Mauro Rodriguez Jr.

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Nationality: American, US-born citizen

Professional appointments

Assistant Professor of Engineering, 07/2021-Present
Brown University, School of Engineering

Postdoctoral Research Fellow, 06/2019-07/2021
California Institute of Technology, Division of Engineering & Applied Science
Postdoctoral mentor: Tim Colonius, Ph.D.

Graduate Research Assistant, 06/2012-12/2018
University of Michigan, Ann Arbor, Michigan, Department of Mechanical Engineering
Doctoral adviser: Eric Johnsen, Ph.D.

Education

University of Michigan (U-M), Ann Arbor
Doctorate of Philosophy, Mechanical Engineering, 2018
Thesis Title: Numerical Simulations of Bubble Dynamics Near Viscoelastic Media
Thesis Link: http://hdl.handle.net/2027.42/147536

Leland Stanford Jr. University
Master of Science, Mechanical Engineering, 2012

University of Illinois at Urbana-Champaign (UIUC)
Bachelor of Science with Honors, Mechanical Science and Engineering, 2010

Research activity

Archived, peer-reviewed publications

10. E. Hersey, **M. Rodriguez**, E. Johnsen, Dynamics of an oscillating microbubble in a blood-like Carreau fluid, J. Acoust. Soc. Am. **153** (2023) 1836–1845. DOI:10.1121/10.0017342.
9. **M. Rodriguez**, S. A. Beig, E. Johnsen, and C. N. Barbier, Dynamics of an inertially collapsing gas bubble between two parallel, rigid walls, J. Fluid Mech. 2022 **946** A43-1-21. DOI:10.1017/jfm.2022.571
8. J. S. Spratt, **M. Rodriguez**, K. Schimdmayer, S. H. Bryngelson, J. Yang, C. Franck, and T. Colonius, Characterizing viscoelastic materials via ensemble-based data assimilation of bubble collapse observations, J. Mechanics and Physics of Solids. 2021 DOI:10.1016/j.jmps.2021.104455
7. L. Mancia, **M. Rodriguez**, J. Sukovich, Z. Xu, E. Johnsen, Acoustic measurements of nucleus size distribution at the cavitation threshold, Ultrasound Med. Biol. 2021 DOI:10.1016/j.ultrasmedbio.2020.12.007.
6. L. Mancia, **M. Rodriguez**, J. Sukovich, Z. Xu, E. Johnsen, Single–bubble dynamics in histotripsy and high–amplitude ultrasound: Modeling and validation, Phys. Med. Biol. 2020 **65** 1-16 DOI:10.1088/1361-6560/abb02b.

5. L. Mancia, E. Vlaisavljevich, N. Yousefi, **M. Rodriguez**, T. J. Ziemlewicz, F. T. Lee, D. Henann, C. Franck, Z. Xu, and E. Johnsen, Modeling tissue–selective cavitation damage, Phys. Med. Biol. 2019 **64**. DOI:10.1088/1361-6560/ab5010
4. C. T. Wilson, T. L. Hall, E. Johnsen, L. Mancia, **M. Rodriguez**, J. E. Lundt, T. Colonius, D. L. Henann, C. Franck, Z. Xu, J. R. Sukovich, A Comparative Study of the Dynamics of Laser and Acoustically Generated Bubbles in Viscoelastic Media, Physical Review E 2019 **99** 1-10. DOI:10.1103/PhysRevE.99.043103
3. **M. Rodriguez**, K. G. Powell and E. Johnsen, A high-order accurate AUSM$^+$-up approach for simulations of compressible multiphase flows with linear viscoelasticity, Shock Waves 2019 **29** 717-734. DOI:10.1007/s00193-018-0884-3
2. **M. Rodriguez** and E. Johnsen, A high-order, finite-difference approach for numerical simulations of shocks interacting with interfaces separating different linear viscoelastic materials, J. Comput. Phys. 2019 **379** 70-90. DOI:10.1016/j.jcp.2018.10.035
1. S. Padhy, **M. Rodriguez**, E. S. G. Shaqfeh, G. Iaccarino, Jeffrey F. Morris, and N. Tonmukayakul, The effect of shear thinning and walls on the sedimentation of a sphere in an elastic fluid under orthogonal shear, J. Non-Newtonian Fluid Mech., 2013 **201** 120-129. DOI:10.1016/j.jnnfm.2013.07.007

