Bhaskarjyoti Sarma

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Executive Summary

- Ph.D. Candidate with prior experience as a Research and Development Engineer in a leading automobile industry.
- Strong background in experimental fluid mechanics, specifically in designing experimental set-up with high – speed imaging system and optical tools.
- Led innovative projects in a collaborative team environment resulting in 3 research articles published in high-impact journals, and 3 manuscripts in preparation.

Education

Ph.D., Mechanical Engineering, CGPA: 9.17/10 *(Expected Graduation : July 2020)*

Indian Institute of Technology Guwahati, India

Dissertation Title: "Experimental and Analytical Study of Field-Induced Dynamics of Liquid Drops."
Advisor: Dr. Amaresh Dalal (Professor) and Dr. Dipankar Narayan Basu (Associate Professor)

Bachelor of Technology, Mechanical Engineering, CGPA: 8.87/10 *(May 2013)*

National Institute of Technology, Silchar, India

Research Experience

Junior Research Fellow, Indian Institute of Technology Guwahati *(Jan. 2016 - Dec. 2017)*
Senior Research Fellow, Indian Institute of Technology Guwahati *(Jan. 2018 - Present)*
Microfluidics Research Laboratory

- **Electrowetting on liquid dielectric (EWOL)**: Experimentally observed and characterized the dynamics of electrowetting on a liquid dielectric surface, instead of conventional solid dielectric surface.
- **Electric discharge induced atomization of sessile liquid drops**: Experimentally explored the effect of confinement of electric discharge inside a liquid droplet, finally leading to droplet atomization. With tunable experimental parameters, we can control the size of the secondary droplets generated.
- **Magnetowetting of sessile ferrofluid droplets:** The wetting behavior of paramagnetic droplets on surfaces with differential wettability is studied experimentally. Additionally, specific stress has been given to analyze the effect of the elastic nature of the underlying surface on magnetowetting.
- **Droplet generation in a porous network:** The study elucidates the critical aspects of droplet generation from a porous network such as yarn engendered by capillary flow. The dynamics of the contact line and scaling laws have been proposed.
- **Electrocoalesence of sessile liquid droplets on superhydrophobic surface:** The effect of adhesive behavior and surface microstructure of a superhydrophobic surface on the electric field mediated merging and mixing of a pair of liquid droplet is studied extensively. The study has been extended to the in-situ preparation of gold nanoparticles in a Lab-on-chip device.
- **Role of surface wettability on droplet impact:** The various regimes of droplet impact on a superamphiphobic surface has been explored extensively with the help of experiments. A few new regimes have been unfurled in case of the impact of viscous liquid droplets with enhanced mass transfer and atomization.
- **Vortex wings induced enhanced mixing of two immiscible fluids in a microchannel:** The role of vortex wings of different shapes (triangular, airfoil, rectangular) and aspect ratios in the enhancement of mixing efficiency of two immiscible liquids in a microchannel is studied with the help of 3D numerical simulations.

Undergraduate Honors Thesis, NIT Silchar, Assam, Advisor: Dr. P.K. Patowary *(2012-2013)*
Project title: - Design and Analysis of Piezoelectric Driven Synthetic Jet Actuator for Mems Applications.

- Modeling and analysis of Synthetic Jet Actuator in the MEMS module of *COMSOL Multiphysics* Version 3.4.
- Lumped Element Analysis of the proposed model and validation with results from *COMSOL*.
- Optimization of the design parameters by fluid mechanical analysis in *FLUENT*.

Junior Research Fellowship, Indian Institute of Technology Guwahati *(Aug. -Dec. 2015)*
P. I. – Dr. Amaresh Dalal

- Development of a general purpose CFD solver over a hybrid unstructured grid --"Anupravaha".
- Validation of test cases with the results obtained from "*OpenFOAM*".

Summer Research Fellowship, Indian Institute of Technology Guwahati *(May – July 2012)*
P. I. – Dr. Ganesh Natarajan (IIT Palakkad) and Dr. Vinayak Kulkarni (IIT Guwahati)

- Development of CFD pre-processor and postprocessor of an in-house solver using CGNS for various aerodynamic applications.

Summer Research Fellowship, Indian Institute of Technology Guwahati *(May – July 2011)*
P. I. – Dr. Uday Shankar Dixit (IIT Guwahati)

- Designed and fabricated the prototype of the alternate form of traditional assamese rice pounding tool, "DHAKEI", using the principle of four-stroke engine.
- Experimental study of friction stir welding of thin sheet of aluminum alloys using vertical milling machine.

