

# Mohammad Mohaghar

*Research Engineer II*

*Georgia Institute of Technology*

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## EDUCATION

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**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

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## RESEARCH EXPERIENCE

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**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 robots/materials using tomographic particle image velocimetry (PIV) measurement
- Analyzed kinematics & hydrodynamics of zooplankton propulsion (Euchaeta, krill) using tomographic PIV measurement
- Investigated the dynamics of double-diffusive convection instability using simultaneous 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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<b>Instructor</b> <i>Georgia Institute of Technology</i>	2024-Present
<ul style="list-style-type: none"><li>• <a href="#">Flow Dynamics of Soft Robotic Swimmers (VIP)</a></li></ul>	
<b>Teaching Assistant</b> <i>Georgia Institute of Technology</i>	2019-Present
<ul style="list-style-type: none"><li>• Dynamics</li></ul>	
<b>Teaching Assistant</b> <i>Georgia Institute of Technology</i>	2016
<ul style="list-style-type: none"><li>• Introduction to Fluid Mechanics</li></ul>	
<b>Teaching Assistant</b> <i>University of Tehran</i>	2006-2010
<ul style="list-style-type: none"><li>• Thermodynamics</li><li>• Engineering Economy</li></ul>	
<b>Instructor</b> <i>Payam Hedayat, Imam Hadi &amp; Talash High Schools</i>	2006-2009
<ul style="list-style-type: none"><li>• Mathematics</li><li>• Physics</li></ul>	

## INDUSTRIAL WORK EXPERIENCE

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

## AWARDS

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- Received *CEE Young Faculty Research Award* of the year at Georgia Tech, 2025
- 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**

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

## **TECHNICAL SKILLS**

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### **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**

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- 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.

## **MENTORED STUDENTS**

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### **PhD Students**

- Ali Mojtabaei Soleimani: *Flow Dynamics of Soft Robotic Swimmers*

### **Master's Students**

- Anika Govil: *Double Diffusive Instability Experiments*
- Blaire Doss: *Double Diffusive Instability Experiments*

### **Undergraduate Students**

#### **Current:**

- Ewan Pritchard: *Double Diffusive Instability Experiments*
- Amelia Faust: *Double Diffusive Instability Experiments*

- **Kennedy Hughes**: *Flow Dynamics of Soft Robotic Swimmers*

**Previous:**

- **Saaketh Reddy Chintha Reddy**: *Flow Dynamics of Soft Robotic Swimmers*
- **Akil Quadir**: *Flow Dynamics of Soft Robotic Swimmers*
- **Blaire Doss**: *Double Diffusive Instability Experiments*
- **Prathyusha Paresh**: *Double Diffusive Instability Experiments*
- **Gracen Dutton**: *Double Diffusive Instability Experiments*
- **Anikait Dhond**: *Non-Linear Internal Waves*

## **GRANTS**

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**Awarded Proposal:**

**Title of Project:** Initiative Proposal: Flow Instabilities and Fluid Dynamics for Space Applications

**Agency/Company:** Space Research Institute Center, Program, Initiative (CPI)

**Total Dollar Amount:** \$8,000 (year 1), \$25,000 (year 2 and 3)

**Role:** Co-PI

**Collaborators:** Suhas Jain (PI), Donald Webster (Co-PI),

**Submitted Proposal:**

**Title of Project:** Evolution and Mixing Mechanisms of Double-Diffusive Instabilities

**Agency/Company:** National Science Foundation (NSF)

**Total Dollar Amount:** \$499,999

**Role:** Co-PI

**Collaborators:** Donald Webster (PI), Suhas Jain (Co-PI)

**Proposal in Preparation:**

**Title of Project:** Design Science for Fluid–Structure Systems: Data-Driven Co-Design with a Soft-Robot Jellyfish Exemplar via Experimental and Computational Hydrodynamics

**Agency/Company:** National Science Foundation (NSF)

**Total Dollar Amount:** Not finalized

**Role:** Co-PI

**Collaborators:** Donald Webster (PI), Karthik Menon (Co-PI), Elizabeth Qian (Co-PI)

## **PEER-REVIEWED JOURNAL PAPERS [[Google Scholar](#)]**

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11. A. Connor, M. Mohaghar, D.R. Webster, “[Hydrodynamics of active metachronal swimming modes in Antarctic krill, \*Euphausia superba\*](#)”, *Marine Biology* **172**, 135 (2025).
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 \(2015\).](#)

## **MANUSCRIPTS IN PREPARATION**

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- [M. Mohaghar, A. Bhattacharjee, S. Jain, D.R. Webster, “Dynamics of finger-type convection in double-diffusive instability”.](#)

## **PEER-REVIEWED PROCEEDINGS**

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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**

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19. [M. Mohaghar, E. Pritchard, B. Doss, D.R. Webster, “Finger Growth to Mixed Layers in Double Diffusive Instability: Simultaneous Scalar-Velocity Measurements”](#), *Ocean Sciences Meeting* , Glasgow (2026).
18. [M. Mohaghar, E. Pritchard, B. Doss, D.R. Webster, “Salinity effects on double-diffusive instability evolution: Finger growth, mixing, and transport”](#), *Bulletin of the American Physical Society* , Houston (2025).
17. [D.R. Webster, E. Pritchard, B. Doss, M. Mohaghar, “Finger-scale dynamics in double-diffusive instability: Vorticity, flux, and zig-zag ascent”](#), *Bulletin of the American Physical Society* , Houston (2025).
16. [A. Mojtabaei Soleimani, M. Mohaghar, D.R. Webster, “Tomographic PIV measurement of a magnetically actuated, bio-Inspired, four-legged soft robot swimmer”](#), *Bulletin of the American Physical Society* , Houston (2025).
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).