Peer-reviewed conference proceedings

6. **M. Rodriguez**, S. H. Bryngelson, T. Colonius, Bubble Growth and Phase Change Dynamics near Compliant Objects, 34th Symposium on Naval Hydrodynamics, Washington, D.C., June 26 – July 1, 2022.
5. **M. Rodriguez**, S. H. Bryngelson, T. Colonius, Acoustically-induced bubble growth and phase change dynamics near compliant surfaces, 11^{th} International Symposium on Cavitation (CAV 2021), Virtual On-line.
4. J.-S. Spratt, **M. Rodriguez**, S. H. Bryngelson, S. Cao, T. Colonius, Eulerian Framework for Bubble-Cloud–Kidney Stone Interaction, 11^{th} International Symposium on Cavitation (CAV 2021), Virtual On-line.
3. **M. Rodriguez**, I. Hasbun, J. L. Estrada, D. Renaud, On the effect of SHPE's social-cognitive leadership theory to Hispanic STEM professionals' leadership self-efficacy (work in progress), 2020 Collaborative Network for Computing & Engineering Diversity, Virtual On-line. https://peer.asee.org/36112 https://peer.asee.org/36121
2. **M. Rodriguez** and K. Siles, D. L. Renaud, A decade-long programmatic study of SHPE's chapter reporting program: best practices, lessons learned, and outcomes for national engineering diversity chapter-based organizations (Experience report), Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On-line. DOI:10.18260/1-2--33997.
1. S. A. Beig, **M. Rodriguez** and E. Johnsen, Non-spherical bubble collapse near rigid and compliant surfaces, 31st Symposium on Naval Hydrodynamics, Monterey, CA, USA, September 11-16, 2016.

Invited Speaker

5. Oak Ridge National Laboratory, Manufacturing Demonstration Facility, Extreme Environment Materials Process Group (2023)
4. Illinois Institute of Technology, Mechanical Engineering Seminar (2021)
3. Ohio State University, Mechanical and Aerospace Engineering Seminar (2021)
2. Brown University, Center of Fluid Mechanics Seminar (2021)
1. Future Leaders in Mechanical and Aerospace Engineering national webinar series (2021)

Published abstracts, posters, and presentations Presented +30 research talks, select talks below

