

Mohammad Mohaghar

Research Engineer II

Georgia Institute of Technology

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EDUCATION

Ph.D. Mechanical Engineering 2014-2019

Georgia Institute of Technology

Ph.D. Thesis: [Effects of Initial Conditions and Mach Number on Turbulent Mixing Transition of Shock-driven Variable-density Flow](#)

Thesis advisor: [Prof. Devesh Ranjan](#)

MSc Mechanical Engineering 2015-2017

Georgia Institute of Technology

MSc Energy for Sustainability 2012-2014

University of Coimbra (MIT-Portugal program)

MSc Thesis: [Developing a Novel Method for Predicting Nearshore and Offshore Wave Energy of the Portuguese Coast](#)

Thesis advisor: Prof. Almerindo Ferreira

MSc Automotive Engineering 2008-2010

Iran University of Science and Technology

MSc Thesis: Analysis and Improvement of Longitudinal and Lateral Stability of an Off-Road Vehicle Moving on a Slope Submitted to External Impact Loading

Thesis advisor: Prof. Javad Marzbanrad

BSc Mechanical Engineering 2004-2008

University of Tehran

BSc Thesis: Modifications and Improvements of FSW Welding

Thesis advisor: Prof. Mohammad Kazem Besharati Givi

RESEARCH EXPERIENCE

Research Engineer II 2022-Present

Georgia Institute of Technology

[Environmental Fluid Mechanics Lab](#)

Research: Biofluids, Biomechanics, Experimental Fluid Mechanics, Turbulence

- Analyzed volumetric flow field around bio-inspired magnetic-responsive materials using tomographic particle image velocimetry (PIV) measurement
- Analyzed kinematics & hydrodynamics of the adult *Euchaeta antarctica* using tomographic PIV measurement
- Investigated the development of double-diffusive convection instability using PLIF/PIV techniques

Postdoctoral Research Fellow

2019-2022

Georgia Institute of Technology

Environmental Fluid Mechanics Lab

Advisor: Prof. Donald Webster

Research: Biofluids, Experimental Fluid Mechanics, Turbulence

- Analyzed kinematics & hydrodynamics of pteropod using tomographic PIV measurement
- Characterized nonlinear internal waves using combined PLIF/PIV techniques
- Analyzed swimming behavior of copepods around internal waves
- Investigated high-Schmidt number passive scalar fields in turbulent boundary layers

Graduate Research Assistant

2014-2019

Georgia Institute of Technology

Shock Tube and Advanced Mixing Laboratory

Research: Experimental Fluid Mechanics, Turbulence

- Addressed the influence of modal content of the initial condition on the Richtmyer-Meshkov instability transition to a turbulent state
- Investigated the influence of Mach number and Atwood number on turbulent mixing transition of a shock-driven variable density flow
- Analyzed the inclined RMI flow development using high-resolution three-dimensional simulations with the FLASH code

Research Fellow

2012-2014

University of Coimbra

Research: Renewable Energy Systems Particularly Ocean Wave Energy

- Developed a novel numerical method for predicting nearshore wave energy using Delft3d and DelftDashboard
- Modeled and simulated a hospital building with different HVAC systems using Energy Plus in order to reduce energy consumption

Research Fellow

2008-2010

Iran University of Science and Technology

Research: Optimization of Automotive Suspension Systems

- Optimized the double-wishbone suspension system of an off-road vehicle in critical position by modified Genetic Algorithm

TEACHING EXPERIENCE

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| Instructor <i>Georgia Institute of Technology</i> <ul style="list-style-type: none">• Flow Dynamics of Soft Robotic Swimmers (VIP) | 2024-Present |
| Teaching Assistant <i>Georgia Institute of Technology</i> <ul style="list-style-type: none">• Dynamics | 2019-Present |
| Teaching Assistant <i>Georgia Institute of Technology</i> <ul style="list-style-type: none">• Introduction to Fluid Mechanics | 2016 |
| Teaching Assistant <i>University of Tehran</i> <ul style="list-style-type: none">• Thermodynamics• Engineering Economy | 2006-2010 |
| Instructor <i>Payam Hedayat, Imam Hadi & Talash High Schools</i> <ul style="list-style-type: none">• Mathematics• Physics | 2006-2009 |

INDUSTRIAL WORK EXPERIENCE

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| Heat Exchanger & Pressure Vessel Designer <i>GarmaGostar Co.</i> | 2011-2012 |
| Product Engineer <i>Mapna Locomotive Co.</i> | 2010-2011 |

AWARDS

- Received *CEE Postdoctoral Excellence Award* of the year at Georgia Tech, 2022
- Received *CEE Future Faculty Fellow Award* at Georgia Tech, 2022
- The article “Characteristics of swimming shelled Antarctic pteropods (*Limacina helicina antarctica*) at intermediate Reynolds number regime” was named an Editors’ Suggestion by *Physical Review Fluids* and selected as a Focus Feature in *Physics*, 2019
- Recorded a patent for Portable Hybrid Generator in Iran, 2011
- Received full scholarship from Iran University of Science and Technology for Masters in Automotive Engineering, 2008 - 2010
- Received full scholarship from University of Tehran for BSc in Mechanical Engineering, 2004 - 2008
- Passed the first level of the National Physics and Mathematics Olympiads with a distinction, 2003

