

Haobo Zhao

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EDUCATION

Johns Hopkins University, Baltimore, MD

Sep. 2023 - Present

Master in Mechanical Engineering

GPA: 4.0/4.3

Advisor: Dr. Rajat Mittal and Dr. Jung-Hee Seo

Southern Illinois University, Carbondale, IL, U.S.

2022-2023

Aviation Technologies (Dual Degree Program with SAU)

GPA: 4.0/4.0

Dean's list: Spring 2022, Fall 2022

Magna cum Laude

Shenyang Aerospace University, Shenyang, Liaoning, China

2019-2023

Aircraft Propulsion Engineering

GPA: 3.8/4.0

National Scholarship (2021, top 1% in Department)

SAU First Class Scholarship (Fall 2020, Fall 2021, Spring 2022)

MAJOR HONORS AND AWARDS

- **National Scholarship (2021)**: Top 1% in Department (Academic Performance). China top scholarship among college students
- **First Prize of National Mathematics Competition (China, 2020)**: Top 8% for non-Mathematical majored college students.
- **Third Prize of Mechanics Competition of Zhou Peiyuan(China, 2021)**: Mechanics competition
- **Top 5 in China of iCAN Innovation Contest (2021)**: 5/3000 in China, AI video surveillance clarity process

RESEARCH INTERESTS

Fluid dynamics, applied mechanics, computational fluid dynamics, multiphase flows, biological flows, immersed boundary methods, multi-physics modeling

RESEARCH EXPERIENCE

Johns Hopkins University, Baltimore, MD

Sep. 2020 - Present

Ph.D. Thesis (Advisor: Rajat Mittal) – Department of Mechanical Engineering

- Developed an imaging data-based computational model of the stomach using an immersed boundary solver.
- Incorporated chemical reactions of food hydrolysis into the model to run chemo-fluid dynamic simulations.
- Employed particle resolved simulations with 6-degrees-of-freedom to model tablets and large food particles.
- Implemented Lagrangian Point Particle Model (LPPM) to simulate small-sized food particles.
- Built a pipeline for patient-specific stomach models using cine-MRI data.
- Used Volume of Fluids (VOF) approach to account for different density fluids.
- Incorporated the stomach muscles via Fluid-Structure-Electrophysiological-Interaction (FSEI) model.
- Studied the effect of posture and motility disorders on the dissolution of an oral tablet.
- Quantified the effects of motility disorders on the mixing and hydrolysis function of the stomach.
- Modeled the consequences of pyloric surgery in different emptying rate disorder patients.
- Simulated the mechanism of gastritis due to bile reflux in patients.

Sterlite Technologies, Dadra & Nagar Haveli, India

Jun. 2019 - Sep. 2020

Modeling and Simulations Division – Research & Development

- Developed theoretical and semi-empirical models to predict the onset of signal attenuation in fiber optic cable designs.
- Simulated structural deformation in finite-element software to analyze cable designs.
- Developed excel-based tools for predicting fiber-optic cable behaviors in extreme temperatures.
- Patented grooved cable designs with higher drag to enable air blowing cables to longer distances.
- Patented flexible ribbon design to enable more efficient packing of fibers inside the cable.

Indian Institute of Technology, Kanpur, UP, India

May 2018 - Jun. 2019

Masters Thesis (Advisor: Arun K. Saha) – Department of Mechanical Engineering

- Using a Marker-and-Cell (MAC) based solver, studied the flow past a square cylinder at different blockages.
- Developed a code to perform the linear stability analysis of the steady symmetric flow.

- Studied the effect of wall proximity on transition from steady to unsteady (Hopf bifurcation) and from symmetric to asymmetric flow (Pitchfork bifurcation).

McGill University, Quebec, Canada

May 2017 - Jul. 2017

MITACS Globalink Summer Internship – Department of Mining Engineering

Advisor: Agus P. Sasmito

- Studied the flow of mine backfill slurry (40-70% solid fraction) through the hydraulic network in mines.
- Modeled the slurry as a two-phase mixture, using Dense Discrete Phase Model (DDPM), and as a Bingham fluid to predict the pumping requirements through different approaches.
- Compared the simulations against different friction factor model predictions and against in-situ data.

Indian Institute of Technology, Kanpur, UP, India

May 2016 - Jul. 2016

Summer Undergraduate Research (Advisor: Arun K. Saha)

- Implemented the immersed boundary method in an existing finite difference flow solver.

JOURNAL PUBLICATIONS

- **S. Kuhar and R. Mittal**, “Computational Models of the Fluid Mechanics of the Stomach.” *Journal of the Indian Institute of Science*, (2024).
- **S. Kuhar, J. H. Seo, P. J. Pasricha, and R. Mittal**, “In silico modelling of the effect of pyloric intervention procedures on gastric flow and emptying in a stomach with gastroparesis”, *Journal of the Royal Society Interface*, 21(210), (2024).
- **S. Kuhar, J. H. Lee, J. H. Seo, P. J. Pasricha, and R. Mittal**, “Effect of stomach motility on food hydrolysis and gastric emptying: Insight from computational models”, *Physics of Fluids*, 34(11), 111909, (2022).
- **J. H. Lee, S. Kuhar, J. H. Seo, P. J. Pasricha, and R. Mittal**, “Computational modeling of drug dissolution in the human stomach: Effects of posture and gastroparesis on drug bioavailability”, *Physics of Fluids*, 34(8), 081904, (2022).
- **B. Bharathan, M. McGuinness, S. Kuhar, M. Kermani, F. P. Hassani, and A. P. Sasmito**, “Pressure loss and friction factor in non-Newtonian mine paste backfill: Modelling, loop test and mine field data.” *Powder Technology*, 344, 443–453, (2019).

