Alireza Mohammad Karim, Ph.D., AFHEA

Assistant Professor of Instruction in Mechanical Engineering
Ingram School of Engineering, Texas State University

Editorial Board Member, Scientific Reports (Nature Portfolio)
Early Career Editorial Board Member, Bioengineering; Fluids; Micromachines

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Google Scholar: scholar.google.com/citations?user=AcF8o7sAAAAJ&hl=en

ACADEMIC METRICS

32 peer-reviewed publications | 4 manuscripts under review (as reported in source CV)
830+ Google Scholar citations | h-index: 15
40+ journals reviewed | 1 issued U.S. patent with international counterparts

RESEARCH PROFILE

I am a quantitative mechanobiologist and fluid dynamics scientist working at the interface of physics of fluids, biology, and multiscale transport phenomena, developing predictive frameworks to understand how physical forces regulate biological systems across scales. My research integrates mechanics, interfacial transport, and molecular self-assembly to uncover how force-mediated processes govern biological structure, function, and adaptation from the nanoscale to tissues. Across my training at UCLA, the University of Cambridge, and the Children's Hospital of Philadelphia (NIH NHLBI T32), I have established combined experimental–theoretical platforms to study mechanotransduction, peptide self-assembly, and complex biointerfaces using AFM, cryo-EM, QCM-D, and microfluidic systems. My work connects molecular structure, mechanical properties, and transport dynamics to emergent biological behavior, with applications spanning mechanobiology, nanotherapeutics, and cardiovascular systems. My research has led to 32 peer-reviewed publications across physics, engineering, and bioengineering journals, 800+ citations (h-index 15), and patented technologies adopted in industry (U.S. Patent 11,369,988 B2). I am currently advancing frameworks that link hemodynamic environments, force transmission, and cellular response, with a broader goal of establishing predictive and engineering-driven approaches to biological systems. My research contributions have also been recognized through inclusion in the 2026 Stanford–Elsevier World's Top 2% Scientists single-year citation-impact database, with a ranking in the top 1.81% worldwide in the Fluids & Plasmas subfield.

RESEARCH VISION

My long-term research program aims to establish a quantitative, predictive framework for force-regulated biological systems, integrating Physics of Life with Engineering Biology. Key directions include:

Force-mediated regulation of biological function across molecular, cellular, and tissue scales

Engineering self-assembled biomolecular systems for programmable therapeutic and biofunctional applications

Multiscale modeling of mechanotransduction linking transport phenomena to cellular signaling and adaptation

Microgravity-enabled platforms to isolate fundamental physical drivers of biological organization and dynamics

ACADEMIC APPOINTMENTS AND TRAINING

Texas State University – Assistant Professor of Instruction | August 2026-Present
Ingram School of Engineering, Mechanical Engineering Program

Children's Hospital of Philadelphia - Rashkind Scholar, NHLBI T32 Research Training Program | 2025-2026
Division of Cardiology, Department of Pediatrics.
Cardiovascular mechanobiology, co-culture models, bioreactors, AFM, confocal microscopy, and gene-expression studies.

Children's Hospital of Philadelphia - Postdoctoral Fellow, NHLBI T32 Research Training Program | 2024-2025
Division of Cardiology, Department of Pediatrics.
Cardiovascular mechanobiology, co-culture models, bioreactors, AFM, confocal microscopy, and gene-expression studies.

University of Minnesota - Postdoctoral Associate, Chemical Engineering and Materials Science | 2015-2018
Rheology-driven curtain coating stability and industry-collaborative process innovation.

University of California, Los Angeles - Lecturer / Instructor of Record, Mechanical and Aerospace Engineering | 2023
Delivered Engineering Mathematics and Elementary Fluid Mechanics with full responsibility for teaching, assessment, office hours, and ABET documentation.

California Institute of Technology - Researcher, Division of Geological and Planetary Sciences | 2009-2010
Numerical study of long-term and short-term variation of atmospheric HDO/H2O ratio.

EDUCATION

University of Cambridge - PhD in Engineering (Nanoscience, Physics of Medicine) | 2023

Cambridge Trust Scholar; thesis on peptide molecular self-assembly for long-acting formulations under the supervision of Professor Sir Mark E. Welland.

University of California, Los Angeles - PhD in Aerospace Engineering | 2015
Specialization in fluid mechanics; minor in applied mathematics; dissertation on liquid contact line dynamics.

California Institute of Technology - MS in Aerospace Engineering | 2008
NASA/JPL Space Fellowship; specialization in fluid mechanics and space propulsion.

University of California, Los Angeles - MS in Mechanical Engineering | 2014

University of California, Los Angeles - BS in Mechanical Engineering, summa cum laude | 2007
Boeing Outstanding Undergraduate Student Award.

