Last updated: February 21st, 2024

Christopher M. Boyce

Columbia University
The Fu Foundation School of Engineering and Applied Science
Department of Chemical Engineering

A. Field of Specialization

Academic Specialization: Chemical Engineering
Research Specialization: Multiphase Flows, Granular Flows

B. Education

- B.S., Massachusetts Institute of Technology, Chemical Engineering and Physics, 2011
- Ph.D., University of Cambridge, Chemical Engineering, 2015

Dissertation: "Fundamental Studies of the Physics of Gas-Solid Fluidization"
Sponsor: Dr. John Dennis

C. Positions Held Since Bachelor's Degree was Conferred

- Associate Professor of Chemical Engineering, Columbia University. (Jan. 2023-Present)
- Assistant Professor of Chemical Engineering, Columbia University. (Jan. 2018-Dec. 2022)
- Postdoctoral Researcher, ETH Zurich. (Jan. 2017-Dec. 2017)
- Postdoctoral Researcher, Princeton University. (Jan. 2015-Dec. 2016)
- Graduate Research Assistant, University of Cambridge. (Sept. 2011-Dec. 2014)

D. Honors, Prizes and Fellowships

- Invited Visiting Professorship, Federal University of Rio de Janeiro, Brazil, January 2024
- ONR Young Investigator Award, 2023
- NSF CAREER Award, 2022
- Published an Invited Paper in the "Futures" Issue of AIChE Journal for Future Leaders in Chemical Engineering, 2022
- Article Selected as Cover Article for Industrial and Engineering Chemistry Research, 2021
- Article Selected as Cover Article for Chemical Engineering Science, 2021
- Provost's Grants Program Award for Junior Faculty Who Contribute to the Diversity Goals of the University, Columbia University, 2021
- Janette and Armen Avanessians Diversity Award, Columbia University SEAS, 2021
- Sabic Young Professional Award from the AIChE Particle Technology Forum for Outstanding Contributions to Particle Technology from an Individual Under 40, 2019
- Article Selected as Cover Article for Chemical Engineering Science, 2019
- Forbes 30 Under 30 in Science, 2019
- Published an Invited Paper in the "Futures" Issue of AIChE Journal for Future Leaders in Chemical Engineering, 2018

- Published an Invited Paper for the Best Presentation in Session at the World Congress on Particle Technology 8, 2018
- Danckwerts-Pergamon Prize for the Best PhD Thesis Related to Chemical Engineering, University of Cambridge, 2015
- Gates Cambridge Scholar, 2011-2014
- 2nd Prize, Third Year Presentation, Department of Chemical Engineering and Biotechnology, University of Cambridge, 2014
- 1st Prize, Second Year Poster Presentation, Department of Chemical Engineering and Biotechnology, University of Cambridge, 2013
- Phi Beta Kappa Academic Honor Society, MIT, 2011
- Sigma Pi Sigma Physics Honor Society, MIT, 2011
- Tau Beta Pi Engineering Honor Society, MIT, 2010

E. Grants and Contracts

Title: Designing and Characterizing Hydrogen-Producing Reactors for Naval Purposes
Lead PI: Chris Boyce
Co-PI: Dan Esposito
Source: Office of Naval Research
Period of Performance: 02/01/2024-01/31/2025

Title: Microfluidic Preparation of Specimens to Enable Submillisecond Time-Resolved Cryo-EM
Lead PI: Qiao Lin
Co-PIs: Chris Boyce, Oliver Clarke, Joachim Frank, Andrew Marks
Source: National Institutes of Health
Period of Performance: 9/22/2023-8/31/2027

Title: Assessment of a Collaboration between Tuskegee University and Columbia University
Lead PIs: Chris Boyce and Shahryar Jafarinejad
Source: Genentech
Period of Performance: 5/1/2023-4/30/2024

Title: Controllable Segregation of Granular Particles for Powering Undersea Vehicles
Lead PI: Chris Boyce
Source: Office of Naval Research
Period of Performance: 11/2022-10-2025

Title: CAREER: Magnetic Resonance Imaging of Periodically Structured Bubbling Phenomena in Dense Suspensions and Fluidized Granular Materials
Lead PI: Chris Boyce
Source: National Science Foundation
Period of Performance: 7/2022-6/2027

Title: REU Site: ChemE-NYC: Climate and Health Solutions
Lead PI: Chris Boyce
Source: National Science Foundation
Period of Performance: 4/2022-3/2025

Title: Magnetic Resonance Imaging of Filtration
Lead PI: Chris Boyce
Co-PI: Jia Guo
Source: Pall Corporation
Period of Performance: 04/2022-04/2024

