

Columbia University
Fu Foundation School of Engineering and Applied Sciences
Curriculum Vitae

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Vijay Vedula

Assistant Professor of Mechanical Engineering
Columbia University in the City of New York
500 W 120th Street,
Mudd 220BA, MC 4703
New York, NY 10027

Telephone: 212.853.2547
Email: yv2316@columbia.edu
Web: [SEAS Directory](#), [MechE](#), [Lab](#)
[LinkedIn](#) [Google Scholar](#) [NCBI](#)

Education

Johns Hopkins University	Ph.D., Mechanical Engineering	2015
Thesis: "Image-based computational modeling of intracardiac flows"		
Advisor: Prof. Rajat Mittal		
Indian Institute of Technology Kanpur, India	M.Tech., Aerospace Engineering	2009
National Institute of Technology Trichy, India	B.Tech., Mechanical Engineering	2007

Principal Fields of Interest

Cardiovascular Biomechanics, Digital Twins, Multiphysics Modeling, Computational Fluid Dynamics, Fluid-Structure Interaction, Inverse Methods, Uncertainty Quantification

Academic Positions

Columbia University Mechanical Engineering	Assistant Professor	01/2020 – present
Stanford University Pediatrics	Postdoctoral Fellow	06/2015 – 12/2019
UC San Diego Mechanical and Aerospace Engineering	Postdoctoral Fellow	02/2015 – 06/2015
Johns Hopkins University	Graduate Research Assistant	07/2010 – 02/2015

Awards and Honors

NSF CAREER Award	2025 – 2030
Second Century Early Faculty Independence Award (SCEFIA), American Heart Association (AHA)	2024 – 2027
SEAS Interdisciplinary Research Seed (SIRS) Award – Blavatnik Fund, Columbia School of Engineering and Applied Sciences (SEAS)	2022 – 2023
Theodore von Kármán Fellowship, RWTH Aachen University	2018
Child Health Research Institute Grant & Postdoctoral Fellowship	2016 – 2018
NSF-sponsored Young Investigator & Travel Award, 5 th Engineering Frontiers Conference on Pediatrics and Congenital Heart Disease, Orlando, Florida	2017
Gordon L. and Beatrice C. Bowles Fellowship, Johns Hopkins University	2010

Publications

Authorship convention in field: senior author listed last
Underlined authors indicate students or postdocs supervised

Metrics

Google Scholar (retrieved: April 2026) Citations: 1940; h-index: 22; i10-index: 31

Peer Reviewed Journal Publications

Manuscripts under review and in preparation (*, corresponding author):

- M8. Mergler, O., Zhai, H., Hiebing, A., Pousse, P.L., **Vedula, V.***, and Kalfa, D.*. Recent advances in mechanical growth and remodeling of the cardiovascular system.
- M7. Mixon, P. and **Vedula, V.***, 2026. The role of ion currents and gap junctions in regulating the contractility of the murine uterus during late pregnancy.
- M6. Mergler, O., Laughlin, A., Shi, L., Myers, K., and **Vedula, V.***, 2026. A Method for Image-Based Modeling of Uterine Passive Mechanics During Late Pregnancy. (in preparation)
- M5. Gan, B., Shi, L., and **Vedula, V.***, 2026. Sensitivities of myocardial mechanics and blood flow to variations in left atrial wall thickness.
- M4. Chen, Y., Zhai, H., Ni, Y., Chen, I.Y., and **Vedula, V.***, 2026. Cardiac motion increases apparent stenosis severity in right coronary artery.
- M3. Chen, Y., Shi, L., **Vedula, V.***, and Kalfa, D.*, 2026. Uncertainty-aware digital twins to assist surgical planning in neonates with borderline left ventricles.
- M2. Zhai, H., Chen, Y., Kitada, Y., Takayama, H., and **Vedula, V.***, 2026. Hemodynamic analysis of repaired ascending aorta with preserved aortic root. *under review for Annals of Biomedical Engineering*. Preprint on *bioRxiv*:2026.01.28.702307.
- M1. Brown, A.L., Shi, L., Salvador, M., Kong, F., Ennis, D., Chen, I.Y., **Vedula, V.***, and Marsden, A.*, 2025. Personalized biventricular mechanics and sensitivity to model morphology. *under review for Biomechanics and Mechanobiology*. Preprint on *bioRxiv*:2025.12.11.693778.

Published since January 1, 2020 after joining Columbia University (*, corresponding author; trainees underlined; ^{PS} = professional service; ^{PF} = postdoc-to-faculty transition):

- J38. Shi, L., Chen, Y., and **Vedula, V.***, 2026. HeartSimSage: attention-enhanced graph neural networks for accelerating cardiac mechanics modeling. *Journal of Computational Physics*, doi: 10.1016/j.jcp.2026.114895, p.114895.
- J37. Chen, Y., Anzai, I., Kalfa, D.*, and **Vedula, V.***, 2026. A patient-specific computational model for neonates and infants with borderline left ventricles. *Annals of Biomedical Engineering*, 54, pp.41–61.
- J36. Shi, L., Gan, B., Chen, I.Y., and **Vedula, V.***, 2026. Personalized multiscale modeling of left atrial mechanics and blood flow. *Computer Methods in Applied Mechanics and Engineering*, 448A, p.118412.
- J35. Luo, C., Li, K., Herschmann, A.R., Sun, M., Waisman, H., **Vedula, V.**, Kysar, J.W. and Kalfa, D.*, 2026. Parameterized shape optimization of a bi-leaflet heart valved conduit for pediatric applications. *Engineering with Computers*, 42(77).
- J34. Aróstica, R., Nolte, D., Brown, A., Gebauer, A., Karabelas, E., Jilberto, J., Salvador, M., Bucelli, M., Piersanti, R., Osouli, K., Augustin, C., Finsberg, H., Shi, L., Hirschvogel, M., Pfaller, M., Africa, P.C., Gsell, M., Marsden, A., Nordsletten, D., Regazzoni, F., Plank, G.,