RESEARCH EXPERTISE

Mechanobiology & Mechanotransduction — force transmission, mechanosensitive pathways (PIEZO), cellular mechanics

Quantitative & Multiscale Biological Systems — linking molecular structure to system-level behavior

Microfluidics & Biointegrated Platforms — controlled physiological transport environments

Interfacial Transport & Complex Fluids — multiphase flows, wetting, flow instabilities, coating flows, capillarity-driven phenomena, droplet impact, contact-line dynamics

Peptide Self-Assembly & Soft Matter — nanofibrillar systems, transport-controlled assembly, structure-property relationships

Experimental & Nanoscale Characterization — AFM, cryo-EM, QCM-D, rheometry, high-speed imaging, confocal imaging, flourescence imaging

Modeling & Scientific Computing — Python, MATLAB, COMSOL Multiphysics, Mathematica; multiphysics modeling

Microgravity Fluid Physics — Diffusion-dominated transport, suppression of buoyancy effects, stability of complex fluid systems

PUBLICATIONS

1. **Mohammad Karim, A.**, Emerging roles of PIEZO2 in cardiovascular biology and diseases: current evidence, knowledge gaps, and future perspectives, Biophysical Reviews, Submitted November 2026.
2. **Mohammad Karim, A.**, Gomes Dos Santos, A. L., and Welland, M. E. Mechanical Properties of Self-assembled Oxyntomodulin and Aib2-Oxyntomodulin Fibrils Elucidated by AFM and Cryo-EM Analysis, Langmuir, Under Review, since September 2026.
3. **Mohammad Karim, A.** Sedimentation and mechanochemical memory in microgravity, APS Open Science, planned, December 2026.
4. **Mohammad Karim, A.** Viscosity resolved hydrodynamic shear transmission across the plasma membrane, Phys. Fluids, Under Review, October 2026.
5. **Mohammad Karim, A.** Membrane-mediated hydrodynamic shear transmission to cells, Phys. Fluids, 38, 102131 (2026).
6. **Mohammad Karim, A.** Engineering nanotherapeutics through interfacial mechanics: mechanobiology and precision drug delivery, Micromachines, 17(9), 1086 (2026).
7. **Mohammad Karim, A.** From drop impact to cellular response: transient interfacial force fields, contact-line physics, and mechanotrasduction in complex biofluids, J. Appl. Phys., 140, 060901 (2026).
8. Stachelek, S. J., Hall, E. J., Yang, X., Laurence, D. W., Rusinkevich, V., Lu, P., Castillero, E., Pressley, B. B., Brady, C., Toomey, N. T., Fishbein, I., Martinez, A., **Mohammad Karim, A.**, Jacobson, E., Levine, D., Cada, S., Margulies, K. B., Bedi, Jr K. C., Anderson, G., Krieger, A. M., Pei, L., Ferrari, G., Levy, R. J. Mechano-sensing channels PIEZO1 and PIEZO2 regulate mitral valve serotonin-mediated homeostasis and pathophysiology, Cardiovascular Research, 122, 2222-2238 (2026).
9. Zakharchenko, A., Toomey, N., Alferiev, I., Martinez, A., Laurence, D., Horyn, O., **Mohammad Karim, A.**, Adamo, A., Takano, H., Nagaswami, C., Stachelek, S. J., Ferrari, G., Levy, R. J. Pyriphenone modification of glutaraldehyde pretreated bovine pericardium mitigates advanced glycation end products, calcification, and platelet adhesion, Acta Biomaterialia, 219, 224-235 (2026).
10. **Mohammad Karim, A.**, Gomes Dos Santos, A. L., and Welland, M. E. Kinetics and thermodynamics of fibril elongation and dissociation of dual glucagon-like peptide and glucagon receptor agonists, Langmuir, 42(32), 23398-23415 (2026).
11. **Mohammad Karim, A.** Smart antidiabetic nanomedicine: a revolutionized therapeutic approach for treatment of diabetes mellitus, Bioengineering, 12, 1309 (2025).
12. **Mohammad Karim, A.** Editorial: “Contact Line Dynamics and Droplet Spreading”, Fluids, 10(8), 206 (2025).
13. **Mohammad Karim, A.** Erratum: “Physics of droplet impact on various substrates and its current advancements in interfacial science: A review” [J. Appl. Phys. 133, 030701 (2023)], J. Appl. Phys., 136, 239903 (2024).