21. M. Rodriguez, J. B. Estrada, and J. Yang, Numerical simulations of inertial cavitation at a compliant object interface, 11th International Conference on Multiphase Flows, Kobe, Japan, April 2023.
20. M. Rodriguez, S. Bryngelson, Cavitation bubble growth near an elastic object, APS 75th Annual Meeting Division of Fluid Dynamics Virtual conference, Indianapolis, Indiana 2022.
19. M. Rodriguez, S. Bryngelson, and T. Colonius, Bubble Dynamics with Phase Change near a Compliant Object, 34th Symposium on Naval Hydrodynamics, Washington, DC, June 2022.
18. M. Rodriguez, S. Bryngelson, and T. Colonius, Numerical Simulations of Cavitation Bubble Growth and Collapse Near a Viscoelastic Object, 19th U.S. National Congress on Theoretical and Applied Mechanics, Austin, Texas, June 2022.
17. M. Rodriguez, S. Bryngelson, and T. Colonius, Numerical simulations of cavitation near an elastic object, 8th European Congress on Computational Methods in Applied Sciences and Engineering, Oslo, Norway, June 2022.
16. M. Rodriguez, S. Bryngelson, and T. Colonius, Vapor and gas bubble growth with phase transition near a wall, APS 74th Annual Meeting Division of Fluid Dynamics Virtual conference, Phoenix, Arizona, November 2021.
15. M. Rodriguez, S. Bryngelson, S. Cao, and T. Colonius, A unified Eulerian multiphase framework for fluid-structure interaction problems including cavitation, XXV International Congress of Theoretical and Applied Mechanics, Milano, Italy, August 2021, Virtual On-line.
14. M. Rodriguez, S. Bryngelson, T. Colonius, Acoustically-induced bubble growth and phase change dynamics near compliant surfaces, 11^{th} International Symposium on Cavitation (CAV 2021), Virtual On-line.
13. M. Rodriguez, T. Colonius, Acoustically growing cavitating bubble with phase transition near a rigid wall, APS 73rd Annual Meeting Division of Fluid Dynamics Virtual conference, November 2020.
12. M. Rodriguez, T. Colonius, Numerical simulations of a cavitating bubble with phase transition near an object, APS 72nd Annual Meeting Division of Fluid Dynamics, Seattle, Washington, November 2019.
11. M. Rodriguez, S. A. Beig, E. Johnsen, and Z. Xu, High-fidelity Numerical Simulations of Collapsing Cavitation Bubbles Near Solid and Elastically Deformable Objects, Blue Waters Symposium, Sunriver, Oregon, June 2019.
10. M. Rodriguez, E. Johnsen, Collapse of a Bubble Near a Viscoelastic Object, 16th Pan-American Congress of Applied Mechanics, Ann Arbor, Michigan, May 2019.
9. M. Rodriguez, S. A. Beig, E. Johnsen, and C. Barbier, Rayleigh Collapse of a Bubble in a Channel, APS 71st Annual Meeting Division of Fluid Dynamics, Atlanta, Georgia, November 2018.
8. M. Rodriguez and E. Johnsen, Simulations of Rayleigh Bubble Collapse Near a Soft Object, 13th World Congress of Computational Mechanics (WCCM) 2018. New York City, New York, July 2018.
7. M. Rodriguez, S. A. Beig, E. Johnsen, and C. Barbier, The Role of Confinement in Bubble Collapse in a Channel, APS 70th Annual Meeting Division of Fluid Dynamics, Denver, Colorado, November 2017.
6. M. Rodriguez and E. Johnsen, Simulations of Shock-induced Bubble Collapse near Hard and Soft Objects, APS 69th Annual Meeting Division of Fluid Dynamics, Portland, Oregon, November 2016.
5. M. Rodriguez and E. Johnsen, Non-spherical Bubble Collapse Dynamics in Viscoelastic Media, XXIV International Congress of Theoretical and Applied Mechanics, Montreal, Canada, August 2016.
4. M. Rodriguez and E. Johnsen, Simulations of Non-spherical Bubble Collapse Dynamics in Viscous and Viscoelastic Media Near a Compliant Object, APS 68th Annual Meeting Division of Fluid Dynamics, Boston, Massachusetts, November 2015.

3. M. Rodriguez and E. Johnsen, Simulations of Bubble Collapse in Viscous and Viscoelastic Media near a Second Viscoelastic Medium, APS 67th Annual Meeting Division of Fluid Dynamics, San Francisco, California, November 2014.
2. M. Rodriguez and E. Johnsen, Shock Waves in Viscoelastic Media, 17th U.S. National Congress on Theoretical and Applied Mechanics, Michigan State University, Lansing, Michigan, June 2014.
1. M. Rodriguez and E. Johnsen, Simulations of Shock Propagation in Viscoelastic Media, American Physical Society (APS) 66th Annual Meeting Division of Fluid Dynamics, Pittsburgh, Pennsylvania, November 2013.

Research awards

Research investigations

4. DoD DEPSCoR Grant FOA-AFRL-AFOSR-2022-0006
   Role: Lead PI
   Collaborators: Prof. David Henann
   Title: Theoretical modeling of non-spherical inertial cavitation for anisotropic soft matter rheometry
   Submission: February 2023
   Budget awarded: $600,000.
3. NSF CMMI MoMs PD 19-1630
   Role: Co-PI
   Collaborators: Jon Estrada, lead PI (U-M), and Jin Yang, co-PI (UT-Austin)
   Title: Collaborative Research: Mutually-informed experiments and modeling for spatial, finite, and fast rheometry of graded hydrogels using inertial cavitation
   Submission: Early June 2022
   Budget awarded: $350,456.
2. Hazeltine Innovation Award
   Role: Lead PI
   Collaborators: Lucas Caretta, Banu Ozkazanc-Pan
   Title: nuSTEM - A scalable American career workforce development program to develop Brown graduate and postdoctoral scholars and attract diverse faculty talent
   Submission: May 1, 2023
   Budget awarded: $48,000
1. Hazeltine Innovation Award
   Role: Co-PI
   Collaborators: Roberto Zenit, Thomas Powers
   Title: The flow of cerebrospinal fluid in the glymphatic system
   Submission: May 1, 2023
   Budget awarded: $77,400