Title: Particle segregation and forces on internal pipes in model particle-liquid-gas multiphase reactors
Lead PI: Chris Boyce
Source: Office of Naval Research
Period of Performance: 1/2022-12/2024

Title: Collaboration between Tuskegee University and Columbia University
Lead PIs: Chris Boyce, Mandar Kathe
Source: Sloan Foundation
Period of Performance: 12/2021-11/2023

Title: Magnetic Resonance Imaging of Flow within Model Gas-Turbines
Lead PI: Chris Boyce
Source: US Army
Prime Applicant: Chris Boyce; no subawards
Period of Performance: 8/2022-11/2022

Title: Sustainable Mining via Novel Separation of Granular Particles
Lead PIs: Chris Boyce, D.R. Nagaraj, Ray Farinato
Source: Columbia University
Period of Performance: 09/2021-08/2023

Title: Summer Research Experience in Chemical Engineering at Columbia University for Underrepresented Minority Undergraduates from Tuskegee University: Multiphase Flows
Lead PI: Chris Boyce
Source: Columbia University
Period of Performance: 05/2021-08/2021

Title: Magnetic Resonance Imaging of Filtration
Lead PI: Chris Boyce
Co-PI: Jia Guo
Source: Pall Corporation
Period of Performance: 01/2020-12/2021

Title: Magnetic Resonance Imaging and Modeling of Gas and Particle Flow in Fluidized Beds
Lead PI: Chris Boyce
Source: National Science Foundation
Period of Performance: 11/2020-10/2023

Title: Take a look inside – Magnetic Resonance Imaging of magma analogues to study volcanic eruptions
Lead PIs: Chris Boyce and Einat Lev
Source: Columbia University
Period of Performance: 09/2020-08/2022

F. Publications

Publication Statistics (Retrieved from Chris Boyce's Google Scholar Page 1/15/2024):

Publications: 53 total, 40 corresponding author, 18 last author
Total citations: 1617
h-index: 23
i10-index: 39

Peer-Reviewed Journal Publications:

Note on Authorship Convention in the Field: The first author is typically a student or postdoctoral researcher who conducted the most experimental, theoretical or numerical work for the paper. The last author is typically the senior researcher primarily advising the research.

Note: Names of students and postdoctoral researchers from the candidate's group are underlined. The candidate's name is **bolded**. Corresponding author is marked with *.

#	Title
53)	Guo, Q.; Spitler, C.; Sanghishetty, J. M.; **Boyce, C. M.*** Advances in vibrated gas-fluidized beds. *Curr. Opin. Chem. Eng.* **2023**, 42, 100977. Link
52)	Bordbar, A.; Benders, S.; Zia, W.; Penn, A.; **Boyce, C. M.*** Computer Simulation of Magnetic Resonance Imaging of the Flow of Fluidized Particles. *Ind. Eng. Chem. Res.* **2023**, 62, 11677–11688. Link
51)	Guo, Q.; Wu, R.; Da, W.; Y. Zhang; J. Wei; **Boyce, C. M.*** Faraday Wave Instability Analog in Vibrated Gas-Fluidized Granular Particles. *Phys. Rev. E* **2023**, 107, 034603. Link
50)	Birnbaum, J.; Zia, W.; Bordbar, A.; Lee, R. F.; **Boyce, C. M.***; Lev, E.* Magnetic Resonance Imaging of Multi-Phase Lava Flow Analogs: Velocity and Rheology. *Journal of Geophysical Research: Solid Earth* **2023**, 128, e2023JB026464. Link
49)	Guo, Q.; Wu, R.; Da, W.; **Boyce, C. M.*** Heat transfer within dynamically structured bubbling fluidized beds subject to vibration: A two-fluid modeling study. *AIChE J.* **2023**, e17970. Link

48) Guo, Q.; Zhang, Y.; Kovar, T. M.; Xi, K.; **Boyce, C. M.*** A Rayleigh-Bénard Convection Instability Analog in Vibrated Gas-Fluidized Granular Particles. *Soft Matter* **2022**, *18*, 3323-3327. Link

47) Guo, Q.; Zhang, Y.; Vazquez, C.; Xi, K.; **Boyce, C. M.*** Multi-Fluid Model Simulations of Gravitational Instabilities in Fluidized Binary Granular Materials. *AIChE J.* **2022**, e17714. Link

46) Guo, Q.; **Boyce, C. M.*** Structured Bubbling in Layered Gas-Fluidized Beds Subject to Vibration: A CFD-DEM Study. *AIChE J.* **2022**, e17709. Link

45) Metzger, J. P.; McLaren, C. P.; Pinzello, S.; Conzelmann, N. A.; **Boyce, C. M.;** Müller, C. R.* Sinking Dynamics and Splitting of a Granular Droplet. *Phys. Rev. Fluids* **2022**, *7* (1), 014309. Link