14. **Mohammad Karim, A.** Droplet Contact Line Dynamics after Impact on Solid Surface: Future Perspectives in Healthcare and Medicine, Fluids, 9(10), 223 (2024).
15. **Mohammad Karim, A.** Principles and Biomedical Applications of Self-assembled Peptides: Potential Treatment of Type 2 Diabetes Mellitus, Pharmaceutics, 16(11), 1442 (2024).
16. **Mohammad Karim, A.** Physics of Droplet Impact on Various Substrates and its Current Advancements in Interfacial Science: A Review, J. Appl. Phys., 133(3), 030701 (2023).
17. **Mohammad Karim, A.** Aib(2)oxyntomodulin Peptide Molecular Self-assembly: Smart Nanostructures Toward Long Acting Formulation for Obesity and Diabetes Type 2 [Apollo – University of Cambridge Repository] (2022) https://doi.org/10.17863/CAM.102211
18. **Mohammad Karim, A.** Physics of Droplet Impact on Flexible Materials: A Review, Advances in Mechanical Engineering, 14(11), 1-21 (2022).
19. **Mohammad Karim, A.** Physics of Dynamic Contact Line: Hydrodynamics Theory versus Molecular Kinetic Theory, Fluids, 7(10), 318 (2022).
20. **Mohammad Karim, A.** A Review of Physics of Moving Contact Line Dynamics Models and its Applications in Interfacial Science, J. Appl. Phys., 132(8), 080701 (2022).
21. **Mohammad Karim, A.**, Suszynski, W. J., Pujari, S., Francis, L. F., and Carvalho, M. S. Contact Line Dynamics in Curtain Coating of Non-Newtonian Liquids, Phys. Fluids, 33, 103103 (2021).
22. **Mohammad Karim, A.**, Suszynski, W. J., and Pujari, S. Liquid Film Stability and Contact Line Dynamics of Emulsion Liquid Films in Curtain Coating Process, J. Coat. Technol. Res., 18(6), 1531-1541 (2021).
23. **Mohammad Karim, A.**, Fujii, K., and Kavehpour, H. P. Contact line dynamics of gravity driven spreading of liquids, Fluid Dyn. Res., 53(3), 035503, 1-14 (2021).
24. **Mohammad Karim, A.** Experimental Dynamics of Newtonian and Non-Newtonian Droplets Impacting Liquid Surface With Different Rheology, Phys. Fluids, 32, 043102 (2020).
25. **Mohammad Karim, A.**, Suszynski, W. J., Pujari, S., Francis, L. F., and Carvalho, M. S. Delaying Breakup and Avoiding Air Entrainment in Curtain Coating Using a Two-Layer Liquid Structure, Chem. Eng. Sci., 213, 115376 (2020).
26. **Mohammad Karim, A.**, Suszynski, W. J., Griffith, W. B., Pujari, S., Francis, L. F., Carvalho, M. S. Effect of rheological properties of shear thinning liquids on curtain stability, J. Non-Newtonian Fluid Mech., 263, 69-76 (2019).
27. **Mohammad Karim, A.** Experimental Dynamics of Newtonian Non-elastic and Viscoelastic Droplets Impacting Immiscible Liquid Surface, AIP Advances, 9, 125141 (2019).
28. **Mohammad Karim, A.**, Suszynski, W. J., Griffith, W. B., Pujari, S., Francis, L. F., and Carvalho, M. S. Effect of Viscoelasticity on Stability of Liquid Curtain, J. Non-Newtonian Fluid Mech., 257, 83-94 (2018).
29. **Mohammad Karim, A.** and Kavehpour, H. P. Effect of Viscous Force on Dynamic Contact Angle Measurement Using Wilhelmy Plate Method, Colloids Surf. A, 548, 54-60 (2018).
30. **Mohammad Karim, A.**, Rothstein, J. P., and Kavehpour, H. P. Experimental Study of Dynamic Contact Angles on Rough Hydrophobic Surfaces, J. Colloid Interface Sci., 513, 658-665 (2018).
31. **Mohammad Karim, A.**, Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Effect of Viscosity on Liquid Curtain Stability, AIChE J., 64(4), 1448-1457 (2018).
32. Abe, Y., Zhang, B., Gordillo, L., **Mohammad Karim, A.**, Francis, L. F., and Cheng, X. Dynamic self-assembly of charged colloidal strings and walls in simple fluid flows, Soft Matter, 13(8), 1681-1692 (2017).
33. **Mohammad Karim, A.**, Davis, S. H., and Kavehpour, H. P. Forced versus Spontaneous Spreading of Liquids, Langmuir, 32(40), 10153-10158 (2016).
34. **Mohammad Karim, A.** Parametric Study of Liquid Contact Line Dynamics: Adhesion vs. Hydrodynamics. UCLA. ProQuest ID: MohammadKarim_ucla_0031D_14090. Merritt ID: ark:/13030/m5w98dmm. (2015) Retrieved from https://escholarship.org/uc/item/5mm1m1kw
35. **Mohammad Karim, A.** and Kavehpour, H. P. Dynamics of Spreading on Ultra-hydrophobic Surfaces, J. Coat. Technol. Res., 12(5), 959-964 (2015).
36. **Mohammad Karim, A.** and Kavehpour, H. P. Spreading of Emulsions on a Solid Substrate, J. Coat. Technol. Res., 11(1), 103-108 (2014).

Full publication list and citation record available at Google Scholar: scholar.google.com/citations?user=AcF8o7sAAAAJ&hl=en

RESEARCH FUNDING, FELLOWSHIPS & AWARDS

Stanford–Elsevier World's Top 2% Scientists (2026 Edition) — International Research Recognition.

Included in the single-year citation-impact database based on 2025 Scopus citation data. Ranked 1,056 out of 58,297 scientists worldwide in the Fluids & Plasmas subfield (top 1.81%), reflecting the international citation impact of research contributions in fluid mechanics and related interdisciplinary scientific fields.

Official dataset: https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/9

Individual ranking profile:

https://explore-labs.com/en/tools/top-2-percent-scientists?q=alireza+mohammad+karim&id=3105601

Pediatric Research LRP Award, National Heart, Lung, and Blood Institute (NHLBI), NIH (2025-2027).

NIH T32 Postdoctoral Fellowship, Children's Hospital of Philadelphia (2024-2026).

Cambridge Trust Scholarship, University of Cambridge (2018-2021).