- Sundnes, J., Dedé, L., Peirlinck, M., **Vedula, V.**, Wall, W., and Bertoglio, C.*, 2025. A software benchmark for cardiac elastodynamics. *Computer Methods in Applied Mechanics and Engineering*, 435, p.117485.
- J33. Watson, C., Saaïd, H., **Vedula, V.**, Cardenas, J.C., Henke, P.K., Nicoud, F., Xu, X.Y., Hunt, B.J. and Manning, K.B.*, 2024. Venous Thromboembolism: Review of Clinical Challenges, Biology, Assessment, Treatment, and Modeling. *Annals of Biomedical Engineering*, 52(3), pp.467–486.
- J32. Shi, L., Chen, I.Y., Takayama, H., and **Vedula, V.***, 2024. An optimization framework to personalize passive cardiac mechanics. *Computer Methods in Applied Mechanics and Engineering*, 432, p.117401.
- J31. Hohri, Y., Chung, M.M., Kandula, V., Kim, I., Leb, J., Hayashi, H., Elmously, A., O'Donnell, T.F., Patel, V., **Vedula, V.**, Takayama, H.*, 2024. Blood flow assessment technology in aortic surgery: a narrative review. *Journal of Thoracic Disease*, 16(4), p.2623.
- J30. Hayashi, H., Singh, S.K., Hahn, R.T., Akita, K., Kurlansky, P., Sun, J., **Vedula, V.**, Leb, J.S., Shimada, Y.J., Weiner, S.D. and Takayama, H.*, 2024. Mitral regurgitation mechanisms related to systolic anterior motion in hypertrophic cardiomyopathy. *Journal of Thoracic Disease*, 16(1), p.26.
- J29. Brown, A.L., Salvador, M., Shi, L., Pfaller, M.R., Hu, Z., Harold, K.E., **Vedula, V.***, and Marsden, A.*, 2024. A modular framework for implicit 3D-0D coupling in cardiac mechanics. *Computer Methods in Applied Mechanics and Engineering*, 421, p.116764.
- J28. Li, R.L., Russ, J.B., Pierre-Louis, P., Kossar, A.P., Gibson, I., Paschalides, C., Herschmann, A.R., Ferrari, G., Bacha, E., Waisman, H., **Vedula, V.**, Kysar, J.W. and Kalfa, D.*, 2023. In vitro proof of concept of a first-generation growth-accommodating heart valved conduit for pediatric use. *Macromolecular Bioscience*, 2300011.
- ^{PF}J27. Zhu, C.[†], **Vedula, V.[†]**, Parker, D., Wilson, N., Shadden, S. and Marsden, A.*, 2022. svFSI: A multiphysics package for integrated cardiac modeling. *Journal of Open Source Software*, 7(78), p.4118.
- J26. Yamabe, T., Ginns, J., **Vedula, V.**, Leb, J.S., Shimada, Y.J., Weiner, S.D. and Takayama, H.*, 2022. Left ventricular remodeling following septal myectomy in hypertrophic obstructive cardiomyopathy. *Journal of Thoracic and Cardiovascular Surgery Open*, 11, pp.105–115.
- ^{PS}J25. Wang, H., Uhlmann, K., **Vedula, V.**, Balzani, D. and Varnik, F.*, 2022. Fluid-structure interaction simulation of tissue degradation and its effects on intra-aneurysm hemodynamics. *Biomechanics and Modeling in Mechanobiology*, 21(2), pp.671–683.
- ^{PS}J24. Bazzi, M.S., Balouchzadeh, R., Pavey, S.N., Quirk, J.D., Yanagisawa, H., **Vedula, V.**, Wagenseil, J.E. and Barocas, V.H.*, 2022. Experimental and mouse-specific computational models of the Fbln4^{SMKO} mouse to identify potential biomarkers for ascending thoracic aortic aneurysm. *Cardiovascular Engineering and Technology*, 13(4), pp.558–572.
- J23. Anzai, I., Hayashi, H., Nguyen, S., **Vedula, V.**, Leb, J.S., Shimada, Y.J., Weiner, S.D., Takayama, H.*, 2022. The septal band: how imaging and 3-dimensional printing guides septal myectomy. *Innovations*, 18(1), pp.11–15.
- J22. Russ, J.B., Li, R.L., Herschman, A.R., Waisman, H., **Vedula, V.**, Kysar, J.W. and Kalfa, D.*, 2021. Design optimization of a cardiovascular stent with application to a balloon expandable prosthetic heart valve. *Materials and Design*, 209, p.109977.
- ^{PS}J21. Wang, H., Balzani, D., **Vedula, V.**, Uhlmann, K. and Varnik, F.*, 2021. On the potential self-amplification of aneurysms due to tissue degradation and blood flow revealed from FSI simulations. *Frontiers in Physiology*, p.2164.
- ^{PF}J20. Roustaei, M., Baek, K.I., Wang, Z., Cavallero, S., Satta, S., Lai, A., O'Donnell, R., **Vedula, V.**, Ding, Y., Marsden, A.L. and Hsiai, T.*, 2022. Computational simulations of the 4-D microcirculatory network in zebrafish tail amputation and regeneration. *Journal of the Royal*

Society Interface, 19, p.20210898.

- ^{PF}J19. Chen, I.[†], **Vedula, V.[†]**, Malik, S., Liang, T., Chung, K., Nguyen, P., Sayed, N., Tsao, P., Giacomini, J., Marsden, A.* and Wu, J.*, 2021. Preoperative computed tomography angiography reveals leaflet-specific contribution to aortic stenosis influenced by local coronary factors. *Circulation: Cardiovascular Imaging*, 14(12), pp.1122–1132.

Published before starting independent faculty career (*, corresponding author):

- J18. Bäuml, K., **Vedula, V.**, Sailer, A.M., Seo, J., Chiu, P., Mistelbauer, G., Chan, F.P., Fischbein, M.P., Marsden, A.L. and Fleischmann, D.*, 2020. Fluid-structure interaction simulations of patient-specific aortic dissection. *Biomechanics and Modeling in Mechanobiology*, 19(5), pp.1607–1628.
- J17. Hsu, J.J., **Vedula, V.**, Baek, K.I., Chen, C., Chen, J., Chou, M.I., Lam, J., Subhedar, S., Wang, J., Ding, Y. and Chang, C.C.*, 2019. Contractile and hemodynamic forces coordinate Notch1b-mediated outflow tract valve formation. *Journal of Clinical Investigation Insight*, 4(10).
- J16. Lee, J.[†], **Vedula, V.[†]**, Baek, K.I., Chen, J., Hsu, J.J., Ding, Y., Chang, C.C., Kang, H., Small, A., Fei, P. and Chuong, C.M.*, 2018. Spatial and temporal variations in hemodynamic forces initiate cardiac trabeculation. *Journal of Clinical Investigation Insight*, 3(13).
- J15. Abiri, A., Ding, Y., Abiri, P., Packard, R.R.S., **Vedula, V.**, Marsden, A., Kuo, C.C.J. and Hsiai, T.K.*, 2018. Simulating developmental cardiac morphology in virtual reality using a deformable image registration approach. *Annals of Biomedical Engineering*, 46(12), pp.2177–2188.
- J14. **Vedula, V.**, Lee, J., Xu, H., Kuo, C.C.J., Hsiai, T.K. and Marsden, A.L.*, 2017. A method to quantify mechanobiological forces during zebrafish cardiac development using 4-D light sheet imaging and computational modeling. *PLoS Computational Biology*, 13(10), p.e1005828.
- J13. **Vedula, V.**, Seo, J.H., Lardo, A.C. and Mittal, R.*, 2016. Effect of trabeculae and papillary muscles on the hemodynamics of the left ventricle. *Theoretical and Computational Fluid Dynamics*, 30(1), pp.3–21.
- J12. Mittal, R.*, Seo, J.H., **Vedula, V.**, Choi, Y.J., Liu, H., Huang, H.H., Jain, S., Younes, L., Abraham, T. and George, R.T., 2016. Computational modeling of cardiac hemodynamics: current status and future outlook. *Journal of Computational Physics*, 305, pp.1065–1082.
- J11. **Vedula, V.**, George, R., Younes, L. and Mittal, R.*, 2015. Hemodynamics in the left atrium and its effect on ventricular flow patterns. *Journal of Biomechanical Engineering*, 137(11).
- J10. Choi, Y.J., Constantino, J., **Vedula, V.**, Trayanova, N. and Mittal, R.*, 2015. A new MRI-based model of heart function with coupled hemodynamics and application to normal and diseased canine left ventricles. *Frontiers in Bioengineering and Biotechnology*, 3, p.140.
- J09. **Vedula, V.**, Fortini, S., Seo, J.H., Querzoli, G. and Mittal, R.*, 2014. Computational modeling and validation of intraventricular flow in a simple model of the left ventricle. *Theoretical and Computational Fluid Dynamics*, 28(6), pp.589–604.
- J08. Seo, J.H., **Vedula, V.**, Abraham, T., Lardo, A.C., Dawoud, F., Luo, H. and Mittal, R.*, 2014. Effect of the mitral valve on diastolic flow patterns. *Physics of Fluids*, 26(12), p.121901.
- J07. Choi, Y.J., **Vedula, V.**, and Mittal, R.*, 2014. Computational study of the dynamics of a bileaflet mechanical heart valve in the mitral position. *Annals of Biomedical Engineering*, 42(8), pp.1668–1680.
- J06. Seo, J.H., **Vedula, V.**, Abraham, T. and Mittal, R.*, 2013. Multiphysics computational models for cardiac flow and virtual cardiography. *International Journal for Numerical Methods in Biomedical Engineering*, 29(8), pp.850–869.
- J05. Zheng, X., Seo, J.H., **Vedula, V.**, Abraham, T. and Mittal, R.*, 2012. Computational modeling and analysis of intracardiac flows in simple models of the left ventricle. *European Journal of Mechanics-B/Fluids*, 35, pp.31–39.