PROFESSIONAL AFFILIATIONS

- Member of Association for the Sciences of Limnology and Oceanography (ASLO), 2019 – Present
- Member of American Physical Society (APS), 2014 – Present

TECHNICAL SKILLS

Experimental Techniques

Particle Image Velocimetry (PIV) techniques, Planar Laser-Induced Florescence (PLIF) measurements and image processing, Flow visualization

Computer Programs

Matlab, C++, Fortran, Python, Visual Basic, LabView, Tecplot, AutoCAD, SolidWorks, FLASH, TSI Insight, LaVision DaVis, Delft3D, SWAN, ADAMS, PDMS, Energy Plus

SERVICE

- Reviewer for various Archival Journals (PRL, PRF, JFM, PoF, Physica D Scripta, Shock Waves, etc.)
- Session chair at International Symposium on Particle Image Velocimetry and American Physical Society DFD conferences.

PEER-REVIEWED JOURNAL PAPERS [Google Scholar]

10. [M. Mohaghar, D.R. Webster, “Hydrodynamics of cruise swimming and turning maneuvers in *Euchaeta antarctica*”, *Scientific Reports* **14**, 1 \(2024\).](#)
9. [M. Mohaghar, A. Connor, S. Wu, R. Zhao, D.R. Webster, “Effects of symmetry-breaking mechanisms on the flow field around magnetic-responsive material appendages that mimic swimming strokes”, *Physical Review Fluids* **9**, 023101 \(2024\).](#)
8. [M. Mohaghar, D.R. Webster, “Experimental investigation of non-linear standing internal waves using combined density and velocity measurements”, *Experiments in Fluids* **64**, 77 \(2023\).](#)
7. [M. Mohaghar, J. McFarland, D. Ranjan, “Three-dimensional simulations of reshocked inclined Richtmyer-Meshkov instability: Effects of initial perturbations”, *Physical Review Fluids* **7**, 093902 \(2022\).](#)
6. [M. Mohaghar, L.P. Dasi, D.R. Webster, “Scalar power spectra and turbulent scalar length scales of high-Schmidt-number passive scalar fields in turbulent boundary layers”, *Physical Review Fluids* **5**, 084606 \(2020\).](#)
5. [M. Mohaghar, S. Jung, K. A. Haas, D. R. Webster, “Copepod behavior responses around internal waves”, *Frontiers in Marine Science* **7**, 331 \(2020\).](#)
4. [M. Mohaghar, D. Adhikari, D.R. Webster, “Characteristics of swimming shelled Antarctic pteropods \(*Limacina helicina antarctica*\) at intermediate Reynolds number regime”, *Physical Review Fluids* **4**, 111101 \(2019\).](#)
3. [M. Mohaghar, J. Carter, G. Pathikonda, D. Ranjan, “The transition to turbulence in shock-driven mixing: effects of Mach number and initial conditions”, *Journal of Fluid Mechanics* **871**, 595-635 \(2019\).](#)
2. [M. Mohaghar, J. Carter, B. Musci, D. Reilly, J. McFarland, D. Ranjan, “Evaluation of turbulent mixing transition in a shock-driven variable-density flow”, *Journal of Fluid Mechanics* **831**, 779-825 \(2017\).](#)
1. [D. Reilly, J. McFarland, M. Mohaghar, D. Ranjan, “The effects of initial conditions and circulation deposition on the inclined-interface reshocked Richtmyer–Meshkov instability”, *Experiments in Fluids* **56**, 168 \(2015\).](#)

PEER-REVIEWED PROCEEDINGS

8. [M. Mohaghar, A. Connor, S. Wu, R. Zhao, D.R. Webster, “Volumetric PIV measurements of bio-inspired magnetic-responsive materials that mimic swimming strokes”, *15th International Symposium on Particle Image Velocimetry*, San Diego \(2023\).](#)
7. [M. Mohaghar, J. McFarland, and D. Ranjan, “A study of modal interaction between different scales of the turbulent Richtmyer-Meshkov instability using high-resolution three-dimensional FLASH simulations”, *17th International Workshop on the Physics of Compressible Turbulent Mixing*, Atlanta \(2022\).](#)