Travel Grant, Fluids, MDPI (2022).

AIChE Biomaterials Graduate Student Award Finalist (2020, 2022).

Featured Researcher, UCLA-USAF Collaborative Center for Aerospace Sciences (2015-Present).

UCLA Graduate Division Fellowship Award, University of California, Los Angeles (2014).

NASA/JPL Space Fellowship Award, California Institute of Technology (Caltech) (2007-2008).

Research Studentship in Engineering with MedImmune Ltd (AstraZeneca), University of Cambridge (2018-2022).

PATENTS AND TRANSLATIONAL IMPACT

Mohammad Karim, A., Pujari, S., Suszynski, W. J., Francis, L. F., Carvalho, M. S., and Yadav, V. Methods for Curtain Coating Substrates. U.S. Patent No. 11,369,988 B2, issued June 28, 2022.

International patent counterparts: Japan, JP7171755B2 (2022); China, CN112154035B (2023); Taiwan, TWI800612B (2023). International publication: WO2019190623A1 (2019).

Institutional and industrial context: University of Minnesota–Dow collaborative research. Patent assignees include the Regents of the University of Minnesota, Dow Global Technologies LLC, and Rohm and Haas Company.

Original inventive contribution: Independently conceived the original engineering concept, formulated its scientific and physical basis, designed and personally performed proof-of-concept experiments, analyzed the experimental findings, and presented the resulting invention to the University of Minnesota and Dow. Contemporaneous research records document the invention-development process.

Technical significance: Developed an experimentally grounded approach to improving the operating characteristics of curtain-coating processes involving complex, non-Newtonian liquids. The research addressed liquid-sheet stability, rheological effects, and coating-process operating limitations relevant to industrial coating technologies.

Technology translation and intellectual-property impact: Advanced the invention from scientific conception and experimental demonstration to issued U.S. patent protection and corresponding international patent grants. The invention was pursued through a university–industry intellectual-property pathway involving multinational patent protection.

Potential industrial relevance: The patented approach has potential applications in improving coating-process stability, operating flexibility, manufacturing consistency, and production efficiency. Commercial deployment and quantified economic outcomes have not yet been independently verified.

EARLY ACADEMIC SCHOLARSHIPS & AWARDS

Peer Reviewer Recognition and Appreciation, ACS Publications (2025).

Boeing Outstanding Undergraduate Student Award, UCLA (2006).

Science/Math/Engineering Division Award, Saddleback College (2004).

Mathematics Scholarship, Saddleback College (2004).

PROFESSIONAL AND ACADEMIC HONORS

Tau Beta Pi Engineering Honor Society (elected 2005).

Phi Theta Kappa International Honor Society (lifetime member).

Golden Key International Honour Society (lifetime member).

Engineering Dean’s Honor List, UCLA (2005).

Summa Cum Laude Latin Honors, UCLA (2007).

National Dean’s List, Saddleback College (2005).

Student of the Year, Division of Science/Math/Engineering, Saddleback College (2004).

Dean’s Honor List, Saddleback College (2002, 2004).

President’s Honor List, Saddleback College (2002, 2003).

Star Reviewer, Physics of Fluids (2020, 2022, 2023).

RESEARCH EXPERIENCE

Children’s Hospital of Philadelphia (CHOP), University of Pennsylvania | 2024-2026

NIH T32 Postdoctoral Fellow (Cardiovascular Mechanobiology)

Investigated mechanobiology of heart-valve interstitial cells (HVICs) under physiologically relevant mechanical stimuli

Developed 2D and 3D co-culture models under cyclic stretch and shear flow to quantify extracellular matrix remodeling and cytoskeletal response

Integrated cell-stretching and flow bioreactors with qRT-PCR, ELISA, confocal microscopy, and AFM to probe force-dependent cellular phenotypes

Advanced multiscale understanding of how mechanical forces regulate cellular behavior in cardiovascular systems

University of Cambridge (Department of Engineering) | 2018-2023

PhD Researcher (Nanoscience & Molecular Self-Assembly)

Investigated self-assembly of therapeutic peptides into nanofibrils for sustained drug delivery applications

Combined AFM, cryo-EM, and thermodynamic modeling to establish structure–mechanics–transport relationships

Demonstrated diffusion-controlled release enabled by ordered nanofibrillar architectures

Work recognized by AIChE Biomaterials Graduate Student Award Finalist (×2)

University of Minnesota (Department of Chemical Engineering and Materials Science) | September 2015-September 2018

Postdoctoral Associate (Complex Fluids, Rheology, and Interfacial Engineering)

Conducted experimental investigations of non-Newtonian fluid rheology, liquid-curtain stability, interfacial dynamics, and coating-process operating limitations in university–industry collaborative research.

Independently conceived and experimentally demonstrated the original engineering concept underlying U.S. Patent No. 11,369,988 B2, Methods for Curtain Coating Substrates.

Designed and performed proof-of-concept experiments, developed the physical interpretation of the results, and communicated the inventive approach to university and industrial collaborators.

Published peer-reviewed research on the influence of viscosity, shear-thinning, viscoelasticity, and multilayer liquid structures on curtain-coating stability and operating behavior.