- J04. Sengupta, T.K.*, **Vijay, V.V.S.N.** and Singh, N., 2011. Universal instability modes in internal and external flows. *Computers and Fluids*, 40(1), pp.221–235.
- J03. Sengupta, T.K.*, Rajpoot, M.K., Saurabh, S. and **Vijay, V.V.S.N.**, 2011. Analysis of anisotropy of numerical wave solutions by high accuracy finite difference methods. *Journal of Computational Physics*, 230(1), pp.27–60.
- J02. Sengupta, T.K.*, **Vijay, V.V.S.N.** and Bhaumik, S., 2009. Further improvement and analysis of CCD scheme: dissipation discretization and de-aliasing properties. *Journal of Computational Physics*, 228(17), pp.6150–6168.
- J01. Sengupta, T.K.*, Lakshmanan, V. and **Vijay, V.V.S.N.**, 2009. A new combined stable and dispersion relation preserving compact scheme for non-periodic problems. *Journal of Computational Physics*, 228(8), pp.3048–3071.

Ph.D. Thesis

- 1. **Vedula, V.**, *Image-based computational modeling of intracardiac flows*, Johns Hopkins University, 2015.

Patent Applications

- 1. Columbia University has filed a provisional patent application on methods for borderline left ventricle patients with inventors **Vijay Vedula**, David Kalfa, and Yurui Chen. Filed July 15, 2025; revised November 13, 2025.
- 2. Columbia University has filed a provisional patent application on methods for evaluating the severity of coronary artery stenosis with inventors **Vijay Vedula**, Ian Y. Chen, Yurui Chen, and Hannah J. Zhai. Filed October 27, 2025.

Invited Talks

University and Virtual Seminar Series

- T25. Scheduled Fall 2026. *Revisiting myocardial mechanics computation: new insights and approaches*, Northeastern University.
- T24. April 24, 2026. *From myocardial to myometrial digital twins*. University of Connecticut, Storrs, CT.
- T23. April 10, 2026. *Multifidelity models of blood flow: from lab to clinic*. CEA FM Seminar Series, Johns Hopkins University, Baltimore, MD.
- T22. January 21, 2026. *Towards digital twins using multiscale multiphysics models for cardiovascular disease and beyond*. Virtual Seminar for CVIRL lab, University of California, Los Angeles, CA.
- T21. October 13, 2025. *Towards digital twins using multiscale multiphysics models for cardiovascular disease and beyond*. Biomechanics and Medical Devices Seminar Series, University of California, San Diego, CA.
- T20. April 17, 2025. *Digital twins for multiscale multiphysics models for cardiovascular disease and beyond*. Inaugural Edition of ASME TCOM Fluids Early Faculty Virtual Seminar Series.
- T19. April 8, 2022. *Computational modeling of cardiac biomechanics for clinical decision-making and support*. Virtual Seminar for the Barocas Lab at University of Minnesota, Twin Cities.
- T18. April 1, 2022. *Computational modeling of cardiac biomechanics for clinical decision-making and support*. Virtual MAE Seminar Series, Syracuse University, Syracuse, NY.
- T17. June 30, 2021. *Towards personalized models of cardiac function in disease and development*. Virtual FEM Seminar Series, University of Pretoria, Hatfield, South Africa.

- T16. May 12, 2021. Virtual Seminar for Initiative for Computational Science and Engineering (iCSE) Research Day, Columbia University, New York, NY.
- T15. April 12, 2021. *Towards personalized models of cardiac function in disease and development*. Virtual Seminar, Indian Institute of Technology Bhubaneswar, India.
- T14. December 9, 2020. *Computational modeling of cardiac biomechanics for clinical decision-making and support*. Virtual Biomechanics Seminar, Columbia University, New York, NY.
- T13. October 8, 2020. *Towards an integrated model of the heart*. Virtual Seminar for the Flow Physics and Computation Lab (FPCL), Johns Hopkins University, Baltimore, MD.
- T12. February 20, 2020. *Computational modeling of cardiovascular biomechanics in disease and development*. 4th Annual Engineering in Medicine (EIM) Symposium, Columbia University, New York, NY.
- T11. April 3, 2019. *Multiphysics model of cardiac function*. Columbia University, New York, NY.
- T10. March 5, 2019. *Towards personalized models of heart function in disease and development*. Michigan Technological University, Houghton, MI.
- T09. October 15, 2018. *Ventricular hemodynamics in disease and development*. Theodore Von Kármán Fellowship Seminar at RWTH Aachen University.
- T08. April 17, 2018. *Ventricular hemodynamics in disease and development*. University of Washington, Seattle, WA.
- T07. April 16, 2018. *Ventricular hemodynamics in disease and development*. Seattle Children's Hospital, Seattle, WA.
- T06. March 13, 2018. *Ventricular hemodynamics in disease and development*. University of California, Los Angeles, CA.
- T05. January 29, 2018. *Ventricular hemodynamics in disease and development*. University of Utah, Salt Lake City, UT.
- T04. October 16, 2017. *Ventricular hemodynamics in disease and development*. Stanford Biomechanics Seminar Series, Stanford University, Palo Alto, CA.
- T03. February 21, 2017. *Computational modeling of cardiac hemodynamics*. Institute for Computational and Mathematical Engineering (ICME) Seminar Series, Stanford University.
- T02. February 15, 2017. *Computational modeling of cardiac hemodynamics: from canonical to patient-specific models*. Purdue University, Lafayette, IN.
- T01. Spring 2016. *Computational modeling of cardiac hemodynamics: from simplified canonical models to patient-specific*. Mechanical Engineering Seminar at University of California Berkeley, CA.

Guest Lectures

- G03. October 2020. Guest lecture on biofluid dynamics and computation for MECE E3100 Introduction to Fluid Mechanics Course at Columbia University, New York, NY.
- G02. Autumn 2019, 2017. Guest lecture on cardiac mechanics for CME 285 Computational Modeling in the Cardiovascular System at Stanford University, Palo Alto, CA.
- G01. October 2018. Invited guest lecture on modeling ventricular hemodynamics at RWTH Aachen University as part of the Theodore Von Kármán Visiting Scientist Fellowship.