44) Padash, A.; Chen, B.; **Boyce, C. M.*** Characterizing Alternating Bubbles Emerging from Two Interacting Vertical Gas Jets in a Liquid. *Chem. Eng. Sci.* **2022**, 117199. Link

43) Guo, Q.; Zhang, Y.; Padash, A.; Xi, K.; Kovar, T. M.; **Boyce, C. M.*** Dynamically Structured Bubbling in Vibrated Gas-Fluidized Granular Materials. *Proc. Natl. Acad. Sci.* **2021**, *118* (35). Link (Featured in *Scientific American*)

42) Guo, Q.; Bordbar, A.; Ma, L.; Yu, Y.; Xu, S.; **Boyce, C. M.***; Ye, M.* A CFD-DEM Study of the Solid-like and Fluid-like States in the Homogeneous Fluidization Regime of Geldart A Particles. *AIChE J.* **2021**, e17420. Link

41) Xi, K.; Guo, Q.; **Boyce, C. M.**; Lu, Y.* Contact-Based Method to Evaluate Mixing in Multicomponent Experiments and Simulations. *Ind. Eng. Chem. Res.* **2021**, *60* (44), 16126–16142. Link

40) Xi, K.; Guo, Q.; **Boyce, C. M.*** Comparison of CFD-DEM and TFM Simulations of Single Bubble Injection in 3D Gas-Fluidized Beds with MRI Results. *Chem. Eng. Sci.* **2021**, *243*, 116738. Link

39) Xi, K.; Kovar, T.; Fullmer, W. D.; Penn, A.; Musser, J.; **Boyce, C. M.*** CFD-DEM Study of Bubble Properties in a Cylindrical Fluidized Bed of Geldart Group D Particles and Comparison with Prior MRI Data. *Powder Technol.* **2021**, *389*, 75–84. Link

38) Xi, K.; Guo, Q.; **Boyce, C. M.*** Comparison of Two-Fluid Model Simulations of Freely Bubbling Three-Dimensional Gas-Fluidized Beds with Magnetic Resonance Imaging Results. *Ind. Eng. Chem. Res.* **2021**, 60 (19), 7429–7442. Link (Journal Cover Image)

37) McLaren, C. P.; Metzger, J. P.; **Boyce, C. M.***; Müller, C. R.* Reduction in Minimum Fluidization Velocity and Minimum Bubbling Velocity in Gas-Solid Fluidized Beds Due to Vibration. *Powder Technol.* **2021**, *382*, 566–572. Link

36) Guo, Q.; Padash, A.; **Boyce, C. M.*** A Two Fluid Modeling Study of Bubble Collapse Due to Bubble Interaction in a Fluidized Bed. *Chem. Eng. Sci.* **2021**, *232*, 116377. Link (Journal Cover Image)

35) Lev, E.*; **Boyce, C. M.*** Opportunities for Characterizing Geological Flows Using Magnetic Resonance Imaging. *iScience* **2020**, *23* (9). Link

34) Penn, A.; Padash, A.; Lehnert, M.; Pruessmann, K. P.; Müller, C. R.*; **Boyce, C. M.*** Asynchronous Bubble Pinch-off Pattern Arising in Fluidized Beds Due to Jet Interaction: A Magnetic Resonance Imaging and Computational Modeling Study. *Phys. Rev. Fluids* **2020**, *5* (9), 094303. Link

33) Padash, A.; **Boyce, C. M.*** Collapse of a Bubble Injected Side-by-Side with Another Bubble into an Incipiently Fluidized Bed: A CFD-DEM Study. *Phys. Rev. Fluids* **2020**, *5* (3), 034304. Link

32) Penn, A.*; **Boyce, C. M.**; Pruessmann, K. P.; Müller, C. R. Regimes of Jetting and Bubbling in a Fluidized Bed Studied Using Real-Time Magnetic Resonance Imaging. *Chem. Eng. J.* **2020**, 123185. Link

31) McLaren, C. P.; Kovar, T. M.; Penn, A.; Müller, C. R.*; **Boyce, C. M.*** Gravitational Instabilities in Binary Granular Materials. *Proc. Natl. Acad. Sci.* **2019**, 201820820. Link (Featured in *Gizmodo* and *Popular Mechanics*)

30) **Boyce, C. M.***; Penn, A.; Lehnert, M.; Pruessmann, K. P.; Müller, C. R. Characteristics of a Single Jet Injected into an Incipiently Fluidized Bed: A Magnetic Resonance Imaging Study. *Adv. Powder Technol.* **2019**. Link