Contributed to the advancement of experimentally validated coating-flow technologies with potential industrial manufacturing applications.

University of California, Los Angeles (UCLA) | 2012-2015

Graduate Researcher (Fluid Mechanics & Microfluidics)

Investigated multiphase interfacial flow dynamics in microfluidic systems

Explored droplet transport, interfacial instabilities, and flow–structure interactions

Recognized as Featured Researcher at the UCLA–USAF Research Laboratory Collaborative Center for Aerospace Sciences

TEACHING EXPERIENCE

Assistant Professor of Instruction — Mechanical Engineering

Ingram School of Engineering, Texas State University

August 2026–Present

ME 3331 — Heat Transfer | Fall 2026

Deliver undergraduate instruction in conduction, convection, radiation, and thermal-system analysis, emphasizing physical interpretation, quantitative problem-solving, and engineering applications.

Guide students in applying governing equations and heat-transfer principles to the analysis and evaluation of thermal engineering systems.

Assess student learning through coursework, examinations, and engineering problem-solving activities.

ENGR 1304 — Engineering Graphics | Fall 2026

Deliver undergraduate instruction in engineering visualization, technical drawing, computer-aided design, and three-dimensional mechanical modeling.

Guide students in applying engineering graphics and SolidWorks-based modeling to the representation and communication of engineering designs.

Develop students' spatial reasoning, technical communication, and foundational design skills essential to engineering innovation and product development.

Instructor of Record (Lecturer)

University of California, Los Angeles (UCLA) — Department of Mechanical & Aerospace Engineering

Jan 2023 – Jun 2023

MAE 103: Elementary Fluid Mechanics (134 students)

Designed and delivered full-course instruction, including lectures, assessments, and office hours; developed concept-driven curriculum linking fundamental fluid mechanics to engineering systems; implemented structured student assessment.

MAE 82: Mathematics of Engineering (64 students)

Delivered complete instruction emphasizing analytical modeling, applied mathematics, and engineering problem-solving; integrated computational tools (MATLAB/Python) and real-world applications; supported course assessment and continuous improvement.

Undergraduate Supervisor (Small-Group Teaching)

University of Cambridge — King's College & Pembroke College

2021 – 2022

Mathematical Methods II & III (Natural Sciences Tripos)

Engineering Mechanics (Engineering Tripos Part IB)

Delivered high-intensity, small-group instruction focused on deep analytical reasoning and independent problem-solving.

Assessed student performance through rigorous problem-based evaluation and individualized feedback.

Mentored students in advanced mathematical and mechanical concepts within the Cambridge supervision system.

Teaching Fellow / Teaching Associate / Teaching Assistant

University of California, Los Angeles (UCLA) — Department of Mechanical & Aerospace Engineering

2012 – 2015

Instructional Leadership & Laboratory Teaching

MAE 157A: Fluid Mechanics & Aerodynamics Laboratory (~25 students/section)

Led and supervised full experimental laboratory program, including wind-tunnel testing and fluid dynamics experiments; mentored students through design–build–test workflows, data analysis, and uncertainty quantification; contributed to laboratory curriculum development.

MAE 157: Mechanical Engineering Laboratory (~25 students/section)

Delivered hands-on instruction in thermofluids and mechanical systems; supervised experimental analysis and technical reporting.

MAE 94: CAD & Prototyping (~50 students)

Delivered laboratory instruction in SolidWorks and AutoCAD; guided students in engineering design, modeling, and prototyping workflows.

Core Course Instruction

MAE 103: Elementary Fluid Mechanics (~90 students)

Conducted discussion sections, delivered lectures, held office hours, and assessed student performance; reinforced core concepts in fluid mechanics and transport phenomena; supported course assessment.

ENGINEERING EDUCATION INNOVATION AND CURRICULUM DEVELOPMENT

Physics-Informed Artificial Intelligence and Machine Learning for Thermal-Fluid Engineering

Academic Innovation Micro-Grant Proposal, Texas State University | Submitted October 2026

Conceived and developed a proposed interdisciplinary educational pathway integrating physics-based engineering analysis with artificial intelligence and machine learning in undergraduate mechanical engineering education.

Designed a progressive instructional framework spanning Fluid Mechanics (ME 3335), Heat Transfer (ME 3331), Fluids/Thermal Laboratory (ME 4131), and Computational Fluid Dynamics (ME 4341), with Introduction to Machine Learning for Engineering Applications (EE 4331) supporting students pursuing the proposed micro-credential.

Proposed instructional applications involving fluid-flow prediction, heat-transfer analysis, experimental-data interpretation, reduced-order modeling, and comparison of machine-learning predictions with conventional computational and experimental results.

Emphasized physical consistency, verification and validation, uncertainty assessment, interpretability, and engineering judgment in the development and responsible application of AI-enabled technologies.

Presented the initiative to Mechanical Engineering faculty and coordinated discussions concerning curricular alignment, instructional feasibility, and potential adoption of course materials.

Intended to prepare future engineers to integrate emerging computational methods into engineering design, modeling, experimentation, and technology development while maintaining a rigorous foundation in physical principles.

Status: Proposal submitted; implementation subject to institutional review, approval, and faculty coordination.