Conferences and Symposia

- C71. Mergler, O., Mixon, P., Myers, K., and **Vedula, V.**, *Towards a uterine electromechanical digital twin during late pregnancy*. 10th World Congress of Biomechanics, Vancouver, Canada, July 11-15, 2026.
- C70. Gan, B., Yue, L., Shi, L., and **Vedula, V.**, *Personalized left atrial mechanics with experimentally-informed tissue heterogeneity*. 9th International Conference on Computational and Mathematical Biomedical Engineering (CMBE), Kobe, Japan, June 22-24, 2026.

- C69. Zhai, H., Chen, Y., Yuichiro, K., Takayama, H., and **Vedula, V.**, *A systematic study of the impact of modeling sensitivities on ascending aortic hemodynamics*. 9th International Conference on Computational and Mathematical Biomedical Engineering (CMBE), Kobe, Japan, June 22-24, 2026.
- C68. Gan, B., Feng, X., Hong, S., Shi, L., and **Vedula, V.**, *A novel GNN-based emulator for cardiac electrophysiology and mechanics*. 20th U.S. National Congress on Theoretical and Applied Mechanics (USNC-TAM), Pasadena, CA, USA, June 21-25, 2026.
- C67. Gan, B., Zhai, H., Haider, H., Shi, L., and **Vedula, V.**, *Hemodynamic impact of geometrical and structural heterogeneity using left atrial digital twins*. 78th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Houston, TX, USA, November 23-25, 2025.
- C66. Mergler, O., Mixon, P., Laughlin, A., Shi, L., Myers, K., and **Vedula, V.**, *Image-based computational modeling of uterine mechanics with excitation and contraction during late pregnancy*. Biomedical Engineering Society (BMES) Annual Meeting, San Diego, CA, USA, October 8-12, 2025.
- C65. Zhai, H., Chen, Y., Hohri, Y., Takayama, H., and **Vedula, V.**, *Sensitivities of simulating blood flow in ascending aorta with applications to ascending thoracic aortic aneurysms*. 10th International Biofluids and Mechanobiology Symposium (IBMS10), Irvine, CA, September 5-7, 2025.
- C64. Chen, Y., Zhai, H., Ni, Y., Chen, I.Y., and **Vedula, V.**, *Hemodynamic impact of myocardial motion on epicardial coronary arteries*. 10th International Biofluids and Mechanobiology Symposium (IBMS10), Irvine, CA, September 5-7, 2025.
- C63. Shi, L., Takayama, H., and **Vedula, V.**, *HeartSimSage: a graph neural network emulator for fast and scalable digital twins of cardiac biomechanics*. 18th US National Congress on Computational Mechanics (USNCCM18), Chicago, IL, USA, July 20-24, 2025.
- C62. Mergler, O., Mixon, P., Laughlin, A., Shi, L., Myers, K., and **Vedula, V.**, *Image-based computational modeling of uterine mechanics with excitation during late pregnancy*. 18th US National Congress on Computational Mechanics (USNCCM18), Chicago, IL, USA, July 20-24, 2025.
- C61. Haider, H., Thalpaguruge, N., Hohri, Y., Shi, L., Takayama, H., and **Vedula, V.**, *Cardiac digital twins for hypertrophic obstructive cardiomyopathy: the role of epicardial boundary conditions and myocardial fibrosis*. 18th US National Congress on Computational Mechanics (USNCCM18), Chicago, IL, USA, July 20-24, 2025.
- C60. Zhai, H., Chen, Y., Hohri, Y., Takayama, H., and **Vedula, V.**, *Fluid-structure interaction analysis of repaired ascending aorta with preserved aortic valve*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C59. Mixon, P. and **Vedula, V.**, *The role of ion currents and gap junctions in regulating the contractility of the murine uterus during late pregnancy*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C58. Mergler, O., Mixon, P., Laughlin, A., Shi, L., Myers, K., and **Vedula, V.**, *Image-based computational modeling of uterine mechanics with excitation during late pregnancy*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C57. Haider, H., Thalpaguruge, N., Hohri, Y., Shi, L., Leb, J., Takayama, H., and **Vedula, V.**, *Cardiac digital twins for hypertrophic obstructive cardiomyopathy*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C56. Gan, B., Haider, H., Shi, L., and **Vedula, V.**, *Digital twin of the left atrium: toward a personalized multi-scale and multi-physics model of atrial biomechanics*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C55. Chen, Y., Zhai, H., Chen, I.Y., and **Vedula, V.**, *Effect of myocardial motion on coronary*

- hemodynamics*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C54. Brown, A.L., Shi, L., Salvador, M., Kong, F., Chen, I.Y., **Vedula, V.**, and Marsden, A.L., *Comparative analysis of anatomic models in personalized cardiac electromechanics simulations*. Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
- C53. **Vedula, V.**, Shi, L., Gan, B., Haider, H., Zhang, C., and Chen, I., *Simulating blood flow in left atrium using personalized multiscale electromechanics modeling framework*. 77th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Salt Lake City, UT, USA, November 24-26, 2024.
- C52. Chen, Y., Zhai, H., Ni, Y., and **Vedula, V.**, *Effect of myocardial motion on coronary hemodynamics*. 77th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Salt Lake City, UT, USA, November 24-26, 2024.
- C51. Haider, H., Shi, L., Takayama, H., and **Vedula, V.**, *Modeling left ventricular mechanics in patients with hypertrophic obstructive cardiomyopathy*. 16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics (WCCM-PANACM), Vancouver, Canada, July 21-26, 2024.
- C50. Shi, L., Brown, A.L., Kong, F., Zhang, C., Haider, H., and **Vedula, V.**, *Patient-specific modeling of left atrial electromechanics*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Lake Geneva, WI, USA, June 11-14, 2024.
- C49. Zhai, H., Chen, Y., Hohri, Y., Takayama, H., and **Vedula, V.**, *Hemodynamic analysis of sinotubular junction plication techniques during ascending aortic replacement*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Lake Geneva, WI, USA, June 11-14, 2024.
- C48. Chen, Y., Zhai, H., Takayama, H., and **Vedula, V.**, *Multiscale modeling of blood flow in aortic root aneurysms*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Lake Geneva, WI, USA, June 11-14, 2024.
- C47. Brown, A.L., Shi, L., Salvador, M., Kong, F., **Vedula, V.**, and Marsden, A.L., *Personalized models of cardiac mechanics: left ventricle vs. biventricle models*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Lake Geneva, WI, USA, June 11-14, 2024.
- C46. Shi, L. and **Vedula, V.**, *A graph neural networks (GNNs)-based surrogate model for personalized biventricular cardiac mechanics*. 17th US National Congress on Computational Mechanics (USNCCM), Albuquerque, NM, USA, July 23-27, 2023.
- C45. Shi, L., Chen, Y., and **Vedula, V.**, *A three-node rotation-free Kirchhoff-Love shell formulation for cardiovascular applications*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C, Virtual), Vail, CO, USA, June 4-8, 2023.
- C44. Chen, Y., Anzai, I., Tran, J., Kalfa, D., and **Vedula, V.**, *Predicting hemodynamic outcomes in patients with borderline left ventricles under uncertainty*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C, Virtual), Vail, CO, USA, June 4-8, 2023.
- C43. **Vedula, V.**, Chen, Y., Anzai, I., Tran, J., and Kalfa, D., *Initial validation of a predictive personalized computational model for patients with borderline left ventricles*. Single Ventricle Investigator Meeting (SVIM), Baltimore, MD, USA, October 6-9, 2022.
- C42. **Vedula, V.**, Chen, Y., Shi, L., Anzai, I., Kalfa, D., and Takayama, H., *Towards planning cardiac surgery using personalized computational modeling*. International Mechanical Engineering Congress and Exposition (IMECE), Columbus, OH, USA, October 30 – November 3, 2022.
- C41. Shi, L., Takayama, H., and **Vedula, V.**, *Modeling ventricular mechanics in patients with obstructive hypertrophic cardiomyopathy*. Summer Biomechanics, Bioengineering, and

Biotransport Conference (SB3C), Chesapeake Bay, MD, USA, June 20-23, 2022.

