposium on Combustion, Dublin, Ireland, July 29–August 3, 2018

J.F. MacArt, T. Grenga, M.E. Mueller, Budgets of flame-conditioned second-order turbulence statistics in low and high Karlovitz number turbulent premixed jet flames, 2018 Spring Technical Meeting of the Eastern States Section of the Combustion Institute, State College, PA, March 5–7, 2018

T. Grenga, J.F. MacArt, M.E. Mueller, Multi-modal counterflow flames under autoignitive conditions, 2018 Spring Technical Meeting of the Eastern States Section of the Combustion Institute, State College, PA, March 5–7, 2018

J.F. MacArt, M.E. Mueller, Flame-conditioned turbulence modeling for reacting flows, 70$^{\text{th}}$ Annual Meeting of the APS Division of Fluid Dynamics, Denver, CO, November 19–21, 2017

T. Grenga, J.F. MacArt, M.E. Mueller, Dynamic mode decomposition of a turbulent premixed planar jet flame, 10$^{\text{th}}$ Mediterranean Combustion Symposium, Naples, Italy, September 17–21, 2017

J.F. MacArt, T. Grenga, M.E. Mueller, Karlovitz number effects on velocity and scalar statistics in turbulent premixed combustion, 10$^{\text{th}}$ U.S. National Meeting on Combustion, College Park, MD, April 23–26, 2017

T. Grenga, J.F. MacArt, M.E. Mueller, Multi-Modal Counterflow Flame Structure under Autoignitive Conditions, 10$^{\text{th}}$ U.S. National Meeting on Combustion, College Park, MD, April 23–26, 2017

J.F. MacArt, T. Grenga, M.E. Mueller, Heat Release Effects on Turbulence Statistics in Premixed and Nonpremixed Flames, 16$^{\text{th}}$ International Conference on Numerical Combustion, Orlando, FL, April 3–5, 2017

T. Grenga, J.F. MacArt, M.E. Mueller, Dynamic Mode Decomposition of Turbulent Non-reacting and Reacting Nonpremixed Jets, 16$^{\text{th}}$ International Conference on Numerical Combustion, Orlando, FL, April 3–5, 2017

J.F. MacArt, T. Grenga, M.E. Mueller, Conditional budgets of second-order statistics in nonpremixed and premixed turbulent combustion, 69$^{\text{th}}$ Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR, November 20–22, 2016

T. Grenga, J.F. MacArt, M.E. Mueller, Three dimensional dynamic mode decomposition of premixed turbulent jet flames, 69$^{\text{th}}$ Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR, November 20–22, 2016

J.F. MacArt, M.E. Mueller, Computationally efficient schemes for large-scale simulations of turbulent reacting flows, 1$^{\text{st}}$ Annual Research Computing Day, Princeton Institute for Computational Science and Engineering, Princeton, NJ, October 14, 2016

J.F. MacArt, T. Grenga, M.E. Mueller, Effects of small-scale heat release on turbulence scaling in

premixed and nonpremixed flames, 2016 Spring Technical Meeting of the Eastern States Section of the Combustion Institute, Princeton, NJ, March 13–16, 2016

J.F. MacArt, M.E. Mueller, Semi-implicit iterative methods for low Mach number turbulent reacting flows, 68$^{\text{th}}$ Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA, November 22–24, 2015

J.F. MacArt, M.E. Mueller, Analysis of operator splitting errors for DNS of low Mach number turbulent reacting flows, 67$^{\text{th}}$ Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA, November 23–25, 2014

J.F. MacArt, Modeling of energetic composites under small-strain chemo-thermo-mechanical loading, 2012 Undergraduate Research Summer Symposium, Notre Dame, IN, August 3, 2012

Academic Community Service

Journal Reviewer
Combustion and Flame
Computers and Fluids
Journal of Computational Physics
Physical Review Fluids

Undergraduate Teaching

Princeton University, Princeton, New Jersey, USA

Assistant in Instruction
MAE 335, Fluid Dynamics
Fall 2015, Fall 2016

MAE 427/ENE 427, Energy Conversion and the Environment: Transportation Applications
Spring 2016

Graduate Teaching

Princeton University, Princeton, New Jersey, USA

Assistant in Instruction
APC 523/AST 523/MAE 507: Numerical Algorithms for Scientific Computing
Spring 2015, Spring 2018

Undergraduate Advisees

Omkar B. Shende (with M.E. Mueller), 2017–2018

Memberships

American Physical Society, Division of Fluid Dynamics

The Combustion Institute

Sigma Gamma Tau

Tau Beta Pi

Computer Skills

Languages: Fortran, C/C++, MATLAB, CUDA, Python, Unix shell, Arduino, LaTeX
Concepts: Computational fluid dynamics, low Mach number and compressible flow solvers, multi-physics simulations, high-performance computing, MPI, OpenMP, hybrid parallelization, parallel debugging, unstructured grids, finite element analysis, version control (git, svn)
Applications: Emacs, EnSight, ParaView, Gnuplot, Inkscape, Gimp
Operating Systems: Unix/Linux, OS X, Windows

Professional Experience

General Electric Aviation, Cincinnati, Ohio, USA
Systems Engineering Intern May 2011 – Aug. 2011

Community and Volunteer Service

Webmaster, Lakeside Apartments Committee, Princeton University, 2015–2018
Assistant Choir Director, Aquinas Institute of Princeton University, 2015
Judge, Mercer County Science and Engineering Fair, Trenton, NJ, 2014–2015

Languages

English (native); German (limited proficiency)