

Redowan Ahmed Niloy

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Research Interest

Mechano-biology, Biophysics, Computational Biology, Mathematical modelling of Biological Structures, Computational Mechanics and Numerical Methods, Cell-Fluid interaction.

Teaching Interest

Undergraduate courses: Thermodynamics, Heat Transfer, Fluid Mechanics, Statics and Dynamics, Solid Mechanics, Machine Design, Control system, Analysis of Engineering systems, Vector-Tensor-Linear Algebra, Computer Programming (Fortran, C, C++, Python, MATLAB, Mathematica, R, HTML/CSS), Numerical Analysis, Computational Mechanics, Finite Element Analysis etc.

Graduate courses: Analysis of Engineering systems, Vector-Tensor-Linear Algebra, Advanced Thermodynamics, Advanced Fluid mechanics, Advanced Numerical Methods, Computational Fluid Dynamics, Mathematical Physics, Statistical Physics, Advanced Dynamics, Computational biology, Quantum Physics etc.

Education

Texas Tech University, Lubbock, TX

Doctor of Philosophy (Ph.D.) in Mechanical Engineering

July 2024

Advisor: Dr. Jerzy Blawdziewicz

Master of Science (M.S.) in Mechanical Engineering

Advisor: Dr. Jerzy Blawdziewicz

CGPA: 3.93/4.00

Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

Bachelor of Science (B.Sc.) in Mechanical Engineering

September 2017

CGPA: 3.60/4.00 (Merit position 29th among 180+ graduating students)

Adviser: Dr. A. B. M. Toufique Hasan.

Thesis: *Transonic aerodynamics of an Air foil cascade.* ([Transonic Aerodynamics](#))

Ph.D. Dissertation

Title: The mechanics of Cephalic furrow formation in the *Drosophila* embryo.

Committee: Dr. Jerzy Blawdziewicz (chair), Dr. Jefferey H Thomas, Dr. Gordon Christopher, Dr. Tanushree Roy, and Dr. Michael C Holcomb.

Summary: Cephalic furrow formation (CFF) is one of the major morphogenetic movements in the *Drosophila* (fruit fly) embryo. The furrow initially develops at the lateral sides of the embryo and then extends over the entire embryo perimeter. An analysis of the cell shape changes that occur in the active region of the epithelial cell layer reveals that the CFF occurs in two distinct phases: the initiation and progression phase. In the initiation phase, the epithelial fold starts to invaginate into the yolk sac and during the progression phase, additional pairs of cells are gradually added to the furrow. While the geometry of the cell shape changes during these processes was imaged in detail, the underlying mechanical forces and stresses are poorly understood. To investigate the invagination mechanics, we have developed an advanced vertex model that considers experimentally observed membrane curvature and relates it to a pressure jump across the membrane. Our model shows that the cell shape sequences observed in the progression phase can be fully explained by a corresponding succession of cell membrane length changes and the corresponding time variation of the membrane tension and cell pressure. However, the initiation of the CFF requires an additional inward force associated with the tension that develops along the curved line of the furrow cleft.

Teaching Experience

Kennesaw State University, Marietta, GA

Visiting Assistant Professor

Aug 2024 to Dec 2024

I taught introductory Thermodynamics (ME 3410) and Fluid Mechanics (ENGR 3343) to the undergraduate students. I had around 140 students distributed in four different sections. As the primary instructor, my primary responsibilities include teaching, providing lecture notes, holding office hours, making and grading assignments, midterms and the final.

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Texas Tech University, Lubbock, TX

Graduate Instructor

Aug 2022 to July 2023

My responsibilities were included but not limited to deliver lectures to undergraduate students, create, or improve course syllabus and lecture materials, design or modify assignments, midterm and final questions and grade them. The courses I was an instructor were Thermodynamics, Machine design, Thermal-fluids system analysis, Computational mechanics etc.