- C40. Chen, Y., Anzai, I., Bacha, E., **Vedula, V.***, and Kalfa, D.*, *Early validation of predictive personalized computational model for patients with borderline left ventricles*. 102nd Annual Meeting of the American Association for Thoracic Surgery (AATS), Boston, MA, USA, May 14-17, 2022.
- C39. Yamabe, T., Ginns, J., **Vedula, V.**, Leb, J.S., Shimada, Y.J., Weiner, S.D., and Takayama, H., *Left ventricular remodeling following septal myectomy in hypertrophic obstructive cardiomyopathy*. 101st American Association for Thoracic Surgery (AATS), Virtual, April 30 – May 2, 2021.
- C38. Tikenogullari, O.Z., Peirlinck, M., **Vedula, V.**, Kuhl, E., and Marsden, A., *Patient-specific characterization of hypoplastic left heart mechanics*. 16th US National Congress on Computational Mechanics (USCNCCM), (Virtual) Chicago, IL, July 25-29, 2021.
- C37. Shim, J.J., Mass, S.A., **Vedula, V.**, Hung, C.T., Weiss, J.A., and Ateshian, G.A., *A computational fluid dynamics formulation with solute transport derived from mixture theory*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Virtual, June 14-18, 2021.
- C36. Chen, Y., Anzai, I., Kalfa, D., and **Vedula, V.**, *Computational modeling of borderline left ventricular circulation for clinical decision-making*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Virtual, June 14-18, 2021.
- C35. Zhu, C., **Vedula, V.**, and Shadden, S., *A row and column scaling preconditioner for efficient fluid-structure modeling in cardiovascular system*. 73rd Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Virtual, November 22-24, 2020.
- C34. Zhu, C., **Vedula, V.**, Liu, J., Marsden, A.L., and Shadden, S.C., *Cardiac contraction modeling using a variational multiscale approach*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Virtual, June 17-20, 2020.
- C33. Chen, I.Y., **Vedula, V.**, Malik, S.B., Liang, T., Chung, K.S., Sayed, N., Tsao, P.S., Giacomini, J.C., Marsden, A.L. and Wu, J.C., *Preoperative CTA reveals leaflet-specific contribution to aortic stenosis*. Circulation, 142(Suppl 3), pp.A16300, 2019. American Heart Association (AHA) Scientific Sessions 2020, Virtual, November 13-17, 2020.
- C32. **Vedula, V.**, Liu, J., Tikenogullari, O., Kuhl, E., and Marsden, A.L., *A multiphysics model of cardiac function - methods and verification*. Computer Methods in Biomechanics and Biomedical Engineering (CMBBE) 2019, New York, NY, USA, August 14-16, 2019.
- C31. Marsden, A.L., **Vedula, V.**, Tikenogullari, O., and Kuhl, E., *Towards patient-specific multiphysics modeling of cardiac function*. Society of Engineering Science (SES) 2019, St Louis, MO, USA, October 13-15, 2019.
- C30. Hsu, J., **Vedula, V.**, Baek, K.I., Chen, C., Ding, Y., Tintut, Y., Marsden, A., and Hsiai, T., *Contractile and hemodynamic forces promote cardiac valve development via Notch1b-mediated Endothelial-to-Mesenchymal transition*. Circulation, 138(Suppl 1), A14393, 2018. American Heart Association (AHA) Scientific Sessions 2019, Philadelphia, PA, USA, November 16-18, 2019.
- C29. Zhu, C., Seo, J., **Vedula, V.**, and Mittal, R., *A highly scalable sharp-interface immersed boundary method for large-scale parallel computers*. 23rd American Institute of Aeronautics and Astronautics (AIAA) Computational Fluid Dynamics (CFD) Conference, Denver, CO, USA, June 5-9, 2017.
- C28. **Vedula, V.**, and Marsden, A., *Patient specific modeling of intraventricular hemodynamics*. 70th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Denver, CO, USA, November 20-22, 2017.
- C27. Bäumlér, K., **Vedula, V.**, Sailer, A., Marsden, A., and Fleischmann, D., *Computer simulations of blood flow in aortic dissections with FSI*. Summer Biomechanics, Bioengineering, and

- Biotransport Conference (SB3C), Tucson, AZ, USA, June 21-24, 2017.
- C26. **Vedula, V.**, Lee, J., Xu, H., Kuo, C.-C., Hsiai, T., and Marsden, A., *A 4-D computational study of developmental cardiac mechanics in zebrafish embryos*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Tucson, AZ, USA, June 21-24, 2017.
- C25. **Vedula, V.**, Feinstein, J., and Marsden, A., *Patient-specific modeling of intraventricular hemodynamics in single ventricle physiology*. 5th International Conference on Computational and Mathematical Biomedical Engineering (CMBE), Pittsburgh, PA, USA, April 10-12, 2017.
- C24. Liu, J., **Vedula, V.**, and Marsden, A., *Variational multiscale formulation for incompressible solid dynamics with particular references to patient-specific modeling*. 5th International Conference on Computational and Mathematical Biomedical Engineering (CMBE), Pittsburgh, PA, USA, April 10-12, 2017.
- C23. Lee, J., **Vedula, V.**, Ding, Y., Chen, J., Marsden, A., and Hsiai, T., *Spatiotemporal variations in intracardiac shear stress differentially modulate trabeculation*. Circulation, 136(Suppl 1), A19511, 2017. American Heart Association (AHA) Scientific Sessions 2018, Chicago, IL, USA, November 10-12, 2018.
- C22. Hsu, J., Chen, J., **Vedula, V.**, Lee, J., Ding, Y., Marsden, A., and Hsiai, T., *Light-sheet microscopy and CFD to evaluate intracardiac hemodynamic modulation on cardiac valve development*. Biomedical Engineering Society (BMES) Annual Meeting, Phoenix, AZ, USA, October 11-14, 2017.
- C21. Hsu, J., Chen, J., **Vedula, V.**, Lee, J., Ding, Y., Marsden, A., and Hsiai, T., *4-D light-sheet imaging and computation reveal oscillatory shear index mediates endocardial notch1b signaling*. American Heart Association (AHA) Scientific Sessions 2017, Anaheim, CA, USA, November 11-15, 2017.
- C20. Bäuml, K., Sailer, A.M., **Vedula, V.**, Chiu, P., Fischbein, A., Marsden, A., and Fleischmann, D., *Computer simulation of blood flow in patients with aortic dissection: Validation with Quantitative MR Flow*. International Society for Magnetic Resonance in Medicine (ISMRM) Workshop, San Francisco, CA, USA, October 20-23, 2016.
- C19. **Vedula, V.**, Feinstein, J., and Marsden, A., *Patient-specific modeling of intraventricular hemodynamics in single-ventricle physiology*. 69th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Portland, OR, USA, November 20-22, 2016.
- C18. Bäuml, K., **Vedula, V.**, Karmann, A.S., Marsden, A., and Fleischmann, D., *Simulations of blood flow in patient-specific aortic dissections with a deformable wall model*. 69th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Portland, OR, USA, November 20-22, 2016.
- C17. **Vedula, V.**, Feinstein, J., and Marsden, A., *Patient-specific modeling of intraventricular hemodynamics in single-ventricle physiology*. Stanford Annual Bioengineering Research Retreat, Santa Cruz, CA, USA, April 16, 2016.
- C16. **Vedula, V.**, Lee, J., Ding, Y., Marsden, A., and Hsiai, T., *Hemodynamic implications of ventricular trabeculation during cardiac morphogenesis*. 5th International Conference on Engineering Frontiers in Pediatrics and Congenital Heart Disease, Orlando, FL, USA, June 2016. (*NSF-sponsored Young Investigator & Travel Award*)
- C15. **Vedula, V.**, Feinstein, J., and Marsden, A., *Patient-specific modeling of intraventricular hemodynamics in single-ventricle physiology*. 5th International Conference on Engineering Frontiers in Pediatrics and Congenital Heart Disease, Orlando, FL, USA, June 2016. (*NSF-sponsored Young Investigator & Travel Award*)
- C14. **Vedula, V.**, Lee, J., Hsiai, T., and Marsden, A., *Effect of trabeculae on the hemodynamics of an embryonic left ventricle*. 68th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Boston, MA, USA, November 22-24, 2015.
- C13. **Vedula, V.**, Seo, J.H., Shoele, K., George, R., Younes, L., and Mittal, R., *Image-based flow*