29) **Boyce, C.M.***; Penn, A.; Lehnert, M.; Pruessmann, K.P.; Müller, C. R. Magnetic Resonance Imaging of Interaction and Coalescence of Two Bubbles Injected Consecutively into an Incipiently Fluidized Bed. *Chem. Eng. Sci.* **2019**, 115152. Link

28) **Boyce, C. M.***; Penn, A.; Padash, A.; Lehnert, M.; Pruessmann, K. P.; Müller, C. R. Anomalous Collapse of Interacting Bubbles in a Fluidized Bed: A Magnetic Resonance Imaging Study. *Phys. Rev. Fluids* **2019**, *4*, 034303. Link

27) **Boyce, C. M.***; Penn, A.; Lehnert, M.; Pruessmann, K. P.; Müller, C. R. Magnetic Resonance Imaging of Single Bubbles Injected into Incipiently Fluidized Beds. *Chem. Eng. Sci.* **2019**, *200*, 147–166. Link

26) **Boyce, C. M.***; Penn, A.; Lehnert, M.; Pruessmann, K. P.; Müller, C. R. Wake Volume of Injected Bubbles in Fluidized Beds: A Magnetic Resonance Imaging Velocimetry Study. *Powder Technol.* **2019**. (Invited). Link

25) Penn, A.*; **Boyce, C. M.**; Conzelmann, N.; Bezinge, G.; Pruessmann, K. P.; Müller, C. R.* Real-Time Magnetic Resonance Imaging of Fluidized Beds with Internals. *Chem. Eng. Sci.* **2019**, *198*, 117–123. Link (Journal Cover Image)

24) **Boyce, C. M.***; Penn, A.; Lehnert, M.; Pruessmann, K. P.; Müller, C. R. Effect of Liquid Bridging on Bubbles Injected into a Fluidized Bed: A Magnetic Resonance Imaging Study. *Powder Technol.* **2019**, *343*, 813–820. Link

23) **Boyce, C. M.*** Gas-Solid Fluidization with Liquid Bridging: A Review from a Modeling Perspective. *Powder Technol.* **2018**, *336*, 12–29. Link

22) Penn, A.*; **Boyce, C. M.***; Kovar, T.; Tsuji, T.; Pruessmann, K. P.; Müller, C. R. * Real-Time Magnetic Resonance Imaging of Bubble Behavior and Particle Velocity in Fluidized Beds. *Ind. Eng. Chem. Res.* **2018**, *57* (29), 9674–9682 (Invited). Link

21) **Boyce, C. M.***; Penn, A.; Pruessmann, K. P.; Müller, C. R. Magnetic Resonance Imaging of Gas–Solid Fluidization with Liquid Bridging. *AIChE J.* **2018**, *64* (8), 2958–2971 (Invited). Link

20) Penn, A.; Tsuji, T.; Brunner, D. O.; **Boyce, C. M.**; Pruessmann, K. P.; Müller, C. R. * Real-Time Probing of Granular Dynamics with Magnetic Resonance. *Science Advances* **2017**, *3* (9), e1701879. Link

19) Kolehmainen, J.*; Sippola, P.; Raitanen, O.; Ozel, A.; **Boyce, C. M**.; Saarenrinne, P.; Sundaresan, S. Effect of Humidity on Triboelectric Charging in a Vertically Vibrated Granular Bed: Experiments and Modeling. *Chem. Eng. Sci.* **2017**, *173*, 363–373. Link

18) **Boyce, C. M.***; Ozel, A.; Kolehmainen, J.; Sundaresan, S.; McKnight, C. A.; Wormsbecker, M. Growth and Breakup of a Wet Agglomerate in a Dry Gas–solid Fluidized Bed. *AIChE J.* **2017**, *63* (7), 2520–2527. Link

17) **Boyce, C. M.***; Ozel, A.; Kolehmainen, J.; Sundaresan, S. Analysis of the Effect of Small Amounts of Liquid on Gas–Solid Fluidization Using CFD-DEM Simulations. *AIChE J.* **2017**, *63* (12), 5290–5302. Link

16) **Boyce, C. M.***; Ozel, A.; Rice, N. P.; Rubinstein, G. J.; Holland, D. J.; Sundaresan, S. Effective Particle Diameters for Simulating Fluidization of Non-Spherical Particles: CFD-DEM Models vs. MRI Measurements. *AIChE J.* **2017**, *63* (7), 2555–2568. Link

15) Kolehmainen, J.*; Ozel, A.; **Boyce, C. M.**; Sundaresan, S. Triboelectric Charging of Monodisperse Particles in Fluidized Beds. *AIChE J.* **2017**, *63* (6), 1872–1891. Link