CONFERENCE PAPERS

- **S. Kuhar, J. H. Seo, P. J. Pasricha, and R. Mittal**, “Computational Fluid Dynamics of Digestion Inside the Stomach.” *Proceedings of the 10th International and 50th National Conference on Fluid Mechanics and Fluid Power (FMFP)*, BFM-057 (2023).

PATENTS

- **S. Kuhar, V. Shukla, S. Sharma, and K. Sahoo**, Sterlite Technologies Ltd, 2021. “Ribbed and grooved cable having embedded strength member with water blocking coating”. U.S. Patent Application 17/347,080 (Granted: 2023).
- **H. Kondapalli, S. Sharma, S. Kuhar, A. Nath, V. Shukla, and B. Sarkaar**, Sterlite Technologies Ltd, 2021. “Intermittently bonded optical fibre ribbon with unequal bond and gap lengths”. U.S. Patent Application 17/139,508 (Granted: 2023).

CONFERENCE PRESENTATIONS

- **S. Kuhar, A. Menys, J. H. Seo, and R. Mittal**, “Computational modeling of solid food digestion inside the stomach.” APS Division of Fluid Dynamics, L10.00008 (2023).
- **S. Kuhar and R. Mittal**, “Computational modeling of digestion and drug-dissolution inside the stomach.” ReCoVor, 64A, (2023).
- **S. Kuhar, A. Menys, J. H. Seo, and R. Mittal**, “StomachSim: An in-silico model of stomach biomechanics based on patient-specific imaging data.” NeuroGASTRO-2023, (2023).
- **S. Kuhar, J. H. Seo, P. J. Pasricha, and R. Mittal**, “StomachSim: An in-silico simulator of gastric biomechanics with application to pyloroplasty.” American Physiology Summit, 38, 5729950 (2023).
- **S. Kuhar, J. H. Seo, P. J. Pasricha, and R. Mittal**, “StomachSim: An in-silico simulator of gastric biomechanics with application to pyloroplasty.” Digesta Disease Week, 164.6 (2023).
- **S. Kuhar, J. H. Lee, J. H. Seo, P. J. Pasricha, and R. Mittal**, “StomachSim: an in-silico simulator of gastric biomechanics” The Johns Hopkins Department of Medicine & Whiting School of Engineering Research Retreat, (2023).
- **S. Kuhar, J. H. Lee, J. H. Seo, P. J. Pasricha, and R. Mittal**, “Biofluid dynamics of digestion in the stomach: Insights from computational modeling.” APS Division of Fluid Dynamics, Z07.00004 (2022).
- **S. Kuhar, J. H. Lee, J. H. Seo, P. J. Pasricha, and R. Mittal**, “The Chemo-Fluid Dynamics of Digestion in the Stomach: Insights from Computational Modeling.” CEA FM Burgers Symposium, (2022).
- **S. Kuhar, J. H. Lee, J. H. Seo, P. J. Pasricha, and R. Mittal**, “The Chemo-Fluid Dynamics of Digestion in the Stomach: Insights from Computational Modeling”, APS Division of Fluid Dynamics, T15.00006, (2021).
- **J. H. Lee, S. Kuhar, J. H. Seo, P. J. Pasricha, and R. Mittal**, “The Fluid Dynamics of the Dissolution of an Oral Drug in the Human Stomach”, APS Division of Fluid Dynamics, T15.00007, (2021).
- **S. Kuhar, Arun K. Saha**, “Linear Stability Analysis Of Two-Dimensional Flow Past A Square Cylinder At Different Blockage Ratios”, Research Scholar Day, Association of Mechanical Engineers, IITK, FTS-18, (2019).

PROFESSIONAL SERVICE

Engineer, Modeling & Simulations Division

Jul. 2019 - Sep. 2020

Research & Development, Sterlite Technologies Limited

- Worked with multiple teams to oversee the development of new cable designs.
- Created and validated models to predict whether the cable designs would pass mechanical and optical tests (tension, crush, thermal cycling, etc.).
- Developed easy-to-use excel-based tools to perform calculations for these models to be used by other teams.
- Organized 'Failure Festival' and regularly released 'Modeling & Simulations Newsletter'.
- Investigated unexpected cable failures at customer end (e.g., kinking during installation).

Helped organize the 2023 JHU Summer Internship Program in Mechanical Engineering

VOLUNTEERING

Core Team Member

Mar. 2016 - Apr. 2017

Institute Counseling Service, IIT Kanpur

- Part of 10-member team responsible for campus-wide counseling service activities.
- Negotiated with banks to raise 150k INR in scholarships for needy students.
- Led a team of 137 student guides during 6-day long orientation program for freshers with a budget of 450k INR.
- Worked with professional counselors to aid in providing emotional, mental, and financial support to students.
- Hosted sessions aimed at providing academic or career help to students.

Assisting my PhD advisor with writing funding grants, submitting annual project reports, and peer-reviewing manuscripts in the field of modeling flow inside the stomach and the intestines.

MENTORING

- **Masters Research:** Weixuan Li, Johns Hopkins University *2023 - Present*
- **Undergraduate Research:** Aditi Gupta, Johns Hopkins University *May 2023 - Jul. 2023*

TEACHING EXPERIENCE

Teaching Assistant at IIT Kanpur:

- Numerical Methods, Fall 2018
- Turbulent Flow, Spring 2019

Teaching Assistant at Johns Hopkins University:

- Numerical Methods, Fall 2021 and Fall 2023
- Computational Fluid Dynamics, Spring 2022 and Spring 2024