- modeling in a two-chamber model of the left heart*. 67th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), San Francisco, CA, USA, November 23-25, 2014.
- C12. **Vedula, V.** and Mittal, R., *Image based modeling of left-ventricular flows*. Johns Hopkins University Center for Environmental and Applied Fluid Mechanics (JHU-CEAFM) - Burger's Annual Symposium, College Park, MD, USA, May 2014.
- C11. Seo, J.H., K. Shoele, **Vedula, V.**, and Mittal, R., *Simulation of Intraventricular Flows with Physiological Mitral Valve Models*. 7th World Congress of Biomechanics, Boston, MA, USA, July 6-11, 2014.
- C10. **Vedula, V.**, Seo, J.H., and Mittal, R., *Effects of trabeculations on the hemodynamics of the left ventricle: a computational study*. 66th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Pittsburgh, PA, USA, November 24-26, 2013.
- C09. Seo, J.H., **Vedula, V.**, George, R., and Mittal, R., *Coupled hemodynamic-biochemical modeling of thrombus formation in infarcted left ventricles*. 66th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Pittsburgh PA, USA, November 24-26, 2013.
- C08. **Vedula, V.**, Seo, J.H., and Mittal, R., *Modeling of blood flow in normal and diseased left-ventricles*. SIAM Conference on Computational Science and Engineering, Boston, MA, USA, February 25 – March 1, 2013.
- C07. **Vedula, V.**, Seo, J.H., Fortini, S., Querzoli, G., and Mittal, R., *Computational modeling of the effects of myocardial infarction on left ventricular hemodynamics*. 65th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), San Diego, CA, USA, November 18-20, 2012.
- C06. **Vedula, V.**, Seo, J.H., Zheng, X., Abraham, T., and Mittal, R., *Computational modeling and analysis of intracardiac flows in normal and diseased hearts*. Johns Hopkins University Center for Environmental and Applied Fluid Mechanics (JHU-CEAFM) - Burger's Annual Symposium, College Park MD, USA, May 2012.
- C05. Seo, J.H., **Vedula, V.**, and Mittal, R., *Multiphysics computational models for cardiac flow and virtual cardiology*. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS), Vienna, Austria, September 10-14, 2012.
- C04. Seo, J.H., **Vedula, V.**, Eslami, P., Mittal, R., and Abraham, T., *Computational fluid dynamics based analysis of cardiovascular flows*. Johns Hopkins 3rd Annual Cardiovascular Research Retreat, Jun 2012.
- C03. **Vedula, V.**, Seo, J.H., and Mittal, R., *Virtual cardiac surgery using CFD: application to septal myectomy in obstructive hypertrophic cardiomyopathy*. 64th Annual Meeting of the American Physical Society Division of Fluid Dynamics (APS-DFD), Baltimore, MD, USA, November 20-22, 2011.
- C02. **Vedula, V.**, Zheng, X., Abraham, T., and Mittal, R., *Computational modeling and analysis of intracardiac flows in normal and diseased hearts*. 2011 Biomedical Engineering Society (BMES) Annual Meeting, Hartford, CT, USA, October 12-15, 2011.
- C01. **Vijay, V.V.S.N.**, Singh, N., and Sengupta, T.K., *Computing internal and external flows undergoing instability and bifurcations*. 5th M.I.T. Conference on Computational Fluid and Solid Mechanics, Cambridge, MA, USA, June 17-19, 2009.

Current Research Group – Cardiovascular Biomechanics Research Lab

1. Yurui Chen, Ph.D. Candidate Fall 2020 – present
 Project: *Development and application of personalized lumped parameter (0D) and multiscale (3D-0D) computational models of blood flow for cardiovascular disease applications.*
 Defended: October 23, 2025
 Expected Completion: April 2026
2. Hannah Zhai, Ph.D. Candidate Fall 2023 – present
 Project: *Unraveling the biomechanics of ascending aortic aneurysms*
 ** NSF GRF 2024
 Expected Completion: Fall 2028
3. Boyang (Bryan) Gan, Ph.D. Candidate Fall 2024 – present
 Project: *Leveraging multiphysics modeling and AI for left atrial digital twins*
 Expected Completion: Fall 2029
4. Olivia Mergler (co-advised with Prof. Kristin Myers), Ph.D. Student Fall 2024 – present
 Project: *Image-based modeling of uterus during late pregnancy*
 ** NSF GRF 2024
 ** Co-advised with Prof. Kristin Myers
 Expected Completion: Fall 2029
5. Parker Mixon, Ph.D. Student Fall 2025 – present
 Project: *Characterizing myometrial activation during late pregnancy using multiscale modeling*
 Expected Completion: Fall 2030
6. Keyu Wan, Ph.D. Student Fall 2026 (incoming)
 Project: *Multiscale multi-fidelity modeling of coronary microvascular disease*
 Expected Completion: Fall 2031
7. Ashley Hiebing, Postdoctoral Research Scientist Spring 2026 – present
 Project: *Personalized multiscale cardiac mechanics models with growth*
 Expected Completion: Spring 2029
8. Shaheer Saleh, M.S. researcher Fall 2025 – present
 Project: *Sensitivity of left atrial hemodynamics to boundary conditions*
 Expected Completion: Spring 2027
9. Xin Feng, M.S. researcher Spring 2026 – present
 Project: *Sensitivities of left atrial electromechanics in health and disease*
 Expected Completion: Spring 2027
10. Shenghao Hong, M.S. researcher Spring 2026 – present
 Project: *Automatic framework for personalized cardiac electromechanics*
 Expected Completion: Spring 2027
11. Eva Melendrez, undergraduate researcher Fall 2024 – present
 Project: *Simulating blood flow in ascending aorta under microgravity*
 Expected Completion: Spring 2027
12. Kristina Isabella Dee, undergraduate researcher Spring 2026 – present
 Project: *Uterine mechanics during late pregnancy*
 Expected Completion: Spring 2027
13. Kashvi Aggarwal, Visiting undergraduate researcher January 2026 – June 2026
 Home Institution: IIT Goa, India
 Project: *Hemodynamics ascending aortic aneurysms and stented grafts post repair*