TEACHING AND PROFESSIONAL CERTIFICATIONS

Associate Fellow of the Higher Education Academy (AFHEA), Advance HE (2026).

Academic Certificate in Teaching, Children's Hospital of Philadelphia / University of Pennsylvania (2025).

CIRTL STEM Teaching Certification (2025).

Peer Reviewer Recognition and Appreciation, ACS Publications (2025).

ACADEMIC SERVICE AND STUDENT MENTORING

Faculty Advisor — Industry-Sponsored Mechanical Engineering Senior Design

Texas State University | September 2026–Present

Industry Sponsor: Boston Scientific

Provide technical and professional mentorship to undergraduate engineering students engaged in an industry-sponsored engineering design project.

Guide students in translating engineering objectives into functional requirements, functional decomposition, concept generation, feasibility assessment, and systematic evaluation of design alternatives.

Mentor students in engineering decision-making, design tradeoffs, technical documentation, and professional communication with industry representatives.

Support the development of independent problem-solving, creative engineering design, and evidence-based evaluation skills relevant to future inventors and technology developers.

Faculty Co-Advisor — Bobcat Aerospace Rocketry Club
Texas State University | 2026–Present

Serve as faculty co-advisor and technical mentor for student-led aerospace engineering and rocketry initiatives.

Guide students in fundamental aerodynamics, propulsion, fluid mechanics, mechanical design, engineering calculations, and technical evaluation of proposed rocket configurations.

Encourage independent design development, critical assessment of modeling assumptions, and iterative refinement of engineering concepts.

Support student preparation for collegiate aerospace engineering competitions, including planned participation in the Lone Star Cup and the 2027 International Rocket Engineering Competition.

Faculty Career Advisor — Mechanical Engineering
Texas State University | September 2026–Present

Advise undergraduate mechanical engineering students on academic development, engineering career pathways, technical competencies, and professional preparation.

Encourage students to connect foundational engineering knowledge with design practice, research opportunities, emerging technologies, and industry applications.

Faculty Representative — Bobcat Day, Academic Majors Fair
Texas State University | October 17, 2026

Represented the Mechanical Engineering Program at Texas State University's prospective student recruitment event.

Engaged with prospective students and families regarding mechanical engineering education, academic opportunities, and engineering career pathways.

Supported university-wide student recruitment and outreach activities.

EDITORIAL AND PROFESSIONAL SERVICE

Editorial Board Appointments

Editorial Board Member, Scientific Reports (Nature Portfolio) (2026–Present)

Early Career Editorial Board Member, Bioengineering (2026-Present)

Early Career Editorial Board Member, Fluids (2026-Present)

Early Career Editorial Board Member, Micromachines (2026-Present)

Topical Advisory Panel Appointments

Fluids (2023-2026)

Micromachines (2022-2026)

Bioengineering (2024-2026)

Editorial Leadership — Special Collections and Special Issues

Lead Guest Editor, “Special Collection on Droplet Impact, Coalescence, and Droplet Formation,” Advances in Mechanical Engineering (SAGE Publications), 2022–Present. Special Collection

Special Issue Editor, “Contact Line Dynamics and Droplet Spreading,” Fluids (MDPI), 2022–Present. Special Issue

Special Issue Editor, “Interfacial Physics, Healthcare and Medicine: Microfluidics and Nanofluidics,” Micromachines (MDPI), 2024–Present. Special Issue

Peer Review Service

Nature Communications, Communications Physics, ACS Applied Materials & Interfaces, Scientific Reports, Soft Matter, Physics of Fluids, Langmuir, Journal of Applied Physics, Experiments in Fluids, Review of Scientific Instruments, Frontiers in Heat and Mass Transfer, AIP Advances, Fluid Dynamics Research, Industrial & Engineering Chemistry Research, Engineering Applications of Computational Fluid Mechanics, European Journal of Mechanics - B/Fluids, International Journal of Molecular Sciences, Bioengineering, Pharmaceutics, Nanomaterials, Molecules, Colloid and Polymer Science, Applied Sciences, Fluids, Journal of Fluids Engineering, Journal of Thermal Science and Engineering Applications, Journal of Materials Engineering and Performance, Coatings, Energies, Aerosol Science & Technology, Micromachines, Diseases, Machines, Polymers, Materials, Processes, Gels, Water, Sensors, Proteomes, Cancers, Sustainability, Symmetry, Biophysica, Biology, Journal of Applied Fluid Mechanics, Journal of Composites Science, American Society of Mechanical Engineers (ASME) Power and Energy Conference, International Journal of Advancements in Technology,

I focus on assessing methodological soundness, reproducibility, and clarity of physical interpretation, and I am accustomed to synthesizing reviewer input into clear, balanced recommendations.

