# Mrudang Mathur, PhD

Email : mrudang@stanford.edu

## EDUCATION

**University of Texas at Austin** — Austin, TX
*PhD in Mechanical Engineering* — *Aug 2018 – May 2024*

**Delhi Technological University** — New Delhi, India
*Bachelor of Technology in Mechanical Engineering* — *Aug 2014 – Jun 2018*

## RESEARCH EXPERIENCE

**Stanford Surgical Intelligence & Modeling Laboratory** — Advisor: William Hiesinger, MD
*Postdoctoral Scholar* — *Jul 2024 – Present*
- Using physics-based simulations to train surgical robots; Optimizing left-heart repairs using fluid-structure interaction simulations; Building medically-consistent generative machine learning models

**Soft Tissue Biomechanics Lab, UT-Austin** — Advisor: Prof. Manuel K. Rausch
*Graduate Research Assistant* — *Aug 2018 – May 2024*
- Thesis: *Towards understanding tricuspid valve mechanics & function in health, disease, and repair*
- Optimized transcatheter tricuspid valve repair using analytical mechanics, histo-mechanical studies, machine learning, and high-fidelity finite element simulations

**Ng Research Group, NTU Singapore** — Advisor: Prof. EYK Ng
*Summer Research Fellow* — *Jun 2017 – Aug 2017*
- Developed non-invasive, thermal diagnostic tools to detect carotid artery stenosis. Modeled system sensitivity through conjugate heat transfer simulations

**Fluid Mechanics Group, DTU India** — Advisor: Prof. Rajkumar Singh
*Undergraduate Researcher* — *Aug 2016 – Jun 2018*
- Designed low-cost, smartphone-based Particle Image Velocimetry system for undergraduate student training

**Innovator Labs Consultants, India** — Advisor: Sujay Shad, MD
*Research Engineer* — *Feb 2015 – Jun 2018*
- Reduced thrombogenicity of novel, mechanical heart valve using fluid-structure interaction simulations

## TEACHING EXPERIENCE

- **Teaching Assistant:** Statics, UT-Austin — *Spring 2021*
- **Teaching Assistant:** Aerospace Materials Lab, UT-Austin — *Spring 2020*
- **Teaching Assistant:** New Product Development, UT-Austin — *Fall 2019 & Fall 2018*
- **Teaching Assistant:** Numerical Methods in BME, UT-Austin — *Spring 2019*

## AWARDS & HONORS

- SES Future Faculty Symposium Travel Award — *Oct 2025*
- USNCCM Travel Award — *July 2025 & 2023*
- **Dean's Prestigious Fellowship Supplement (UT-Austin)** — ***Aug 2023 & 2022***
- Finalist, PhD Paper Competition, SB3C — *Jun 2023*
- SES Annual Meeting Travel Award — *Oct 2022*
- **American Heart Association Predoctoral Fellowship, $64K** — ***Jan 2022 – Dec 2023***

- **Warren A. & Alice L. Meyer Scholarship in Engineering (UT-Austin)** *Aug 2021 & 2019*
- Departmental Research Award (GAIN, UT-Austin) *Feb 2021*
- **Member, Living Heart Project (Dassault Systèmes)** *Nov 2020 – Present*
- **Summer Research Fellowship (NTU, Singapore)** *Jun - Aug 2017*
- Best Re-engineered 3D Printed Product (ASME) *Sept 2016*
- Merit Scholarship (DTU, India) *Dec 2014*
- **DST INSPIRE Scholarship – declined (Govt. of India)** *Aug 2014*