Computational allocations

5. 2018 National Science Foundation (NSF) Extreme Science and Engineering Discovery Environment (XSEDE) computation renewal (Co-PI)
   Name: Numerical Simulations of Shock Waves, Interfacial Instabilities, and Compressible Turbulence
   Equivalent amount: $42,141.47
4. 2018 NSF Blue Waters Great Lakes Consortium for Petascale Computation allocation (Co-PI)
   Name: Inertial Collapse of Individual Bubbles near Solid/Free Boundaries
   Amount: 350,000 node-hours

3. 2018 NSF Blue Waters Broadening Participation Computational allocation (Co-PI)
   Name: Numerical Simulations of a Collapsing Cavitation Bubble near an Elastically Deformable Object
   Amount: 300,000 node-hours
2. 2017 NSF XSEDE computational renewal (Co-PI)
   Name: Numerical Simulations of Shock Waves, Interfacial Instabilities, and Compressible Turbulence
   Amount: $204,685.40
1. 2017 NSF Blue Waters Great Lakes Consortium for Petascale Computation allocation (Co-PI)
   Name: Numerical Simulations of Collapsing Bubbles near Rigid and Compliant Surfaces
   Amount: 880,000 node-hours

Teaching & Advising

Research Adviser

PhD Student: Sawyer Remillard, Fluid & Thermal Sciences, started 2023

Research Mentor

Program: The Leadership Alliance, 06-08/2022
Student: Katherine Alcazar (Arizona State University)
Project: Ultrasound-Induced Microbubble Perturbations in a Non-Newtonian Fluid

Student: Morgan Jones (Howard University)
Project: Theoretical microbubble growth dynamics from a liquid-solid interface

Student: Sira Morales (University of Puerto Rico)
Project: A numerical model of coupled arterial blood flow and cerebrospinal fluid transport

Program: Brown's Undergraduate Teaching and Research Awards (UTRA)
Student: Lana Yang-Maccini (Engineering), Summer 2023
Project: Data-driven simulations for potential flow modeling of non-spherical bubble collapses

Student: Stephanie Samaha (Engineering), Summer 2023
Project: On the fluid dynamics of cerebrospinal fluid flow

Student: Alexey Izmailov (Applied math), Spring and Summer 2022
Project: A comprehensive inertial microcavitation bubble dynamics solver for soft tissue characterization

Student: Matthew Meeker (Applied math), Spring and Summer 2022
Project: A comprehensive inertial microcavitation bubble dynamics solver for soft tissue characterization

Student: Sudatta Hor (Computer science), Spring and Summer 2022
Project: Microbubble surface oscillations for targeted drug delivery

Student: Hanna Stein (Applied math), Spring 2022
Project: Numerically simulating thin-film rupture and merger in slow motion

Instructor

Brown University, Providence, Rhode Island
School of Engineering – Fluid and Thermal Sciences
Course 1: ENGN 1840 Numerical Methods for Engineers, Spring 2022, Spring 2023
Course 2: ENGN 2830 Compressible Fluid Dynamics, Fall 2023

University of Michigan, Ann Arbor, Michigan

College of Engineering – Mechanical Engineering Department
Position: Graduate Student Instructor–Introduction to Fluids Mechanics, 01/2017-04/2017

Service

Reviewer

Grants: National Science Foundation 2022 Fluids Dynamics Panel Reviewer

Journals: Journal of Fluid Mechanics, Journal of Computational Physics, Physical Review Fluids, Physical Review E, Physical Review Applied, Ultrasonics - Sonochemistry, Physics in Medicine and Biology, Physics of Fluids, Fluids