14) **Boyce, C. M.***; Rice, N. P.; Ozel, A.; Davidson, J. F.; Sederman, A. J.; Gladden, L. F.; Sundaresan, S.; Dennis, J. S.; Holland, D. J. Magnetic Resonance Characterization of Coupled Gas and Particle Dynamics in a Bubbling Fluidized Bed. *Phys. Rev. Fluids* **2016**, *1* (7), 74201. Link

13) **Boyce, C. M.***; Ozel, A.; Sundaresan, S. Intrusion of a Liquid Droplet into a Powder under Gravity. *Langmuir* **2016**, *32* (34), 8631. Link

12) Kolehmainen, J.*; Ozel, A.; **Boyce, C. M.**; Sundaresan, S. A Hybrid Approach to Computing Electrostatic Forces in Fluidized Beds of Charged Particles. *AIChE J.* **2016**, *62* (7), 2282. Link

11) **Boyce, C. M.***; Rice, N. P.; Davidson, J. F.; Sederman, A. J.; Dennis, J. S.; Holland, D. J. Magnetic Resonance Imaging of Gas Dynamics in the Freeboard of Fixed Beds and Bubbling Fluidized Beds. *Chem. Eng. Sci.* **2016**, *147*, 13. Link

10) **Boyce, C. M.***; Rice, N. P.; Sederman, A. J.; Dennis, J. S.; Holland, D. J. 11-Interval PFG Pulse Sequence for Improved Measurement of Fast Velocities of Fluids with High Diffusivity in Systems with Short T2∗. *J. Magn. Reson.* **2016**, *265*, 67. Link

9) Lu, X.; **Boyce, C. M.**; Scott, S. A.; Dennis, J. S.; Holland, D. J.* Investigation of Two-Fluid Models of Fluidisation Using Magnetic Resonance and Discrete Element Simulations. *Procedia Eng.* **2015**, *102*, 1436. Link

8) **Boyce, C. M.***; Holland, D. J.; Scott, S. A.; Dennis, J. S. Limitations on Fluid Grid Sizing for Using Volume-Averaged Fluid Equations in Discrete Element Models of Fluidized Beds. *Ind. Eng. Chem. Res.* **2015**, *54* (43), 10684. Link

7) Pore, M.; Ong, G. H.; **Boyce, C. M.**; Materazzi, M.; Gargiuli, J.; Leadbeater, T.; Sederman, A. J.; Dennis, J. S.*; Holland, D. J.; Ingram, A.; et al. A Comparison of Magnetic Resonance, X-Ray and Positron Emission Particle Tracking Measurements of a Single Jet of Gas Entering a Bed of Particles. *Chem. Eng. Sci.* **2015**, *122*, 210. Link

6) **Boyce, C. M.***; Davidson, J. F.; Holland, D. J.; Scott, S. A.; Dennis, J. S. The Origin of Pressure Oscillations in Slugging Fluidized Beds: Comparison of Experimental Results from Magnetic Resonance Imaging with a Discrete Element Model. *Chem. Eng. Sci.* **2014**, *116*, 611. Link

5) **Boyce, C. M.***; Holland, D. J.; Scott, S. A.; Dennis, J. S. Novel Fluid Grid and Voidage Calculation Techniques for a Discrete Element Model of a 3D Cylindrical Fluidized Bed. *Comput. Chem. Eng.* **2014**, *65*, 18. Link

4) Harper, R. N.; **Boyce, C. M.**; Scott, S. A.* Oxygen Carrier Dispersion in Inert Packed Beds to Improve Performance in Chemical Looping Combustion. *Chem. Eng. J.* **2013**, *234*, 464. Link

3) **Boyce, C. M.***; Holland, D. J.; Scott, S. A.; Dennis, J. S. Adapting Data Processing To Compare Model and Experiment Accurately: A Discrete Element Model and Magnetic Resonance Measurements of a 3D Cylindrical Fluidized Bed. *Ind. Eng. Chem. Res.* **2013**, *52* (50), 18085. Link

2) Taylor, R. E.; **Boyce, C. M.**; Boyce, M. C.; Pruitt, B. L.* Planar Patterned Stretchable Electrode Arrays Based on Flexible Printed Circuits. *J. Micromechanics Microengineering* **2013**, *23* (10), 105004. Link

1) Barr, M. C.; Rowehl, J. A.; Lunt, R. R.; Xu, J.; Wang, A.; **Boyce, C. M.**; Im, S. G.; Bulović, V.*; Gleason, K. K.* Direct Monolithic Integration of Organic Photovoltaic Circuits on Unmodified Paper. *Adv. Mater.* **2011**, *23* (31), 3500. Link

G. Patents

#	Title

3) **Boyce, C.M.**, Socrate, S., Greviskes, B.P., Boyce, M.C. "Structured materials with tailored isotropic and anisotropic poisson's ratios including zero and negative poisson's ratios" (Application 2011, full patent not pursued)

2) Taylor, R.E., Pruitt, B.L., Boyce, M.C., **Boyce, C.M.**, "In-plane-strain-actuated out-of-plane actuator", U.S. Utility Patent 10150665 (Application 2014, Granted 2018).