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|---|-----------------------------|
| 14. Veronika Pak, Visiting M.S. researcher
Home Institution: EPFL, Switzerland
Project: <i>Multiscale modeling of aortic valve calcification</i> | March 2026 – September 2026 |
| 15. Alice Roscelli, Visiting M.S. researcher
Home Institution: Mines Paris PSL
Project: <i>Neural networks to accelerate cardiac activation time prediction</i> | April 2026 – September 2026 |

Awards and Honors to Trainees

- | | |
|---|-------------|
| 1. Travel award from World Congress of Biomechanics, Olivia Mergler | 2026 |
| 2. Summer Research Fellowship from Columbia SEAS, Kristina Isabella Dee | 2026 |
| 3. Summer Research Fellowship from Columbia SEAS, Shenghao Hong | 2026 |
| 4. Finalist, ASME-BED SBC M.S. Student Paper Competition, Parker Mixon | 2025 |
| 5. SEAS Fellow for Summer Research, Eva Melendrez | 2025 |
| 6. Summer Research Fellowship from Columbia SEAS, Nathasha Thalpaguruge | 2025 |
| 7. Summer Research Fellowship from Columbia SEAS, Yiding Wen | 2025 |
| 8. NSF GRFP, Hannah Haider (applied and awarded while in Vedula lab) | 2025 – 2030 |
| 9. NSF GRFP, Hannah Zhai (applied and awarded while in Vedula lab) | 2024 – 2029 |
| 10. Travel award from 17th USNCCM Conference, Lei Shi | 2023 |
| 11. Bonomi Summer Research Scholarship from Columbia SEAS, Elise Yang | 2022 |

Undergraduate Student Research Supervised (completed)

- | | |
|-------------------------|-------------------------|
| 1. Michael Garcia | Fall 2024 – Spring 2025 |
| 2. Natasha Thalpaguruge | Fall 2024 – Spring 2025 |
| 3. Prince Kagunyi | Fall 2023 – Spring 2024 |
| 4. Elise Yang | Summer 2022 – Fall 2022 |

Masters Student Research Supervised (completed)

- | | |
|---------------------------------|---------------------------|
| 1. Yiding Wen | Fall 2024 – Fall 2025 |
| 2. Hannah Haider | Fall 2023 – Summer 2025 |
| 3. Parker Mixon | Summer 2024 – Summer 2025 |
| 4. Gabrielle Nour Lais Roustand | Fall 2024 – Spring 2025 |
| 5. Chen Shirley Zhang | Fall 2023 – Spring 2024 |
| 6. Yeqing Ni | Fall 2023 – Spring 2024 |
| 7. Haoyang Chen | Summer 2022 – Fall 2022 |
| 8. Xinyi Lu | Summer 2022 – Fall 2022 |
| 9. Yurui Chen | Summer 2020 |

Teaching Experience

****Overall Instructor and Course Evaluation Scale:**

****1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent**

MECE E3100, Introduction to Mechanics of Fluids, undergraduate course

Fall 2022, 87 students:	Instructor evaluation – 3.5;	Course evaluation – 3.5
Fall 2025, 91 students:	Instructor evaluation – 3.24;	Course evaluation – 3.36

MECE E3311, Heat Transfer, undergraduate course

Spring 2026, 114 students: Instructor evaluation – 4.1; Course evaluation – 3.97

MECE E4100, Mechanics of Fluids, intermediate course for graduates and senior undergraduates

Spring 2020, 6 students: Instructor evaluation – 4.5; Course evaluation – 3.5

Spring 2022, 9 students: Instructor evaluation – 5.0; Course evaluation – 4.3

MECE E6102, Computational Heat Transfer and Fluid Flow, advanced graduate course

Spring 2021, 5 students: Instructor evaluation – 4.5; Course evaluation – 4.0

Spring 2023, 6 students: Instructor evaluation – 4.0; Course evaluation – 4.0

Spring 2025, 10 students: Instructor evaluation – 4.0; Course evaluation – 4.0

MECE E6106, Finite Element Method for Fluid Flow and Fluid-Structure Interactions, advanced graduate course

Fall 2021, 4 students: Instructor evaluation – 3.5; Course evaluation – 4.0

Fall 2024, 13 students: Instructor evaluation – 5.0; Course evaluation – 5.0

Teaching Innovations

I have created and received approval from the Committee on Instruction (COI) for a new course in my computation-focused research area: MECE E6106 Finite Element Method for Fluid Flow and Fluid-Structure Interactions. This course introduces our students to advanced finite element analysis and its application to modeling the mechanics of fluid motion and its interactions with deformable structures, such as blood flow through compliant vessels. I taught the course in Fall 2021 and Fall 2024, and plan to teach it in Fall 2026.

Outreach & Broad Engagement

1. Summer@SEAS, Columbia University 06/2026 – 08/2026
**will mentor 2 Columbia Engineering students through the summer, including 1 M.S. (Shenghao Hong) and 1 undergraduate woman (Kristina Isabella Dee)
2. Columbia Outreach Engineering the Next Generation (ENG) 07/2025 – 08/2025
**mentored 3 underrepresented minority high school students, including 1 woman (Destin Huang, Stephania Reinozo, and Andrew Tsai)
3. Summer@SEAS, Columbia University 06/2025 – 08/2025
**mentored 3 Columbia Engineering students, including 1 M.S. student (Yiding Wen), 2 women undergraduates with 1 underrepresented minority (Eva Melendrez, Nathasha Thalpaguruge)
4. Columbia Outreach Engineering the Next Generation (ENG) 07/2024 – 08/2024
**mentored 1 underrepresented minority high school student (Temitope Tereao)
5. Summer@SEAS, Columbia University 06/2022 – 08/2022
**mentored 1 Columbia Engineering undergraduate woman (Elise Yang)
6. Johns Hopkins Center for Talented Youth (CTY), Stanford University 06/2018
**demonstrated experiments using vortex rings for middle-high-school students
7. Johns Hopkins Center for Talented Youth (CTY), Stanford University 06/2017
**used the Stanford Virtual Heart model to explain complex congenital heart disease conditions in an immersive virtual reality environment
8. La Jolla Elementary School Family Science Night, San Diego 03/2015
**designed experiments to demonstrate Bernoulli's principle in fluid mechanics to elementary school children and get them excited about science
9. Prayas, Indian Institute of Technology (IIT) Kanpur, India Spring 2008
**volunteered to tutor underprivileged elementary school children
10. Aeromodelling Club, Indian Institute of Technology (IIT) Kanpur, India Summer 2008

****volunteered to educate high school students and undergraduates on the basics of flight and help them design, build, and fly airplanes made from paper and wood**

