

MANIKANTAM G. GADDAM

Stanford University
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EDUCATION

Ph.D., Mechanical and Aerospace Engineering

Oklahoma State University, Stillwater, OK, USA

Jul 2021

Dissertation - Fluid dynamics of unsteady breathing patterns in human airway models

M.S., Mechanical and Aerospace Engineering

Oklahoma State University, Stillwater, OK, USA

Dec 2016

Thesis - Currents generated by upside-down jellyfish and its implications in suspension feeding and pore-water pumping

B.E., Mechanical Engineering

Osmania University, Hyderabad, TG, India

May 2014

Research Engineer

Jun 2022 – present

Department of Urology, Stanford University - Palo Alto, CA

- Device design and development for Urological clinical needs.
- Developing Machine Learning/applications for advancement of clinical technologies.

Scientist

Aug 2021 – Jun 2022

Cardiovascular Research Department, Spectrum Health - Grand Rapids, MI

- Developed a semi-automated MATLAB program to generate a point cloud from clinical data of Ovine heart model to generate heart model for tricuspid valve regurgitation analysis.
- Quantified variations in right heart structural variations due to papillary muscle approximations and atrial fibrillation.
- Leaflet kinematics and its effects on TR was quantified.

Graduate Research Assistant

Aug 2014 – Jul 2021

Applied Fluid Mechanics Laboratory

www.appliedfluidslab.org

- Conducting research which includes Product Design and Development of Respiratory and Cardiovascular experiments.
- Conducting verification and validation (V&V) of Product Design and Experimental setup using FEA, SOLIDWORKS and CFD simulations.
- Responsible for jellyfish Animal Care, Feeding and Tank Maintenance for suspension feeding studies.
- Handled and analyzed Clinical MRI and Laboratory data and successfully implemented photogrammetry method in designing cardiovascular chamber.

- Summarizing the experimental procedures, results of Data Analysis and investigations into clear concise complaint documentation, presentations, reports and journals for peers, cross functional teams and stored according to Good Documentation Practices.
- Documented Standard Operations Procedures (SOP), Lab Safety Manuals, Material Data Sheets (MDS) and ensured their compliance with Environmental Health and Safety (EHS) in a timely manner.
- Acted as a liaison between advisor and senior design team in analyzing and solving problems related to contradictions on project data collection and evaluation.

Graduate Teaching Assistant

Aug 2014 – May 2021

Oklahoma State University – Stillwater, OK

- Fluid Mechanics, Spring 2016 - present - Junior level course, duties include attending in-class lectures, holding weekly discussion hours, homework and exam help hours, proctoring and grading.
- Engineering Analysis, Summer 2018 -duties include grading and helping students with homeworks online.
- Heat Transfer, Fall 2014 - Fall 2015, duties include grading.
- Thermodynamics, Fall 2014 - Fall 2015, duties include grading.

PROJECTS

Cardiovascular Flows

- Quantified diastolic vortex alterations with reduced left ventricular volume, increased atrial pressures, and high aortic blood pressure using particle image velocimetry (PIV) techniques.
- Increased left ventricular wall confinement decreased end diastolic volume and decayed the rate of peak circulation of diastolic vortex.
- Extracted 3D point cloud of left ventricle using photogrammetry technique during PIV and MRI scanning. Successfully reconstructed left ventricular wall using Segment (MATLAB image analysis) and SOLIDWORKS for CFD simulations.
- Developed multi scale algorithm for generating a point cloud for anatomical reconstruction in MATLAB.
- Analysed tricuspid valve complex changes of ovine heart model during pulmonary artery banding.
- Quantified leaf kinematics, and annular changes during atrial fibrillation, pulmonary banding and papillary muscles approximations for acute and chronic phases of tricuspid regurgitation.