## OUTREACH & SERVICE

- **Committee Member**: *Stanford Cardiovascular Institute (CVI) Early Career Committee* – Planning career development activities, outreach talks, and research seminars for Stanford CVI trainees
- **Organizer**: *Early Career Lunch & Learn, Bay Area Cardiovascular Research Symposium, 2025* – Organized professional development lunch for early-career trainees to learn from faculty members at Stanford, UCSF, UC Davis, and SJSU.
- **Technical Workshop Host**:
  *Building AR Visualizations for Computational Mechanics*, USNCCM 2023
  *Reimagining Scientific Visualization using Augmented Reality*, SB3C 2023
- **Volunteer**: *Girl Day 2023, UT Austin* – Helped children create blood clots and examine their mechanical properties
- **Mentor**: *INVVIZ 2022* – Helping Indian high-school students design a low-cost, "smart" sanitary pad dispenser to improve menstrual health of teenagers
- **Ad-hoc Reviewer**: Frontiers in Physiology, Cardiovascular Engineering & Technology, Scientific Reports, Biomechanics & Modeling in Mechanobiology, Annals of Biomedical Engineering, Device, Journal of Biomechanical Engineering, International Journal of Solids & Structures, Acta Biomaterialia, Stanford CVI Summer Research Program, Engineering with Computers

## INVITED TALKS

I6 **Mathur, M.**(2025). *Cardiothoracic Digital Twins for Robot-assisted Surgery.* Harrington Faculty Fellow Symposium, Department of Aerospace Engineering & Engineering Mechanics, UT-Austin, TX.
Note: Only trainee invited to speak alongside members of NAE.

I5 **Mathur, M.**(2024). *Coding, Stretching & (Deep) Learning: My Journey Through Cardiovascular Science.* Pathways Seminar, Department of Biomedical Engineering, San Jose State University, CA.

I4 **Mathur, M.**(2023). *Augmented Reality for Scientific Visualization.* Yang Lab Seminar, Department of Aerospace Engineering & Engineering Mechanics, UT-Austin, TX.

I3 **Mathur, M.** and Rausch, M.K. (2021). *Uncovering the Effects of Structural Intervention on the Human Tricuspid Valve Using Predictive Models.* 7th International Symposium: Virtual Twin of Human & Living Heart, Virtual.

I2 **Mathur, M.**, Meador, W.D. and Rausch, M.K. (2021). *Animal and Computer Models Towards a Better Understanding of Tricuspid Valve (Dys-)Function.* Edwards Lifesciences, Irvine, CA

I1 **Mathur, M.** and Rausch, M.K. (2020). *Subject-Specific Computational Models Of The Human Tricuspid Valve.* 6th Annual Living Heart Symposium, Virtual.

## BOOK CHAPTERS

B1 Meador W.D., **Mathur M.**, Rausch M.K. (2020). *Tricuspid Valve Biomechanics: A Brief Review.* In: *Advances in Heart Valve Biomechanics*, Springer

## Journal Articles

: **\*** indicates equal contribution; undergraduate & graduate mentees are underlined

As first author –

J30 Cho, J.\*, **Mathur, M.\***, Zakka, C.\*, Kaur, D., Leipzig, M., Dalal, A., Krishnan, A., Koo, E., Wai, K., Zhao, C.S., Shad, R., Fong, R., Wightman, R., Chaudhari, A., and Hiesinger, W. *MediSyn: A Generalist Text-Guided Latent Diffusion Model For Diverse Medical Image Synthesis.* Under review. Preprint: arXiv:2405.09806

J29 **Mathur, M.**, Malinowski, M., Jazwiec, T., Timek, T.A., and Rausch, M.K. (2024). *Leaflet Remodeling Reduces Tricuspid Valve Function in a Computational Model.* Journal of the Mechanical Behavior of Biomedical Materials, 152, p.106453.

J28 **Mathur, M.**, Brozovich, J.M., and Rausch, M.K. (2023). *A brief note on building augmented reality models for scientific visualization.* Finite Elements in Analysis & Design, 213, p.103851.

J27 Lin, C.-Y.\*, **Mathur, M.\***, Malinowski, M., Timek, T., and Rausch, M.K. (2022). *The impact of thickness heterogeneity on soft tissue biomechanics: A novel measurement technique and a demonstration on heart valve tissue.* Biomechanics and Modeling in Mechanobiology, pp.1-12.