Work Experience

Research and Development Engineer (Assistant Manager),
Fuel and Turbocharging System, Maruti Suzuki India Limited, India *(July 2013 – July 2015)*

- Design and development of fuel system components of both 800 CC and 1600 CC diesel engines and to study their performance at the component level, different stages of vehicle development, and demographic conditions, accompanied by a robust feedback loop.
- Design and development of turbocharging components of 800 CC diesel engine and to study their performance at different stages of vehicle development and implementation of countermeasures whenever required.
- Design of Experiments (DOE) for all the fuel components at component level.
- Designing of process flow for the defect free production of all the sheet metal components, and to study the durability during each vehicle level durability test.
- Study and analyze the performance of existing rubber and metal tube components of the fuel system and improvisation of the performing testing methods for them.
- Analysis and design the layout of the components in the engine and its periphery.
- Analysis of failure of existing fitting components (screws, bolts and nuts) and propose best design parameters for the improvement of performance.
- Worked in a team comprising of various departments, including engineering, quality testing, manufacturing, and supply chain management, along with the Japanese experts, and took full responsibility for the components concerned from the design stage to the vehicle launch stage.
- Implementation of value analysis and value engineering (VA/VE) method for cost optimization.

Machine Operator, Non-conventional Machining Workshop
Indian Institute of Technology Guwahati *(Jan. 2016 – Dec. 2017)*

- Modelling and product development on Wire EDM machine for various student and research projects of IIT Guwahati.
- Modelling and product development on 3D printing machine.

Teaching Experience

Graduate Teaching Assistant, Indian Institute of Technology Guwahati *(Spring 2016-Fall 2019)*
Courses:

- Fluid Mechanics (*Instructor: Dr. D. N. Basu*) *Course strength: 45, undergrad*
- Basic Thermodynamics (*Instructor: Dr. D. N. Basu*) *Course strength: 45, undergrad*
- Conduction and Radiation (*Instructor: Dr. D. N. Basu*) *Course strength: 60, gradschool*
- CNC milling and CNC lathe machine (Non-conventional Machining Workshop, IIT Guwahati, Superintendent: Dr. P. S. Robi) *Course strength: 30, Undergrad*

Online Teaching Assistant, MOOC online course by IIT Madras *(Fall 2018-Spring 2020)*

Courses:

- **Introduction to CFD,**
  Course Instructor: Dr. Amaresh Dalal, IIT Guwahati
  (Enrollment Ongoing) *Spring 2020*

- **Fundamentals of Conduction and Radiation**
  Course Instructor: Dr. Amaresh Dalal and Dr. D. N. Basu, IIT Guwahati
  Student strength: - 2100 *Fall 2019*

- **Principles of Mechanical Measurement**
  Course Instructor: Dr. D. N. Basu, IIT Guwahati
  Student strength: - 1600 *Spring 2019*

- **Fundamentals of Nuclear Power Generation.**
  Course Instructor: Dr. D. N. Basu, IIT Guwahati
  Student strength: - 1700 *Fall 2018*