Marine Flows

- Conducted 3D flow characterization invivo experiments on upside-down jellyfish to quantify the suspension feeding behavior.
- Conducted 2D flow characterization and visualization invivo experiments on upside-down jellyfish to obtain morphometrics and suspension feeding behavior.
- Programmed agent-based model to quantify the suspension feeding rates of upside-down jellyfish from PIV processed data in MATLAB.
- Quantified effects of background flows on upside down jellyfish using invivo experiments
- Performed flow visualization studies on upside-down jellyfish to demonstrate pore water pumping.

Respiratory Flows

- Designed and developed an electronically controlled syringe pump and respiratory system for laboratory experiments at low manufacturing costs and validated respiratory flows using commercial RANS-CFD simulations.
- Developed New flow regime map and characterized respiratory flows for normal and abnormal breathing patterns.

Product Design & Development: Filtration device

- Designed and developed aerosols filtration prototype for indoor spaces using SOLIDWORKS to mitigate the spread of COVID-19. 3D printed and assembled the parts with integration of electronic components.

Biomechanics

- Studied muscular forces using OpenSim simulations of Musculoskeletal models and ANSYS structural analysis.
- Characterized drag forces of solid and bristled insect wings and found that bristled wings constitute lower drag forces over solid wings by 80%.
- Characterized flow surrounding jellyfish, obtained morphometrics and kinematics for suspension feeding behavior using image analysis, particle image velocimetry, laser induced fluorescence and computational techniques.
- Programmed predator-prey model using 2D PIV data and quantified suspension feeding efficiency vs prey speed, and prey escape efficiency vs prey speed in MATLAB computational modeling. A graphical user interface (GUI) was developed for visualization of results. Feeding efficiency was 55% at prey speed of 2.5 cm s^{-1} .
- Quantified marine flow around sea fans and feather duster worms for suspension feeding.

PUBLICATIONS

- Battista N, **Gaddam MG**, Hamlet CL, Hoover AP, Miller LA and Santhanakrishnan A(2022). The presence of a substrate strengthens the jet generated by upside down jellyfish. *Frontiers in Marine Science*.
- **Gaddam MG**(2021). Flow characterization inside airways with unsteady breathing patterns. *Doctoral dissertation*.
- **Gaddam MG** and Santhanakrishnan A(2021). Effects of varying inhalation duration and respiratory rate on human airway flow. *Fluids*.
- Samaee M, Nelson NH, **Gaddam MG** and Santhanakrishnan A(2020). Diastolic vortex alterations with reducing left ventricular volume: an in vitro study. *Journal of Biomechanical Engineering*.
- Ford MP, Kasoju VT, **Gaddam MG** and Santhanakrishnan A(2019). Aerodynamic consequences of varying solid surface area of bristled wings performing clap and fling. *Bioinspiration and Biomimetics*.
- **Gaddam MG**(2021). Currents Generated by Upside-down Jellyfish: Implications for Suspension Feeding and Pore Water Pumping. *Masters Thesis*.
- Iwasieczko A, **Gaddam MG**, Gaweda B, Goodyke A, Mathur M, Meador W, Zagorski J, Solarewicz M, MacDougall B, Bush J, Cohle S, Rausch M and Timek T (2022). Tricuspid valvular complex remodeling in ovine functional tricuspid regurgitation: Implications for surgical repair. In review *Journal of Thoracic and Cardiovascular Surgery*.
- **Gaddam MG**, Takyi-Micah M, Mathur N and Santhanakrishnan A(2022). Interaction of Cassiopea feeding and exchange currents with steady ambient flows. To be submitted to *Journal of Experimental Biology*.
- **Gaddam MG** and Santhanakrishnan A(2022). Pore water pumping by upside-down Cassiopea jellyfish. To be submitted to *Journal of Experimental Biology*.