6. [M. Mohaghar, D.R. Webster, “Characterization of non-linear internal waves using PIV/PLIF techniques”](#), *14th International Symposium on Particle Image Velocimetry* , Chicago (2021).
5. [G. Pathikonda, J. Carter, M. Mohaghar, and D. Ranjan, “Temporal evolution of Richtmyer-Meshkov induced mixing using simultaneous high-speed PIV-PLIF”](#), *32nd International Symposium on Shock Waves* , Singapore (2019).
4. [M. Mohaghar, J. Carter, G. Pathikonda and D. Ranjan, “Turbulent mixing driven by Richtmyer-Meshkov instability: Effect of Atwood number”](#), *16th International Workshop on the Physics of Compressible Turbulent Mixing* , Marseilles (2018).
3. [J. Carter, M. Mohaghar, G. Pathikonda and D. Ranjan, “Turbulent mixing driven by Richtmyer-Meshkov instability: Effect of Mach number”](#), *16th International Workshop on the Physics of Compressible Turbulent Mixing* , Marseilles (2018).
2. [V. Tsiklashvili, D. Reilly, M. Mohaghar, J. Carter and D. Ranjan, “Effect of the initial conditions on the evolution of Richtmyer - Meshkov instability turbulent quantities”](#), *15th International Workshop on the Physics of Compressible Turbulent Mixing* , Sydney (2016).
1. [M. Mohaghar, Z. Mousavi Karimi and A. Ferreira, “Developing a novel method for predicting nearshore wave energy of Matosinhos, Portugal”](#), *Energy for Sustainability Multidisciplinary Conference* , Coimbra (2013).

CONFERENCE PRESENTATIONS

15. [M. Mohaghar, P. Paresh, B. Doss, E. Pritchard, G. Dutton, D.R. Webster, “Quantitative analysis of double-diffusive instability: Growth and mixing transition of ascending fingers”](#), *Bulletin of the American Physical Society* , Salt Lake City (2024).
14. [M. Mohaghar, P. Paresh, B. Doss, E. Pritchard, G. Dutton, D.R. Webster, “Dancing Fingers: The Evolution of Double-Diffusive Instability”](#), *APS - Gallery of Fluid Motion* , Salt Lake City (2024).
13. [M. Mohaghar, D.R. Webster, “Hydrodynamic characterization of the adult Euchaeta antarctica during straight swimming and turning”](#), *Ocean Sciences Meeting 2024* , New Orleans (2024).
12. [M. Mohaghar, D.R. Webster, “Hydrodynamics of cruise locomotion in the adult Euchaeta antarctica”](#), *Bulletin of the American Physical Society* , Washington (2023).
11. [M. Mohaghar, A. Connor, R. Zhao, D.R. Webster, “Analysis of flow field around magnetic-responsive soft materials using tomographic particle image velocimetry”](#), *Bulletin of the American Physical Society* , Indianapolis (2022).
10. [M. Mohaghar, D.R. Webster, “Characterization of non-linear internal waves using PIV/PLIF techniques”](#), *Bulletin of the American Physical Society* , Phoenix (2021).
9. [D.R. Webster, M. Mohaghar, S. Jung, K. Haas, “Marine copepod behavior responses in and near internal waves”](#), *Bulletin of the American Physical Society* , Phoenix (2021).
8. [M. Mohaghar, S. Jung, K.A. Haas, D.R. Webster, “Copepod behavior responses around internal waves”](#), *Ocean Sciences Meeting 2020* , San Diego (2020).

7. M. Mohaghar, L.P. Dasi, D.R. Webster, “[Scalar power spectra and turbulent length scales in high-Schmidt-number scalar fields](#)”, *Bulletin of the American Physical Society* , Seattle (2019).
6. M. Mohaghar, J. Carter, J.S. Rubio, G. Pathikonda and D. Ranjan, “[Experimental investigation of the effects of Mach number and initial condition on mixing transition in shock-driven flow](#)”, *Bulletin of the American Physical Society* , Atlanta (2018).
5. M. Mohaghar, J. Carter, G. Pathikonda and D. Ranjan, “[Investigation of Atwood ratio influence on turbulent mixing transition of a shock-driven variable density flow after reshock](#)”, *Bulletin of the American Physical Society* , Denver (2017).
4. M. Mohaghar, J. Carter, B. Musci and D. Ranjan, “[Experimental investigation of the effect of multimodal inclined interface on Richtmyer-Meshkov instability evolution](#)”, *APS Meeting Abstracts* , Portland (2016).
3. D. Reilly, M. Mohaghar, J. Carter, J. McFarland and D. Ranjan, “[Progress on simultaneous PLIF/PIV measurements for a turbulent complex fluid interface](#)”, *APS Meeting Abstracts* , Boston (2015).
2. M. Mohaghar, D. Reilly, J. Carter, J. McFarland and D. Ranjan, “[Simultaneous PLIF/PIV measurements for a single-mode inclined interface](#)”, *APS Meeting Abstracts* , Boston (2015).
1. D. Reilly, J. Carter, M. Mohaghar, D. Jarrahbashi, J. McFarland and D. Ranjan, “[Observations of variable-density turbulence from a complex fluid interface](#)”, *APS Shock Compression of Condensed Matter Meeting Abstracts* , Tampa (2015).