Conference Presentations

1. **B. Sarma**, *"Capillary Flow Mediated Drop Formation in a Yarn-based Microfluidic System"* **InterPore 2020,** 31 August - 3 September, 2020 (Virtual).
2. **B. Sarma**, *"Soft Magnetowetting"* **UK Colloids 2020,** 21 July, 2020 (Virtual).
3. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, and D. Bandyopadhyay, *"Electric Discharge Mediated Transient Interfacial Dynamics of a Sessile Liquid Droplet: Plethora of Hydrodynamic Features",* **APS March Meeting 2020,** 2 - 6 March, 2020, Denver, Colorado. (Cancelled due to COVID 19)
4. **B. Sarma**, A. Dalal, and D. N. Basu, *"Altered Energy Landscape of Hydrophobic Surfaces: Role of Soot Nanoparticles"* Poster no: PG207, **6th International Conference on Advanced Nanomaterial and Nanotechnology (ICANN-2019)**, 18 -21 December, 2019, IIT Guwahati, India.
5. **B. Sarma**, A. Dalal, and D. N. Basu, *"Transient Interfacial Dynamics of Viscous Droplets Impacting on Superhydrophobic Surfaces."* Paper no: 868, **25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2019)**, 28-31 December, 2019, IIT Roorkee, India.
6. **B. Sarma**, A. Dalal, and D. N. Basu, *"Impact Dynamics of Viscous Droplets on Superhydrophobic Surface."* **Fluids and Health 2019: Fluid Dynamics of Disease Transmission** 23 July- 3 August, 2019, The Cargese Institute of Scientific Studies, France. (**Oral Presentation**)
7. **B. Sarma**, D. N. Basu, and A. Dalal, *"Dynamics of Droplet Generation in a Critically Low Weber Number Flow."* Paper no: 236, **Indian Conference on Applied Mechanics (INCAM-2019)**, 3-5 July, 2019, IISc Bengaluru, India. (**Selected for journal publication)**
8. **B. Sarma**, V. Shahapure, A. Dalal, and D. N. Basu, *"Self-similar Temporal Dynamics of Liquid Droplets Evolving from a Yarn.",* **Research Conclave,** 14-17 March, 2019, IIT Guwahati.
9. V. Shahapure, **B. Sarma**, A. Dalal, and D. N. Basu, *"Role of High-Speed Imaging and Image Analysis in Droplet Dynamics."* **Research Conclave,** 14-17 March, 2019, IIT Guwahati.
10. **B. Sarma**, A. Dalal, and D. N. Basu, *"Universal scaling laws in drop-on-demand generation from a yarn."* Paper no: 467, 7th **International and 45th National Conference on Fluid Mechanics & Fluid Power (FMFP 2018)**, 10-12 December, 2018, IIT Bombay, India. (**BEST PAPER AWARD, M. G. DESHPANDE MEMORIAL PRIZE**)
11. V. Shahapure, **B. Sarma**, A. Dalal, and D. N. Basu, *"High speed imaging and analysis of drop formation."* Paper no: 680, 7th **International and 45th National Conference on Fluid Mechanics & Fluid Power (FMFP 2018)**, 10-12 December, 2018, IIT Bombay, India.
12. **B. Sarma**, S. Pokhrel, S. Kumar, A. Dalal, D. Bandyopadhyay, and D. N. Basu, *"Prediction of Sauter mean diameter of spray during electric discharge mediated bursting of a droplet."* Paper no: 251, **International Conference on Recent Innovations and Developments in Mechanical Engineering**, 8-10 November, 2018, NIT Meghalaya, India.
13. **B. Sarma**, S. Kumar, D. Bandyopadhyay, A. Dalal, D. N. Basu and A. K. Dasmahapatra, *"Electrowetting-on-Liquid (EWOL): A Novel Technique for Microfluidics Based Applications."* **Research Conclave** 8-10 March, 2018, IIT Guwahati, **(BEST POSTER AWARD)**

14. **B. Sarma**, *"Friction stir welding of thin aluminium alloy plates using milling machine: a basic compatibility study."* 1st **International Conference on Mechanical Materials and Renewable Energy (ICMMRE 2017),** 8-10 December, 2017, SMIT, Sikkim.
15. S. Kumar, **B. Sarma**, A. Dalal, D. N. Basu, A. K. Dasmahapatra and D. Bandyopadhyay, "*Field induced anomalous spreading, oscillation, ejection, spinning, and breaking of oil droplets on a strongly slipping water surface*", **Chemical Physics of Electroactive Materials Faraday Discussion**, 10-12 April, 2017, Cambridge, United Kingdom.
16. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, A. K. Dasmahapatra and D. Bandyopadhyay, *"On Demand Magnetic Manipulation of Nanoparticle Laden Droplets on Micro-Fiber Highway."* **REFLUX 2017,** IIT Guwahati.
17. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, A. K. Dasmahapatra and D. Bandyopadhyay, *"Dynamics of electrolyte droplet in presence of electric field"* **Research Conclave 2017,** IIT Guwahati.
18. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, A. K. Dasmahapatra and D. Bandyopadhyay, *"Directional motion of Nanoparticle Laden Droplets on Micro-Fiber Highway."* **NANO INDIA 2017,** IIT Delhi (supported by Department of Science & Technology (DST)).
19. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, A. K. Dasmahapatra and D. Bandyopadhyay *"Instability and Breaking of Aqueous Droplet on a Dielectric Coated Electrode."* **COMPFLU 2016,** IIIT Hyderabad.