CONFERENCE PRESENTATIONS

- George N, **Gaddam MG** and Santhanakrishnan A(2021). "Feeding currents of upside-down jellyfish: role of oral arm structure," Annual Meeting of the Society of Integrative and Comparative Biology, Jan 3 (Virtual).
- Santhanakrishnan A and **Gaddam MG**(2021). "Feeding and exchange currents of epibenthic upside-down jellyfish," Bulletin of the 74th Annual Meeting of the APS Division of Fluid Dynamics, November 21-23.
- **Gaddam MG** and Santhanakrishnan A(2020). "Squishy suction pumps: pore water release by upside-down jellyfish," Annual Meeting of the Society of Integrative and Comparative Biology, Jan 3-7, Austin, TX.
- **Gaddam MG** and Santhanakrishnan A(2020). "Pore water release and mixing by epibenthic upside-down jellyfish," 2020 Ocean Sciences Meeting, February 16-21, San Diego, CA.
- **Gaddam MG** and Santhanakrishnan A(2020). "Airway flow generated in abnormal breathing patterns," Bulletin of the 73rd Annual Meeting of the APS Division of Fluid Dynamics (Virtual), November 22-24.
- Santhanakrishnan A(2020), **Gaddam MG** and Yasaman F. "PTV visualization of currents generated by upside-down jellyfish," Bulletin of the 73rd Annual Meeting of the APS Division of Fluid Dynamics (Virtual), November 22-24.
- **Gaddam MG**, Feng Y and Santhanakrishnan A(2019). "Effect of varying inhalation durations in normal breathing and HFOV conditions," Bulletin of the 72nd Annual Meeting of the APS Division of Fluid Dynamics, November 23-26, Seattle, WA.
- Ford MP, Kasoju VT, **Gaddam MG** and Santhanakrishnan A(2019). "Clap and fling of bristled wings with varying solid surface areas," Annual Meeting of the Society of Integrative and Comparative Biology, Jan 3-7, Tampa, FL.
- Ford MP, Kasoju VT, **Gaddam MG** and Santhanakrishnan A(2018). "Clap and fling with bristled wings: effects of varying solid membrane area," Bulletin of the 71st Annual Meeting of the APS Division of Fluid Dynamics, November 18-20, Atlanta, GA.
- **Gaddam MG**, Samaee M and Santhanakrishnan A(2017). "Left ventricular filling under elevated left atrial pressure," Bulletin of the 70th Annual Meeting of the APS Division of Fluid Dynamics, November 19-21, Denver, CO.
- Nelsen N, **Gaddam MG** and Santhanakrishnan A(2017). "The intraventricular filling vortex under heightened aortic blood pressure," Bulletin of the 70th Annual Meeting of the APS Division of Fluid Dynamics, November 19-21, Denver, CO.
- **Gaddam MG** and Santhanakrishnan A(2016). "Pore water pumping by upside-down jellyfish," Bulletin of the 69th Annual Meeting of the APS Division of Fluid Dynamics, November 20-22, Portland, OR.
- **Gaddam MG** and Santhanakrishnan A(2016). "Feeding currents generated by Cassiopea jellyfish," 2016 Ocean Sciences Meeting, February 21-26, New Orleans, LA.

AWARDS & HONORS

- Recipient of CEAT -Mechanical and Aerospace Engineering Outstanding Graduate Student Award-2020.
- Winner for Oral Presentation at MAE Graduate Research Symposium (2020).
- Recipient of Robberson Summer Dissertation Fellowship 2019.
- Recipient of CIE Scholarship for Fall 2018.
- 3rd Prize for Oral Presentation at MAE Graduate Research Symposium (2017).
- Top 10 finalists in CEAT 3MT competition (2017).

SERVICES

- Judge for Annual MAE Graduate Research Symposium-Nov 2018
- President for Mechanical and Aerospace Engineering Graduate Student Council Aug 2017-Dec 2018.
- Treasurer for OSU - Automation Society Aug 2017- May 2018.
- MAE representative for Graduate and Professional Student Government Association (GPSGA) for 2016.

MEMBERSHIPS

American Physical Society (APS)
International Society of Automation (ISA)
Association for the Sciences of Limnology and Oceanography (ASLO)
Society for Integrative and Comparative Biology (SICB)