Conference:

(a) American Physical Society (APS) Division of Fluid Dynamics (DFD)
   i. Session chair, 2019-2022
   ii. Faces of Fluids panelist, 2021
   iii. Underrepresented Minorities Breakfast panelist, poster session judge, 2022

(b) American Society of Mechanical Engineers (ASME)
   i. Multiphase Flow Technical Committee member

Committees

Brown University - School of Engineering
Honors Committee member (2022), co-chair (2023)
Selection Committee member for Brown's Postdoctoral Excellence Awards

California Institute of Technology - Division of Engineering and Applied Science (2021)
Diversity, equity, and Inclusion (DE&I) Initiative - postdoctoral scholar member

University of Michigan - College of Engineering (2020)
Diversity, equity, and Inclusion (DE&I) Initiative - graduate strategy subcommittee member

External – Society of Hispanic Professional Engineers (SHPE)

Leadership & **Conference Chair** Held 20+ positions, select positions below

9. National Chapter Program Lead Developer, 06/2019-Present
8. National Report Program Lead Developer, 06/2011-2019
7. National Affairs Committee Member, 06/2011-06/2018
6. National Graduate Committee Co-Chair, 06/2011-08/2016
5. National Institute for Leadership Advancement (NILA) Curriculum Chair, 2018-2020
4. Deans' Summit organizer, 2015 National SHPE Conference, 03/2015-11/2015
3. Academic Programs Co-Chair, 2015 National SHPE Conference, 03/2015-11/2015
2. Graduate Programs Co-Chair, 2015 National SHPE Conference, 03/2015-11/2015
1. Pre-College Symposium Outreach Chair, 2014 National SHPE Conference, 02/2014-11/2014

Invited Speaker Selected lectures provided below, given +25 invited talks, full list available upon request

6. Rodriguez, M., Selecting the Best Graduate Program – Masters vs Doctoral, SHPE National Virtual Convention, August 2020.
5. Rodriguez, M., Towards the the post-graduation success of first-generation college students, (*presented in Spanish to parents*), SHPE National Convention, Phoenix, Arizona, August 2019.
4. Rodriguez, M., Securing a Postdoctoral Fellowship after Successfully Completing Your Graduate Degree, SHPE National Convention, Phoenix, Arizona, August 2019.
3. Rodriguez, M., How to Be a Servant Leader, National Institute for Leadership Advancement, Albuquerque, New Mexico, August 2017.
2. Rodriguez, M., Post-undergraduate Success for the LatinX STEM Community, SHPE National Conference, Seattle, Washington, November 2016.
1. Rodriguez, M., State of the LatinX Community in STEM, SHPE Conference - Deans' Summit, Seattle, Washington, November 2016.

Financial awards & Honors

Selected awards provided below, received +20 honors, full list available upon request

10. Brown Harriet W. Sheridan Center for Teaching and Learning - Reflective Teaching Seminar, Fall 2021
9. Caltech & Claremont Graduate University Leader Development Coaching Program Completion, 2020
8. NSF Alliances for Graduate Education and the Professoriate (AGEP) Postdoctoral Fellowship, 2019
7. Ford Foundation Postdoctoral Fellowship, 2019
6. Ford Foundation Dissertation Writing Fellowship, 2017
5. Edward A. Bouchet Graduate Honor Society Member, 2015
4. Society of Hispanic Professional Engineer's National Paper Competition Finalist, 2013
3. Rackham Graduate Engineering Fellowship Award, University of Michigan, 2012
2. National Science Foundation Graduate Research Fellowship Honorable Mention, Stanford, 2011
1. Stanford's Mechanical Engineering Graduate Engineering Fellowship Award, 2010

Organization Memberships

American Society of Engineering Education (ASEE), since 2015

American Physical Society (APS), since 2013

Edward A. Bouchet Graduate Honor Society, since 2015

Society for Advancing Hispanics/Chicanos and Native Americans in Science (SACNAS), since 2009

Society for Industrial and Applied Mathematics (SIAM), since 2015

Society of Hispanic Professional Engineers (SHPE), since 2006, lifetime member