INVITED TALKS

Invited seminars at leading institutions including:
Temple University (2026); University of North Carolina at Chapel Hill (2024); University of Illinois Urbana–Champaign (2023); Virginia Tech (2023); Johns Hopkins University (2022); University of Minnesota (2015)

INVITED PERSPECTIVE AND EXPERT COMMENTARY PUBLICATIONS

Mohammad Karim, A. Invited expert perspective (quoted) on mechano-responsive nanomedicine, mechanotransduction-targeted therapeutics (PIEZO), and organ-on-chip–enabled precision medicine. In: "Nanomedicine in 2026: Experts Predict the Year Ahead." AZoNano, Dec 2025. https://www.azonano.com/article.aspx?ArticleID=6976

CONFERENCES

Mohammad Karim, A. Mechano-regulation of Serotonin Related Genes Expression in Co-culture Mitral Valve Interstitial/Endothelial Cells, Cardiology Research Training Symposium, The Children's Hospital of Philadelphia, Cardiac Center, Philadelphia, PA (2025).

Mohammad Karim, A. Mechanical Regulation of Serotonin Transporter Expression in Mitral Valve Interstitial Cells, Cardiology Research Training Symposium, The Children's Hospital of Philadelphia, Cardiac Center, Philadelphia, PA (2024).

Mohammad Karim, A., Gomes Dos Santos, A. L., and Welland, M. E. Graduate Student Award Session: Kinetics and Thermodynamics of Peptide Binding and Peptide Release from Oxyntomodulin and Aib2-Oxyntomodulin Nano-Fibrils, AIChE Annual Meeting, Phoenix, AZ (2022).

Mohammad Karim, A., Gomes Dos Santos, A. L., and Welland, M. E. Kinetics and Thermodynamics of Peptide Binding and Peptide Release from Oxyntomodulin and Aib2-Oxyntomodulin Nano-Fibrils, AIChE Annual Meeting, Phoenix, AZ (2022).

Mohammad Karim, A., Gomes Dos Santos, A. L., and Welland, M. E. Kinetics and Thermodynamics of Fibril Elongation and Dissociation of Oxyntomodulin and Aib2-Oxyntomodulin, MRS Fall Meeting & Exhibit, Boston, MA (2021).

Mohammad Karim, A., Suszynski, W. J., Pujari, S., Francis, L. F., and Carvalho, M. S. Stability of Two-Layer Curtain Coating, ICR 2020 - 18th International Congress on Rheology, Virtual ICR 2020, Rio de Janeiro, Brazil (2020).

Mohammad Karim, A., Gomes Dos Santos, A. L., Sader K., Castro-Hartmann, P., Qian, P., and Welland, M. E. Graduate Student Award Session: Material/Structural Characteristics of Reversibly Self-Assembled Oxyntomodulin/Aib2-Oxyntomodulin Fibrils Revealed By AFM and Cryo-EM, Virtual AIChE Annual Meeting (2020).

Mohammad Karim, A., Suszynski, W. J., Pujari, S., Francis, L. F., and Carvalho, M. S. Using two-layer structure to expand operability window of curtain coating process, 20th International Society of Coating Science and Technology Symposium (ISCST), Virtual Event (2020).

Francis, L. F., Mohammad Karim, A., Suszynski, W. J., Pujari, S., and Carvalho, M. S. Effect of Rheology on Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2019).

Bazzi, M. S., Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Effect of Viscoelasticity on the Hole Growth Dynamics in a Liquid Curtain, 90th Annual Meeting of The Society of Rheology, Houston, TX (2018).

Mohammad Karim, A., Suszynski, W. J., Griffith, W. B., Pujari, S., Francis, L. F., and Carvalho, M. S. Effect of Viscoelasticity on Stability of Curtain Coating, 19th International Society of Coating Science and Technology Symposium (ISCST), Long Beach, CA (2018).

Mohammad Karim, A., Suszynski, W. J., Griffith, W. B., Pujari, S., Francis, L. F., and Carvalho, M. S. Effect of Viscoelasticity on Stability of Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2018).

Mohammad Karim, A., Francis, L. F., Carvalho, M. S., and Suszynski, W. J. Effect of Elasticity on Stability of Viscoelastic Liquid Curtain, AIChE Annual Meeting, Minneapolis, MN (2017).

Kavehpour, H. P., Mohammad Karim, A., Rothstein, J. P., and Davis, S. Laws of Spreading: When Hydrodynamic Equations Are Not Enough, 70th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 62(14), Denver, CO (2017).

Mohammad Karim, A., Suszynski, W. J., Griffith, W. B., Pujari, S., Carvalho, M. S., and Francis, L. F. Effect of Rheological Properties on Liquid Curtain Coating, 70th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 62(14), Denver, CO (2017).

Mohammad Karim, A., Suszynski, W. J., Griffith, W. B., Pujari, S., Carvalho, M. S., and Francis, L. F. Effect of Rheological Properties on Liquid Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2017).

Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Effect of Elasticity on Stability of Viscoelastic Liquid Curtain, 69th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 61(2), Portland, OR (2016).

Abe, Y., Zhang, B., Gordillo, L., Mohammad Karim, A., Francis, L. F., and Cheng, X. Assembly of Colloidal Strings in a Simple Fluid Flow, 18th International Society of Coating Science and Technology Symposium (ISCST), Pittsburgh, PA (2016).

Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Effect of Viscosity on Liquid Curtain Stability, 18th International Society of Coating Science and Technology Symposium (ISCST), Pittsburgh, PA (2016).

Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Effect of Rheological Characteristics of non-Newtonian Liquids on Liquid Curtain Stability, 18th International Society of Coating Science and Technology Symposium (ISCST), Pittsburgh, PA (2016).

Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Stability in Liquid Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2016).

Mohammad Karim, A., Rothstein, J. P., and Kavehpour, H. P. Dynamics of Spreading on Micro-Textured Surfaces, 68th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 60(21), Boston, MA (2015).

Houssainy, S., Mohammad Karim, A., and Kavehpour, H. P. Effect of Viscous Force on Dynamic Contact Angle Measurement with Tensiometer, 68th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, Boston, MA, (2015) (accepted).

Mohammad Karim, A., Rothstein, J. P., and Kavehpour, H. P. Spreading Dynamics on Micro-textured Surfaces, Symposium Interfacial Phenomena for Bobbles, Droplets, Films, and Soft Matter (2015) (accepted).

Kavehpour, H. P., Mohammad Karim, A., and Davis, S. H. Inconsistencies in the experimental study of spontaneous spreading vs. forced spreading, Droplets 2015, University of Twente, The Netherlands (2015).

Mohammad Karim, A., and Kavehpour, H. P. Laws of spreading: why Tanner, Hoffman, Voinov, Cox and de Gennes were wrong, generally speaking, 67th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 59(20), San Francisco, CA (2014).

Mohammad Karim, A., and Kavehpour, H. P. Parametric Study of the Dynamics of Partial Wetting, 17th International Society of Coating Science and Technology Symposium (ISCST), San Diego, CA (2014).

Mohammad Karim, A., and Kavehpour, H. P. Spreading of Emulsions on a Solid Substrate, SO CAL FLUIDS VIII, UCLA, Los Angeles, CA (2014).

Mohammad Karim, A., Kim, J., Rothstein, J. P., and Kavehpour, H. P. Dynamics of Wetting of Ultra-hydrophobic Surfaces, 66th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 58(18), Pittsburgh, PA (2013).

Mohammad Karim, A., and Kavehpour, H. P. Spreading of Emulsions on Glass Substrates, 65th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 57(17), San Diego, CA (2012).

Mohammad Karim, A., and Kavehpour, H. P. Spreading of Emulsions on Solid Substrate, 16th International Society of Coating Science and Technology Symposium (ISCST), Atlanta, GA (2012).

POSTER PRESENTATIONS

Zakharchenko, A., Toomey, N., Alferiev, I., Martinez, A., Horyn, O., Laurence, D., Mohammad Karim, A., Adamo, A., Stachelek, S. J., Ferrari, G., Levy, R. J. Photomodification of bioprosthetic heart valves with Vitamin B6 to mitigate structural valve degeneration, Society For Biomaterials (SFB) 2026 Annual Meeting and Exposition, Atlanta, GA (2026).

Yang, X., Hall, E., Laurence, D., Mohammad Karim, A., Stachelek, S., Levy, R. J. Differential Gene Expression of Mitral Valve Interstitial and Endothelial Cells Under Cyclic Tension: Roles of PIEZO1 and Serotonin Transporter, Biomedical Engineering Society (BMES) 2025 Annual Meeting, San Diego, CA (2025).

Mohammad Karim, A., Gomes Dos Santos, A. L., Sader K., Castro-Hartmann, P., Qian, P., and Welland, M. E. Material and Structural Characteristics of Reversibly Self-Assembled Oxyntomodulin and Aib2-Oxyntomodulin Fibrils Revealed By AFM and Cryo-EM, Virtual AIChE Annual Meeting (2020).

Mohammad Karim, A., Suszynski, W. J., Griffith, W. B., Pujari, S., Francis, L. F., and Carvalho, M. S. Effect of Viscoelasticity on Stability of Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2018).

Mohammad Karim, A., Suszynski, W. J., Griffith, W. B., Pujari, S., Carvalho, M. S., and Francis, L. F. Effect of Rheological Properties on Liquid Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2017).

Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Stability in Liquid Curtain Coating, Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME) Annual Meeting, Minneapolis, MN (2016).

Mohammad Karim, A., Suszynski, W. J., Francis, L. F., and Carvalho, M. S. Effect of Viscosity on Liquid Curtain Stability, 69th Annual Meeting of the Fluid Dynamics Division of the American Physical Society, 61(2), Portland, OR (2016).

TECHNICAL SKILLS

AFM, Cryo-EM, QCM-D, FTIR, CD Spectroscopy, Confocal Microscopy, Fluorescence Microscopy
Microfluidics, Bioreactors
MATLAB, Python, SolidWorks
Co-culture, 3D-culture, qPCR, ELISA

COLLABORATIONS

Dow Chemical
AstraZeneca (MedImmune)
Children's Hospital of Philadelphia
University of Cambridge

UCLA

University of Minnesota
Caltech

PROFESSIONAL MEMBERSHIPS

American Heart Association, AHA
American Physical Society, APS
American Chemical Society, ACS
American Institute of Chemical Engineers, AIChE
Materials Research Society, MRS
International Society of Coating Science and Technology, ISCST
Phi Theta Kappa, International Honor Society
Tau Beta Pi Engineering Honor Society
Golden Key International Honour Society
Engineering Society of University of California, ESUC, UCLA
Beta Epsilon Beta Chapter
University of Cambridge Alumni Community
Caltech Alumni Association