Service

Department of Mechanical Engineering, Columbia University

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|---|----------------|
| 1. M.S. Admissions Czar, Graduate Committee | 2025 – present |
| 2. Member, Graduate Committee | 2020 – present |
| 3. Coordinator, Department Colloquium and Seminar Series | 2023 – present |
| 4. Member, DEI Committee | 2023 |
| 5. Department Scribe, Faculty Meetings | 2020 – 2022 |
| 6. Speaker, Biomechanics Seminar Series | 12/9/2020 |
| 7. Speaker, MECE E3100, Introduction to Mechanics of Fluids Course | 10/2020 |
| 8. Speaker, Mechanical Engineering Graduate Students Association (MEGA) | 2020 |

Doctoral Theses, As Reader on Committee

1. Yuezhi Wu, *Data-driven rural communities electrification planning in sub-Saharan Africa*, advisor: Vijay Modi, defended in March 2026
2. Alicia B. Dagle, *Automated uterocervical feature extraction from transvaginal ultrasound images to inform preterm birth prediction and digital twin models*, advisor: Kristin Myers, defended in June 2025
3. Erin Louwagie, *Development and implementation of a parametric patient-specific computational approach to study pregnancy biomechanics*, advisor: Kristin Myers, defended in May 2024
4. Carly LaGrotta, *Multiscale data-driven modeling of foundational combustion reaction systems*, advisor: Michael Burke, defended in February 2023
5. Nicole Lee, *Identification of the mechanical role of extracellular matrix components in cervical remodeling*, advisor: Kristin Myers, defended in August 2022
6. Richard Li, *Toward growth-accommodating polymeric heart valves with graphene-network reinforcement*, advisor: Jeffrey Kysar, defended in September 2021
7. Lei Shi, *On the mechanical experiments and modeling of human cervix*, advisor: Kristin Myers, defended in June 2021
8. Jay Shim, *A multiphasic fluid-structure interaction formulation based on mixture theory and its finite element implementation in FEBio*, advisor: Gerard Ateshian, defended in April 2021

Doctoral Thesis Proposals

1. Chaoqun Zhou, *Facilitate microneedle enabled safe inner ear delivery and diagnosis*, advisor: Jeffrey Kysar, proposed in January 2025
2. Hasan Siddiqui, *Irrigation detection in sub-Saharan Africa*, advisor: Vijay Modi, proposed in December 2024
3. Erin Louwagie, *Development and implementation of a parametric patient-specific computational approach to study pregnancy biomechanics*, advisor: Kristin Myers, proposed in May 2023
4. Carly LaGrotta, *Multiscale data-driven modeling of foundational combustion reaction systems*, advisor: Michael Burke, proposed in September 2021
5. Richard Li, *Toward growth-accommodating polymeric heart valves with graphene-network reinforcement*, advisor: Jeffrey Kysar, proposed in February 2021

Professional Service

Conference, Mini-symposium, and Workshop Organizer, Session Chair

1. Co-chair, *Machine learning in cardiac biomechanics*, 10th International Biofluid Mechanics and Mechanobiology Symposium (IBMS10), Irvine, CA, USA, September 5-7, 2025.
2. Co-chair, *Biofluids*, Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
3. Co-chair, *Cardiac mechanics*, Summer Bioengineering Conference (SBC), Santa Ana Pueblo, NM, USA, June 22-25, 2025.
4. Co-organizer with Noelia Grande-Gutiérrez, *Advances in computational modeling of thrombosis: methods and applications*, Computer Methods in Biomechanics and Biomedical Engineering (CMBBE) Conference, Barcelona, Spain, September 3-5, 2025.
5. Co-chair, *Biofluids*, Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Chesapeake Bay, MD, USA, June 20-23, 2022.
6. Co-chair, *Vascular mechanics*, Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Chesapeake Bay, MD, USA, June 20-23, 2022.
7. Co-organizer, SimVascular/SimCardio Workshop and Training, Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Virtual, June 14-18, 2021.
8. Co-organizer with Noelia Grande-Gutiérrez, SimVascular/SimCardio Workshop and Training, Computer Methods in Biomechanics and Biomedical Engineering (CMBBE) Conference, New York City, NY, USA, August 14-19, 2019.
9. Co-chair, Computer Methods in Biomechanics and Biomedical Engineering (CMBBE) Conference, New York City, NY, USA, August 14-19, 2019.

Professional Organization Membership

- | | |
|---|----------------|
| 1. American Physical Society (APS) | 2012 – present |
| 2. American Society of Mechanical Engineering (ASME) | 2016 – present |
| 3. American Heart Association (AHA) | 2019 – present |
| 4. Biomedical Engineering Society (BMES) | 2025 – present |
| 5. U.S. Association for Computational Mechanics (USACM) | 2025 – present |

Grant Review Panel

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| 1. British Heart Foundation | 2026 |
| 2. NIH Fellowships Special Emphasis Panel | 2026 |
| 3. NIH NHLBI Catalyze Enabling Technologies | 2026 |
| 4. UK Research and Innovation | 2025 |
| 5. NSF Office of Advanced Cyberinfrastructure (OAC) | 2025 |
| 6. Additional Ventures Single Ventricle Research Fund (SVRF) | 2024 |
| 7. Columbia SEAS Interdisciplinary Research Seed (SIRS) Fund | 2024 |
| 8. Graduate Women in Science Fellowship | 2024 |
| 9. Columbia Avanesian Fellowship | 2023 |
| 10. Columbia SEAS Interdisciplinary Research Seed (SIRS) Fund | 2023 |
| 11. NIH NHLBI Catalyze Enabling Technologies | 2022 |
| 12. AHA Transformational Project Award (AHA TPA, Bioengineering) | 2022 |
| 13. US-Israel Binational Science Foundation (BSF) | 2020 |
| 14. NSF Fluids | 2020 |

Open-Source Software Contribution

- | | |
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| SimVascular project, svFSI code, examples, and forum | 2015 – 2022 |
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Conference Abstract Reviewer

Computer Methods in Biomechanics and Biomedical Engineering (CMBBE), Summer Biomechanics Conference (SBC), Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), and World Congress in Biomechanics (WCB)

Manuscript Reviewer

Acta Biomaterialia, Annals of Biomedical Engineering (ABME), Biomechanics and Modeling in Mechanobiology (BMMB), Biomedical Engineering / Biomedizinische Technik (BMT), Computers and Fluids (CAF), Computer Methods and Programs in Biomedicine (CMPB), Cardiovascular Engineering and Technology (CVET), European Journal of Biomechanics/B Fluids (EJMB-Fluids), Engineering with Computers (EwC), MDPI Fluids, Flow (JFM-Flow), Frontiers in Bioengineering (fBioE), Frontiers in Physiology (fPhys), International Journal of Numerical Methods in Biomedical Engineering (IJNMBE), Journal of Biomechanics, Journal of Biomechanical Engineering (JBME), Journal of Computational Physics (JCP), Journal of Fluid Mechanics (JFM), Journal of Mechanical Behavior of Biomedical Materials (JMBBM), Journal of Medical and Biological Engineering (JMBE), Journal of Mechanics in Medicine and Biology (JMMB), MDPI Bioengineering, Medical and Biological Engineering and Computing (MBEC), Medical Imaging and Analysis (MedIA), Metrology and Measurement Systems (MMS), Nature Communications Medicine, npj Digital Medicine, Physics of Fluids (PoF), Physiological Reports, PLOS Computational Biology, Thrombosis Research, and others.