1) Boyce, M.C., Socrate, S., **Boyce, C.M.** and Greviskes, B., "Structured material substrates for flexible, stretchable electronics", U.S. Utility Patent 8,883,287 (Application 2010, Granted 2014).

H. Teaching Experience

Courses Taught
CHEN E3110, Transport Phenomena I (Undergraduate Core) (2018-2021)
CHEN E3110, Principles of Transport Phenomena (Undergraduate Core) (2022-Present)
CHEN E4150, Computational Fluid Dynamics in Chemical Engineering (Graduate Elective) (2018-Present)
CHEN E9000, Chemical Engineering Colloquium (PhD Core) (2020-2021)
CHEN E9500, Doctoral Research (PhD Core) (2018-Present)
CHEN E9400, Master's Research (Master's Elective) (2018-Present)
CHEN E3900, Undergraduate Research Project (Undergraduate Elective) (2018-Present)

Course Development:

- Developed CHEN E4150, Computational Fluid Dynamics in Chemical Engineering from scratch, 2018.
- Incorporated in-class, collaborative problem solving sessions for full class periods into the curriculum of CHEN E3110, Transport Phenomena I, 2020.
- Developed a new CHEN E3110, Principles of Transport Phenomena, incorporating fluid mechanics, heat and mass transport into one course, 2022.

Experience as a Thesis Sponsor and Committee Member for Student Research

Doctoral Students (Sponsored):

1. **Azin Padash** (Sept. 2018-Nov. 2021; Current Position: Healthcare Consultant at Guidehouse)
   Thesis Title: *Bubble Rise Dynamics in Complex Fluids*
   Publications: 7 total; 3 first-author
2. **Jagan Mohan Sanghishetty** (Sept. 2019-Present)
   Thesis Area: *Granular Separations for Sustainable Mining using Vibrated Gas-Fluidized Beds*
3. **Alireza Bordbar** (Jan. 2020-Present)
   Thesis Area: *Magnetic Resonance Imaging of the Flow of Granular Suspensions*
   Publications: 1 total; 1 first-author
4. **Christopher Spitler** (Jan. 2022-Present)
   Thesis Area: *Controlling Wetted Granular Flows for Aluminum-Water Reactors*
5. **Javad Omidi** (Jan. 2022-Present)
   Thesis Area: *Characterizing Periodically Repeating Flow Patterns in Complex Fluids*

Doctoral Students (Reader and Committee Member):

1. Chen Yong, ETH Zurich, Mechanical and Process Engineering, 2017
2. Jonathan Davis, Columbia University, Chemical Engineering, 2019
3. Richa Batra, Columbia University, Mechanical Engineering, 2019
4. Christopher McLaren, ETH Zurich, Mechanical and Process Engineering, 2022
5. Jamie Robinson, University of Canterbury (NZ), Chemical Engineering, 2022
6. Philipp Riechmann, EPFL, Chemical Engineering, 2022
7. Kiran Dhatt-Gauthier, Columbia University, Chemical Engineering, 2022
8. Xueqi Pang, Columbia University, Chemical Engineering, 2022
9. Zhengyan Zhang, Columbia University, Chemical Engineering, 2023
10. Daniela Fraga, Columbia University, Chemical Engineering, 2023

Undergraduate Students (Sponsored Senior Thesis):

1. Carolina Vazquez (2021, Pursuing a Master's at University of Michigan)
   Co-author on 1 publication
2. Yuxuan Zhang (2022, Pursuing a Master's at EPFL)
   Co-author on 3 publications
3. Shawn Chiu (2022, Pursuing a PhD at UCLA)
   Co-author on 1 publication
4. Lisa Tian (2023, Pursuing a PhD at UCLA)

5. Boyuan Chen (2023, Pursuing a PhD at Caltech)
   Co-author on 1 publication

Postdoctoral Researchers Advised:

1. **Qiang Guo** (Dec. 2019-Aug. 2023, Applying for faculty positions in Chemical Engineering)
   Publications: 11 total, 8 first author, more in preparation
2. **Wasif Zia** (Jul. 2020-Dec. 2022, Now an MRI Engineer at Nathan Klein Institute)
   Publications: 2 total
3. **Oscar Punch** (Jul. 2023-Present)

Postbaccalaureate Researchers Advised:

1. **Michael Jordan** (Sep. 2023-Present, recent alumnus from Tuskegee University, starting an MS program at Columbia in 2024)