J26 **Mathur M.**, Meador W.D., Malinowski M., Jazwiec T., Timek T.A., and Rausch M.K. (2022). *Texas TriValve 1.0: a reverse-engineered, open model of the human tricuspid valve.* Engineering with Computers, 38(5), pp.3835-3848.

J25 **Mathur, M.\***, Meador, W. D.\*, Jazwiec, T., Malinowski, M., Timek, T. A., and Rausch, M. K. (2020). *Tricuspid valve annuloplasty alters leaflet mechanics.* Annals of Biomedical Engineering, 48(12), pp.2911-2923.

J24 **Mathur, M.**, Malinowski, M., Timek, T.A. and Rausch, M.K. (2020). *Tricuspid annuloplasty rings: A quantitative comparison of size, non-planar shape, and stiffness.* The Annals of Thoracic Surgery, 110(5), pp.1605-1614.

J23 **Mathur, M.**, Meador, W.D., Jazwiec, T., Malinowski, M., Timek, T.A. and Rausch, M.K. (2020). *The effect of downsizing on the normal tricuspid annulus.* Annals of Biomedical Engineering, 48(2), pp.655-668.

J22 **Mathur, M.**, Jazwiec, T., Meador, W.D., Malinowski, M., Goehler, M., Ferguson, H., Timek, T.A. and Rausch, M.K. (2019). *Tricuspid valve leaflet strains in the beating ovine heart.* Biomechanics and Modeling in Mechanobiology, 18(5), pp.1351-1361.

As coauthor –

J21 Shad R., Zakka C., Kaur, D., **Mathur, M.**, Cho, J., Fong, R., Filice, R., Mongan, J., Kallianos, K.G., Khandwala, N., Eng, D., Leipzig, M., Witschey, W., de Fiera, A., Ferrari, V., Ashley, E., Acker, M.A., Langlotz, C., Hiesinger, H. A Generalizable Deep Learning System for Cardiac MRI. In revision.

J20 Kaur, D., Shad, R., Kumar, A., **Mathur, M.**, Cho, J., Fong, R., Zakka, C., Phillips, C., and Hiesinger, W. *Sex Disparities in Deep Learning Estimation of Ejection Fraction from Cardiac Magnetic Resonance Imaging.* In revision.

J19 Kostelnik, C.\*, Meador, W.\*, Lin, C-Y., **Mathur, M.**, Malinowski, M., Jazwiec, T., Malinowskwa, Z., Piekarska, M., Gaweda, B., Timek, T.A., and Rausch, M.K. (2025) *Tricuspid valve leaflet remodeling in sheep with biventricular heart failure: A comparison between leaflets.* Acta Biomaterialia, in press.

J18 Haese, C.E., Dubey, V., **Mathur, M.**, Pouch, A.M., Timek, T.A., Rausch, M.K. (2024) *Valvular Edge-to-Edge Repair Simulations are Highly Sensitive to Annular Boundary Conditions.* Journal of the Mechanical Behavior of Biomedical Materials.

J17 Haese, C.E., **Mathur, M.**, Malinowski, M., Timek, T.A., and Rausch, M.K. (2023) *Geometric Data of Commercially Available Tricuspid Valve Annuloplasty Devices.* Data in Brief, 52, p.110051.

J16 Haese, C.E., **Mathur, M.**, Lin, C-Y, Malinowski, M., Timek, T.A., and Rausch, M.K. (2023) *Impact of Tricuspid Annuloplasty Device Shape and Size on Valve Mechanics - A Computational Study.* JTCVS Open, 17, pp.111-120.

J15 Kakaletsis, K., Malinowski, M., Snider, C.J., **Mathur, M.**, Sugerman, E., Jazwiec, T., Bersi, M.R., Timek, T.A., and Rausch, M.K. (2023) *Untangling the mechanisms of pulmonary arterial hypertension-induced right ventricular stiffening in a large animal model.* Acta Biomaterialia, 171, pp.155-165.

