Mrudang Mathur

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

- **Hiesinger Laboratory, Stanford University** — 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
- **Soft Tissue Biomechanics Lab, UT-Austin** — Advisor: Prof. Manuel K. Rausch
  Graduate Research Assistant — *Aug 2018 – May 2024*
  - Optimizing 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 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

Awards & Honors

- **Dean's Prestigious Fellowship Supplement (UT-Austin)** — ***Aug 2023 & 2022***
- USNCCM17 Travel Award — *July 2023*
- 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***

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 mentees are underlined

As first author –

J22 **Mathur, M.**, Mettelsiefen, H., Rausch, M.K., Yoganathan, A.P., and Raghav, V. *Progress in the development of bioprosthetic aortic valves.* Submitted

J21 **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.

J20 **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.

J19 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.

J18 **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.

J17 **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.

J16 **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.

J15 **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.

J14 **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 –

J13 Haese, C.E., **Mathur, M.**, Malinowski, M., Timek, T.A., and Rausch, M.K. *Geometric Data of Commercially Available Tricuspid Valve Annuloplasty Devices.* Data in Brief, 52, p.110051.

J12 Haese, C.E., **Mathur, M.**, Lin, C-Y, Malinowski, M., Timek, T.A., and Rausch, M.K. *Impact of Tricuspid Annuloplasty Device Shape and Size on Valve Mechanics - A Computational Study.* JTCVS Open, 17, pp.111-120.

J11 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.

J10 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).

J9 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.

J8 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.

J7 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.

J6 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.

J5 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.

J4 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.

J3 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.

J2 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 –

J1 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.

Conference Proceedings

: * indicates presenting author, undergraduate mentees are underlined

C25 **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.

C24 **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$^{\text{th}}$ U.S National Congress on Computational Mechanics, Albequerque, NM.

C23 **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$^{\text{th}}$ World Congress of Computational Mechanics, Virtual.

C22 **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.

C21 **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.

C20 **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.

C19 **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.* 16th U.S National Congress on Computational Mechanics, Virtual.

C18 **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.* 15th U.S National Congress on Computational Mechanics, Austin TX, USA.

C17 Shad, R.*, **Mathur, M.***, Saxena, A.*, Prasad, A., and Shad, S. (2015).*Prosthetic Heart Valve Design*, 4th BIRAC Innovators Conference, New Delhi, India.

Other presentations –

C16 Rausch, M.K.*, **Mathur, M.**, Haese, C.E., Meador, W.D., Malinowski, M., Timek, T.A. (2024) *Tricuspid valve annuloplasty alters leaflet strains.* Annual Meeting of the Heart Valve Society, Boston, MA.

C15 Madariaga, A.*, Lin, C-Y, **Mathur, M.**, and Rausch, M.K. (2023). *An inexpensive, shared biaxial device to study the multiscale mechanics of soft materials.* Proceedings of the Summer Biomechanics, Bioengineering, & Biotransport Conference, Vail, CO.

C14 **Mathur, M.**, Dubey, V.*, and Rausch, M.K. (2023). *No strings attached: Predicting tricuspid valve coaptation without in vivo chordal geometry.* Proceedings of the Summer Biomechanics, Bioengineering, & Biotransport Conference, Vail, CO.

C13 **Mathur, M.**, Timek, T.A., and Rausch, M.K*. (2022). *How does tricuspid valve remodeling affect its function: A computational investigation.* Annual Meeting of the Society of Engineering Science, College Station, TX.

C12 Lin, C-Y*, **Mathur, M.**, Meador, W.D., Sugerman, G.P., and Rausch, M.K. (2022). *Spatially mapping heterogeneous soft tissue thickness: A novel technique and a demonstration of its importance.* Proceedings of the 9th World Congress of Biomechanics, Taipei, Taiwan.

C11 Lin, C-Y*, **Mathur, M.**, Meador, W.D., Sugerman, G.P., Rausch, M.K. (2021). *Significance of a non-invasive method to quantify heterogeneous thickness in membranous soft tissues.* Carnegie Mellon Biomedical Engineering Forum, Virtual.

C10 Meador W.D.*, Iawsieczko, A.J., Jazwiec, T., **Mathur, M.**, Malinowski, M., Timek, T.A., and Rausch, M.K. (2021). *The tricuspid valve (mal)adapts in two ovine models of ventricular heart disease.* Proceedings of the Annual Summer Biomechanics, Bioengineering, and Biotransport Conference, Virtual.

C9 Meador, W.D., **Mathur, M.**, Malinowski, M., Jazwiec, T., Timek, T.A., and Rausch, M.K.* (2020). *The Tricuspid Valve Also Maladapts: Evidence From Sheep With Functional Tricuspid Regurgitation.* Proceedings of the Annual Meeting of the AHA Basic Cardiovascular Sciences, Virtual.

C8 **Mathur, M.**, Malinowksi, M., Jazwiec, T., Timek, T.A., and Rausch, M.K.* (2020). *Tricuspid valve mechanics after surgical repair – An in-vivo study in sheep.* Proceedings of the Annual Summer Biomechanics, Bioengineering, and Biotransport Conference, Virtual.

C7 Rausch, M.K., Meador, W.D., and **Mathur, M.**, Jazwiec, T., and Timek, T.A. (2020). *The tricuspid valve leaflets also adapt to functional regurgitation.* Proceedings Of the Annual Meeting of the Heart Valve Society, Abu Dhabi, United Arab Emirates.

C6 Meador, W.D., **Mathur, M.**, Malinowski, M., Jazwiec, T., Timek, T.A., and Rausch, M.K.* (2019). *The Microstructural-Mechanical Relationship of Ovine Tricuspid Valve Leaflets.* Proceedings of the Annual Meeting of the Biomedical Engineering Society, Philadelphia, PA.

C5 **Mathur, M.**, Meador, W.D., Malinowski, M., Jazwiec, T., Timek, T.A., and Rausch, M.K.* (2019). *Mechanics of the Normal Tricuspid Valve Complex: An Investigation in Sheep.* Proceedings of the Annual Meeting of the Biomedical Engineering Society, Philadelphia, PA.

C4 Rausch, M.K.*, **Mathur, M.**, Meador, W.D., Malinowski, M., Jazwiec, T., and Timek, T.A. (2019). *Tricuspid Valve Leaflet Strains in the Beating Ovine Heart.* Proceedings of the Summer Bioengineering, Biomechanics, Biotransport Conference, Seven Springs, PA

C3 Kashyap, V.*, Kumar, S., Jajal, N., **Mathur, M.** and Singh, R. (2018). *Design and Development of a Smartphone-Based Particle Image Velocimetry System.* Bulletin of the American Physical Society, 63.

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 Saxena A.*, Shad R.,**Mathur M.**, Chattoraj A. and Shad S. (2017).*Evaluation of Paravalvular Leakage in a Novel Mechanical Heart Valve Prototype.* Proceedings of ASME IDETC, Cleveland OH, USA.

Invited Talks

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.

Teaching, Outreach, & Service

- **Teaching Assistant**: Statics, Aerospace Materials Laboratory, New Product Development & Additive Manufacturing , Introduction to Numerical Methods in BME
- **Volunteer**: *Girl Day 2023, UT Austin* – Helped girls 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
- **Technical Workshops**:
  Reimagining Scientific Visualization using Augmented Reality, SB3C 2023
  Building AR Visualizations for Computational Mechanics, USNCCM 2023
- **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