I. Invited Talks

25) **Boyce, C.M.** (2024) "Structured Flow Instabilities in Granular Materials Subject to Combined Gas Flow and Vibration" *Invited Seminar at the Federal University of Rio de Janeiro.*
24) **Boyce, C.M.** (2023) "Structured Flow Instabilities in Excited Granular Materials and Applications to Powering Undersea Vehicles" *Invited Seminar for the Department of Defense Basic Research Forum*.
23) **Boyce, C.M.** (2023) "Structured Flow Instabilities in Vibrated Gas-Fluidized Beds" *Invited Keynote Presentation at the Fluidization XVII Conference*.
22) **Boyce, C.M.** (2023) "Structured Flow Instabilities in Granular Materials Subject to Combined Gas Flow and Vibration" *Invited Seminar at Caltech.*
21) **Boyce, C.M.** (2022) "Structured Flow Instabilities in Granular Materials Subject to Combined Gas Flow and Vibration" *Invited Seminar at the Chinese Academy of Sciences.*
20) **Boyce, C.M.** (2022) "Structured Flow Instabilities in Granular Materials Subject to Combined Gas Flow and Vibration" *Invited Seminar at Granular Matter Gordon Research Conference*.
19) **Boyce, C.M.** (2022) "Structured Flow Instabilities in Granular Materials Subject to Combined Gas Flow and Vibration" *Invited Seminar at the Federal University of Rio de Janeiro*.
18) **Boyce, C.M.** (2022) "Fluid or Not? Structured Instabilities in Excited Granular Flows" *Invited Seminar at the City College of New York*.
17) **Boyce, C.M.** (2021) "Structured Bubbly Flows in Particle-Laden Complex Fluids" *Invited Seminar at Rutgers University*.
16) **Boyce, C.M.** (2021) "Characterizing and Structuring Multiphase Granular Flows" *Invited Seminar at the University of Cambridge*.
15) **Boyce, C.M.** (2021) "Characterizing and Structuring Multiphase Granular Flows" *Invited Seminar at The Ohio State University*.
14) **Boyce, C.M.** (2021) "Characterizing and Structuring Multiphase Granular Flows" *Invited Seminar at New York University*.

13) **Boyce, C.M.** (2021) "Characterizing and Structuring Multiphase Granular Flows" *Invited Seminar at UC Davis*.
12) **Boyce, C.M.** (2020) "Characterizing and Structuring Multiphase Granular Flows" *Invited Seminar at Stevens Institute of Technology*.
11) **Boyce, C.M.** (2020) "Characterizing and Structuring Multiphase Granular Flows" *Invited Seminar at Columbia University*.
10) **Boyce, C.M.** (2020) "Magnetic Resonance Imaging and Optical Imaging of Multiphase Granular Flows" *Invited Seminar at Lamont-Doherty Earth Observatory.*
9) **Boyce, C.M.** (2020) "Gaseous Bubbles and Granular Bubbles in Fluidized Granular Particles" *Invited Seminar at Stony Brook University.*
8) **Boyce, C.M.** (2020) "Phenomena in Fluidized Granular Flows" *Invited Plenary Lecture at the 12th Northeast Complex Fluids and Soft Matter Conference*.
7) **Boyce, C.M.** (2019) "MRI, Optical Imaging and Computational Modeling of Fluidization Phenomena" *Invited Sabic Young Professional Award Lecture at the AIChE Annual Meeting.*
6) **Boyce, C.M.** (2019) "MRI and Computational Modeling of Multiphase Granular Flows" *Invited Seminar at the City College of New York*.
5) **Boyce, C.M.** (2019) "MRI and Computational Modeling of Multiphase Granular Flows" *Invited Seminar at the U.S. Naval Undersea Warfare Center*.
4) **Boyce, C.M.** (2019) "Magnetic Resonance Imaging of Multiphase Granular Flows" *Invited Seminar at TU Hamburg*.
3) **Boyce, C.M.** (2019) "Structures and Instabilities in Multiphase Granular Flows" *Invited Seminar at the Chinese Academy of Sciences*.
2) **Boyce, C.M.** (2018) "MRI and Computational Modeling of Multiphase Chemical Reactors" *Invited Seminar at ExxonMobil Chemical*.
1) **Boyce, C.M.** (2018) "MRI and Computational Modeling of Multiphase Flows" *Invited Seminar at Pall Corporation*.