J14 Iwasieczko, A., Gaddam, M., Gaweda, B., Goodyke, A., **Mathur, M.**, Lin, C-Y, Zagorski, J., Solarewicz, M., Cohle, S., Rausch, M.K., Timek, T.A. (2023). *Valvular complex and tissue remodeling in ovine functional tricuspid regurgitation.* European Journal of Cardio-Thoracic Surgery, 63(5).

J13 Meador, W.D., **Mathur, M.**, Kakaletsis, S., Lin, C.-Y., Bersi, M.R., and Rausch, M.K. (2022). *Biomechanical phenotyping of minuscule soft tissues: An example in the rodent tricuspid valve.* Extreme Mechanics Letters, 55, p.101799.

J12 Kakaletsis S., Meador W.D., **Mathur M.**, Sugerman G.P., Jazwiec M., Lejeune E., Timek T.A., and Rausch M.K.(2021) *Right ventricular myocardial mechanics: Multi-modal deformation, microstructure, and modeling.* Acta Biomaterialia, 123, pp.154-166.

J11 Jazwiec, T., Malinowski, M. J., Ferguson, H., Parker, J., **Mathur, M.**, Rausch, M. K., and Timek, T. A. (2021). *Tricuspid valve anterior leaflet strains in ovine functional tricuspid regurgitation.* Seminars in Thoracic and Cardiovascular Surgery, 33(2), pp.356-364.

J10 Meador W.D., **Mathur M.**, Sugerman G.P., Malinowski M., Jazwiec T., Wang X., Lacerda C., Timek T.A., and Rausch M.K. (2020). *The tricuspid valve also maladapts: A multiscale study in sheep with biventricular heart failure.* eLife, 9:e63855.

J9 Smith, K.J., **Mathur, M.**, Meador, W.D., Phillips-Garcia, B., Sugerman, G.P., Menta, A.K., Jazwiec, T., Malinowski, M., Timek, T.A. and Rausch, M.K. (2021). *Tricuspid chordae tendineae mechanics: Insertion site, leaflet, and size-specific analysis and constitutive modelling.* Experimental Mechanics, 61, pp.19-29.

J8 Meador, W.D., **Mathur, M.**, Sugerman, G.P., Jazwiec, T., Malinowski, M., Bersi, M.R., Timek, T.A. and Rausch, M.K. (2020). *A detailed mechanical and microstructural analysis of ovine tricuspid valve leaflets.* Acta Biomaterialia, 102, pp.100-113.

J7 Saxena A., Ng E.Y.K., **Mathur M.**, Manchanda C., and Jajal N.A. (2019) *Effect of carotid artery stenosis on neck skin tissue heat transfer*, International Journal of Thermal Sciences, 145, p.106010.

J6 Rausch, M.K., **Mathur, M.** and Meador, W.D. (2019). *Biomechanics of the tricuspid annulus: A review of the annulus in vivo dynamics with emphasis on ovine data.* GAMM Mitteilungen, 42(3), p.e201900012.

Preprints –

J5 Kashyap, V., Kumar, S., Jajal, N.A., **Mathur, M.**, and Singh, R.K. (2020). *Parametric analysis of smartphone camera for a low cost particle image velocimetry system.* arXiv preprint arXiv:2002.01061.

In preparation –

J4 **Mathur, M.** Corpuz, A., Zhao, H., Saraein, M., Haese, C., Fong, R., Hsu., M-C, Hiesinger, W., and Rasuch, M.K. *An Open-source Framework For Immersogeometric Analysis of Atrioventricular Heart Valves.*

J3 **Mathur, M.\***, Kumar, A.\*, Duda, M., Eades, A.T., Cho, J., Fong, R., Peltier, G., Leon, M., Ruaengsri, C., Hiesinger, W. *Towards building real-time digital twins for robot-assisted cardiac surgery.*