Graduate Teaching Assistant

Aug 2018 to Dec 2021

The primary responsibilities as a teaching assistant were to assist the instructors in delivering lectures, and delivering lectures time to time, teach in discussion sessions, provide one-on-one problem-solving support to the students and grading assignments and exams. The courses I was a teaching assistant for include Dynamics, Introduction to Design, Computer aided analysis, Thermo-fluids sessional, Computational mechanics sessional etc.

Research Experience

Texas Tech University, Lubbock, TX

Graduate Research Student and Research Assistant

Aug 2018 to Present

Conceptualization of research projects, finding possible knowledge gaps in existing literatures, developing novel algorithms, and improving existing algorithms of solving biophysical problems, assisting PI in conceptualizing research proposals, training new graduate and undergraduate students the important research protocols, managing the computational facilities for performing at highest capacities etc.

Awards and Honors

- **Doctoral Dissertation Completion Fellowship**, awarded by the graduate school of Texas Tech University, given to very few graduate students each year for their academic excellence.
- Granted travel fund from the Mechanical Engineering department and Graduate School of Texas Tech University for presenting at different national and international conferences.
- **Research Assistantship**: Awarded by Provost's Office, Texas Tech University.
- **Dean's Scholarship**: Awarded by College of Engineering of Texas Tech University.
- **Dean's Merit Award**: Awarded based on academic excellence in the undergraduate program by BUET.
- Awarded 1st Prize on Mechanical Engineering Design & Project competition for building short range surveillant Unmanned Aerial Vehicle.

Journal Publications

Journal Papers Accepted/To be Submitted:

1. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "The mechanics of cephalic furrow formation in the *Drosophila* embryo" in *Bio Physical Journal*, 2022. [[CFF Mechanics](#)]
2. **Redowan Ahmed Niloy**, Guo-Jie Jason Gao, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "The role of local and long-range stresses in cephalic furrow formation in the *Drosophila melanogaster* embryo" in *Development*, January 2025. [[biorxiv Link](#)]
3. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "Geometry based Vertex modelling: an alternative approach to analyse physical phenomena (case study: Gastrulation in *Drosophila* embryo)" in the *PLOS One*, 2025. [Manuscript to be submitted]
4. Asma Harun, **Redowan Ahmed Niloy**, Jerzy Blawdziewicz, "Understanding the hydrodynamics of metachronal waves in the Ciliary motion" in *Physical Review Fluids*, 2024. [Manuscript under preparation]

Conference Proceedings/Poster Presentations

1. **Redowan Ahmed Niloy**, Guo-Jie J. Gao, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "The Role of Tensile Stress in the Initiation and Coordination of Cephalic Furrow Formation in the *Drosophila* Embryo", in *IUTAM Symposium on Theoretical and Numerical Developments in Cellular Mechanobiology*, Seville, Spain, June 2024.
2. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "Modelling Cephalic Furrow Architecture in the *Drosophila Melanogaster* Embryo Using an Automated Multi-node Lateral Vertex Model Approach" in *American Physical Society (APS), March Meeting*, 2024.

3. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "The cellular mechanics of cephalic furrow formation in the *Drosophila* embryo investigated using an advanced vertex model" in *American Physical Society (APS), March Meeting*, 2023.
4. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "The Mechanics of Cephalic Furrow Formation in the *Drosophila* Embryo Investigated Using an Advanced Vertex Model" on *19th United States National Congress on the Theoretical and Applied Mechanics (USNCTAM)*, 2022.
5. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "Mechanics of Cephalic Furrow Formation using an Advanced vertex modelling", in *American Physical Society (APS), March Meeting*, 2022.
6. **Redowan Ahmed Niloy**, Jeffery H Thomas, Jerzy Blawdziewicz, "Vertex Modelling of Cephalic Furrow Formation", in *American Physical Society (APS), March Meeting*, 2021.
7. **Redowan Ahmed Niloy**, Michael C Holcomb, Jeffery H Thomas, Jerzy Blawdziewicz, "Mechanical modelling of Cephalic Furrow Formation: An Embryogenetic movement", on *22nd Graduate Student Research poster presentation of Texas Tech University*, March 2023.
8. **Redowan Ahmed Niloy**, Jeffery H Thomas, Jerzy Blawdziewicz, "Mechanics of furrow formation in the *Drosophila* embryo", on *Texas Tech University's Graduate Student Three Minute Thesis (3MT) competition*, October 2023.
9. Jerzy Blawdziewicz, Asma Harun, **Redowan Ahmed Niloy**, "Circular-Rower Model of Particle Transport by Cilia Arrays in Parallel-Wall Channels", on *76th Annual Meeting of the Division of Fluid Dynamics*, November 2023.
10. Michael C Holcomb, **Redowan Ahmed Niloy**, Jeffery H Thomas, Jerzy Blawdziewicz, "The Mechanics of Cephalic Furrow Formation in the *Drosophila* Embryo", in the *Fall 2023 Joint Meeting of the Texas Section of the APS, Texas Section of the AAPT & Zone 13 of the SPS*, October 2023.
11. Zabir Mahmud, Rifat Ibn Azad, **Redowan Ahmed Niloy**, Adibuzzaman Rahi, Shadman Tahmid, "Observation of unsteady shock behaviour around a biconvex circular air foil with circular cavities on it in a channel", on *3rd International Conference on Mechanical Industrial and Materials Engineering*.
12. Sujun Barua, Sattajit Barua, Adibuzzaman Rahi, **Redowan Ahmed Niloy**, Shadman Tahmid, "Numerical analysis of shock oscillation around a biconvex circular arc air foil by incorporating a bump on it in a channel", on *3rd International Conference on Mechanical Industrial and Materials Engineering*.

Technical Skills

Programming Skills:

- Around five years of experience in Fortran, Bash in research problems.
- Object oriented programming in Fortran/C++.
- Experience in Python, MATLAB, C, C++, Mathematica, R, HTML-CSS in academic curriculum.

Numerical Computing Environment: Mathematica, MATLAB

Operating System: Linux, Windows

Modelling, Simulation tool: ANSYS Fluent, COMSOL

Data Plotting & Visualization: GNU plot, Tec plot, CFD-post.

Drawing and Design Tools: SolidWorks, AutoCAD

Documentation and Presentation: Office Suite, LaTeX.

Editing Software: Inkscape, Adobe Illustrator, Adobe Photoshop

Mentorship Experience

I have mentored one graduate and four undergraduate students:

- Asma Harun, *graduate student of Physics at the Texas Tech University* Fall 2022 - Present
- Sujun Barua, Sattajit Barua, Zabir Mahmud Sami, Rifat Ibn Azad Tanim, *undergraduate students of Mechanical Engineering at the Bangladesh University of Engineering & Technology*.

Extra-curricular Activities

- Served as a judge multiple times at South Plains Regional Science and Engineering Fair (SPRSEF) at various levels.
- Organized inter-department Mechanics Olympiad for Mechanical, Civil and Industrial Engineering students of BUET.
- Presented my junior year college project in the International Engineering Innovation Summit, Dhaka, Bangladesh.

Collaborators

- Jeffery H Thomas, PhD, Associate Prof., Cell Biology & Biochemistry, TTUHSC, Lubbock, TX, USA.
- Michael C Holcomb, PhD, Assistant Prof., Angelo State, San Angelo, TX, USA.
- Guo-Jie Jason Gao, PhD, Associate Prof., Mathematical and Systems Engineering, Shizuoka University, Hamamatsu, Japan.

Professional Memberships

- Student Member, American Physical Society (APS)
- Member, Forum of Graduate Students' Affair (FGSA), American Physical Society.
- Member, Mechanical Engineering Graduate Students' Association (MEGA), Texas Tech University.

Curriculum Vitae: Redowan A Niloy

- Mechanical Engineering Association, BUET.

References

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