J. Service

Service to the School of Engineering and Applied Sciences

- Columbia-Amazon Summer Undergraduate Research Experience (SURE) Program Committee Member, SEAS, 2020-2022
    - Co-organized program, recruited students and evaluated applications
- Undergraduate Education Reform Committee Member, SEAS, 2019
    - Worked on ways to expose first year undergraduates to more forms of engineering
- Engineering Outreach Committee Member, SEAS, 2021-2022
    - Worked on a committee to find new ways to improve engineering outreach

Service to the Department of Chemical Engineering

- Undergraduate Committee Member, Department of Chemical Engineering, 2018-Present
    - Conducted biannual advising sessions, streamlined student course selection, evaluated senior theses, participated in various recruitment events
- Designed a new course from scratch "CHEN 4150: Computational Fluid Dynamics in Chemical Engineering", 2018.

- Undergraduate Transport Committee Member, Department of Chemical Engineering, 2021-Present
    - Personally combined fundamentals of transport phenomena from two semester-long courses into a single semester-long course to provide more flexibility and choice to undergraduates in their education
- Chemical Engineering Department Representative, Committee of Instruction (COI), SEAS, 2021
    - Passed changes to the undergraduate chemical engineering curriculum
- Diversity, Equity and Inclusion (DEI) Committee, Department of Chemical Engineering, 2022-Present
    - Conducted various efforts to improve DEI in the department

Service to the Discipline

- **Peer Reviewer for Journals** (10-20 papers per year): *PNAS*, *PRL*, *Science Advances*, *PLoS ONE*, *Scientific Reports*, *AIChE Journal*, *Chemical Engineering Science*, *Industrial and Engineering Chemistry Research*, *Chemical Engineering Research and Design*, *Journal of Fluid Mechanics*, *Physical Review Fluids*, *Physics of Fluids*, *International Journal of Multiphase Flow*, *Powder Technology*
- **Grant Proposal Reviewer**: National Science Foundation (3 times), Army Research Office (1 time)
- **External Reviewer**: Department of Energy, National Energy Technology Laboratory (1 time)
- Young Professional Editorial Board, *Particuology*, 2021-Present
- Editorial Advisory Board, *ACS Engineering Au*, 2021-Present
- Session Chair, APS Fluids Meeting, 2022-Present
- Session Chair, AIChE Annual Meeting, Powder Technology Forum, 2021-Present
- Session Chair, AIChE Annual Meeting, Powder Technology Forum, 2022-Present

Conferences and Workshops Organized

- Organized a new seminar series, "Fluids@Columbia", for fluid mechanics research across schools and departments, 2021-Present
- Organized and chaired the 18th Northeast Complex Fluids and Soft Matter Workshop, 2023

Outreach

- Hosted lab tours for NYC middle school students through Columbia's Inside Engineering Program, 2019-Present
- Hosted 6 total high school students for summer laboratory research through Columbia's Engineering the Next Generation Program, 2019-Present
- Created research videos published online with thousands of views and conducted subsequent interviews for media outlets, including features in *Scientific American*, *Gizmodo* and *Popular Mechanics*, 2019-Present

Diversity, Equity and Inclusion (DEI)

- Hosted underrepresented minority (URM) high school students for summer laboratory research, 2019-Present

- Service in the formation of the Amazon-SURE summer research program for undergraduate URM students, 2020-Present
- Hosted three URM female students from Tuskegee University for summer research, 2021-Present
- Hosted two Amazon-SURE summer research program students, 2022-Present
- Collaboration with Historically Black Tuskegee University (TU), 2020-Present
    - Secured $350,000 in funds from the Sloan Foundation and Genentech Giving to fund creation of biomedical engineering courses at TU, an alumnus from TU in Columbia's Bridge-to-the-PhD program, a master's student from TU to conduct collaborative research with Columbia and undergraduate research and design challenges involving Columbia and TU students
    - Part of Columbia delegation to visit TU in person to further collaborations, 2022
- Organized a National Science Foundation Research Experiences for Undergraduates (REU) Site at Columbia Chemical Engineering, 2022-Present
    - Recruited applicants, conducted admissions and recruited 10 participants for the program
    - Received excellent reviews for the quality of the experience, community and research from the students
- Chemical Engineering DEI Committee, 2022-Present
    - Organized DEI Town Hall Meetings
    - Recruited and selected a set of student ambassadors from four undergraduate classes, the master's program, the PhD program and postdocs
    - Initiated communications with the community to honor DEI-related holidays and observances (e.g. Black History Month)
    - Started a centralized funding application for students to travel to DEI-related events (e.g. NSBE Annual Convention)

K. Media Coverage

Research findings have been written about in popular scientific media outlet articles:

1. "These Bubbles are Made of Sand" by Ryan Mandelbaum, *Gizmodo*, 2019.
2. "Scientists Made Bubbles of Sand, and That's a Big Deal" by Avery Thompson, *Popular Mechanics*, 2019.
3. "Tiny Vibrating Bubbles Could Make Mining More Sustainable" by Tesse Joose, *Scientific American*, 2021.