J2 Cho, J.*, **Mathur, M.***, <u>Kaur, D.</u>, Duda, M., Krishnan, A., Dahlan, A., Siedman, C., Gonzales, A., Logan, J., Fong, R., Kumar, A., Shad R., Zakka, C., Wu, W., Jolley, M., and Hiesinger, W. *From Big Data to Little Hearts: A View-agnostic Deep Learning Model for Pediatric Echocardiography.*

J1 **Mathur, M.**, Haese C.E., Meador, W.D., Malinowski, M., Jazwiec, T., Simonian, N., Sacks, M., Timek, T.A., and Rausch, M.K. *No Strings Attached: Predicting Tricuspid Valve Coaptation Without In Vivo Chordal Geometry.*

## Selected Conference Proceedings & Presentations

: * indicates presenting author

C11 **Mathur, M.*** Corpuz, A., Zhao, H., Saraein, M., Haese, C., Fong, R., Hsu., M-C, Rausch, M.K., and Hiesinger W. (2025). *An Open-source Framework For Immersogeometric Analysis of Atrioventricular Heart Valves.* 18th US National Congress on Computational Mechanics, Chicago, IL.

C10 **Mathur, M.***, Malinowski, M., Timek, T.A., and Rausch, M.K. (2023). *Suppressing leaflet thickening and stiffening may restore tricuspid valve function.* Proceedings of the Summer Biomechanics, Bioengineering, & Biotransport Conference, Vail, CO.

C9 **Mathur, M.***, Malinowski, M., Timek, T.A., and Rausch, M.K. (2023). *"Are Images Enough?" – Examining the sensitivity of imaging-based finite element models of the human tricuspid valve.* 17$^{th}$ U.S National Congress on Computational Mechanics, Albequerque, NM.

C8 **Mathur, M.***, Lin, C-Y, Shad, R., Fong, R., Hiesinger, W. and Rausch, M.K. (2022). *On the Sensitivity of Tricuspid Valve Models Built From Non-invasive Imaging Data.* 15$^{th}$ World Congress of Computational Mechanics, Virtual.

C7 **Mathur, M.***, Meador, W.D., Malinowski, M., Jazwiec, T., Timek, T.A. and Rausch, M.K. (2022). *Texas TriValve 1.0: A reverse engineered, open model of the human tricuspid valve.* Proceedings of the Summer Biomechanics, Bioengineering, & Biotransport Conference, Cambridge, MD, USA.

C6 **Mathur, M.***, Meador, W.D., Malinowski, M., Timek, T.A. and Rausch, M.K. (2021). *True Subject-Specific Computational Models Of The Human Tricuspid Valve.* Annual Meeting of the Heart Valve Society, Virtual.

C5 **Mathur, M.***, Meador, W.D., Malinowski, M., Timek, T.A. and Rausch, M.K. (2021). *Engineering a Structural Twin of the Human Tricuspid Valve.* 4th Carnegie Mellon Forum on Biomedical Engineering, Virtual.

C4 **Mathur, M.***, Meador, W.D., Malinowski, M., Timek, T.A. and Rausch, M.K. (2021). *Using Predictive Simulations to Uncover the Effects of Ring-based Annuloplasty on the Human Tricuspid Valve.* 16$^{th}$ U.S National Congress on Computational Mechanics, Virtual.

C3 **Mathur, M.***, Shen, C., Meador, W.D., Malinowski, M., Timek, T.A. and Rausch, M.K. (2019). *Imaging-based Reconstruction Methods for Patient-Specific Tricuspid Valve Models.* 15$^{th}$ U.S National Congress on Computational Mechanics, Austin TX, USA.

C2 **Mathur M.**, Saxena A.*, Shad R. and Chattoraj A. (2017). *Computational Evaluation of the Haemodynamic Performance of a Novel Prosthetic Heart Valve*, Proceedings of ASME IDETC, Cleveland OH, USA.

C1 Shad, R.*, **Mathur, M.***, Saxena, A.*, Prasad, A., and Shad, S. (2015).*Prosthetic Heart Valve Design*, 4$^{th}$ BIRAC Innovators Conference, New Delhi, India.