Journal Publications

1. **B. Sarma,** V. Shahapure, A. Dalal, and D. N. Basu, "Magnetowetting Dynamics of Sessile Ferrofluid Droplets on Soft Surface." *Soft Matter*, (2020) 16, 970-982.
2. **B. Sarma,** V. Shahapure, A. Dalal, and D. N. Basu, "Experimental Characterization of the Growth Dynamics during Capillarity-Driven Droplet Generation." *Physical Review E* (2019) 100, 013106.
3. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, and D. Bandyopadhyay, "Electric Discharge Mediated Jetting, Crowning, Bursting, and Atomization of a Hemispherical Droplet." (under review in *Physical Review Applied*)
4. **B. Sarma**, M. Dhar, U. Manna, A. Dalal, D. N. Basu, G. Biswas, and D. Bandyopadhyay, "Electrocoalescence of Sessile Liquid Droplets on Adhesive Superhydrophobic Surfaces." (In preparation)
5. **B. Sarma**, A. Dalal, and D. N. Basu, "Dynamic wetting characterisation of PDMS derived candle soot based superhydrophobic surface." (In preparation)
6. S. Kumar, **B. Sarma**, A. Dalal, D. N. Basu, A. K. Dasmahapatra, and D. Bandyopadhyay, "Field Induced Anomalous Spreading, Oscillation, Ejection, Spinning, and Breaking of Oil Droplets on a Strongly Slipping Water Surface." *Faraday Discussions*, (2017) 199, 115-128.
7. **B. Sarma**, "Friction Stir Welding of Thin Aluminum Alloy Plates Using Milling Machine: A Basic Compatibility Study." *IOP Conference Series: Materials Science and Engineering*, (2018), 377, 012012.

Awards and Achievements

- Recipient of **International Society for Porous Media** Conference grant for InterPore 2020. *2020*
- Recipient of **MIT Department of Civil and Environmental Engineering's Travel Grant** (Full Grant) for attending the **Fluids and Health 2019: Fluid Dynamics of Disease Transmission conference** held at The Cargese Institute of Scientific Studies, France. *2019*
- Recipient of **"Tse Cheuk Ng Tai Innovations in Fluids and Health 2019 Award**" in the **Fluids and Health 2019: Fluid Dynamics of Disease Transmission conference** held at The Cargese Institute of Scientific Studies, France. *2019*
- Awarded M. G. Deshpande Memorial Prize in the "**Best Paper Award**" category in the **7th International and 45th National Conference on Fluid Mechanics & Fluid Power (FMFP 2018)** held at IIT Bombay. *2018*
- **Best Poster Award** in **Research Conclave 2018** organized by IIT Guwahati. *2018*
- **Award of Appreciation** from **Royal Society of Chemistry** for conducting a pre-

conference workshop in the **Complex Dynamical Systems and Applications conference (CDSA-2017)** held at IIT Guwahati. *2017*

- Recipient of **North-East Scholarship** for showing Excellent Performance in Academics. *2010 - 2013*

Instrument Operational Skills

- **High Speed Visualization camera** by Photron.
- **Contact Angle Goniometer.**
- **Wire Electro Discharge Machine.**
- **3D printing Machine.**
- **Optical Microscope (Leica)**
- **Thermal Imager.**
- **High Voltage AC/DC source.**
- **Spin coating unit (**Apex instruments co., India make**)**
- Operation of the **Source-meter** (Keithley instruments inc., USA)
- **Ultrasonicator.**

Methods & Skills

- *Lab Methods:* Ultrathin film manufacture, film characterization (structural, optical, electrical properties), all basic analytical methods.
- *Programming:* C, C++, LaTeX, Python (Plotting + Basic), Seaborn (Plotting), Django (Basics), Linux tools
- *Computational Software*: ANSYS, COMSOL MULTIPHYSICS 5.2, SPSS.
- *Quantitative:* ImageJ, Tracker, Origin, Tecplot, Mathematica, Microsoft Office
- *Languages:* English and Hindi, Assamese (mother tongue)
- Currently participating in writing 1 research grant proposal to DST-SERB India.

Hobbies

- *Sports:* Played Cricket as a Batsman in school and college level; practices Body-building.

- *Arts and Music:* Actively engaged in creative content writing of all kinds, including prose, poetry, sketch, skits, drama, ads. Also, served as an editor of several schools, and college magazines. Actively participated in performing arts specifically skit, drama, and mime both as actor and director since school days.

- *Digital Graphics Design:* Ad and Video making using Adobe Premiere Pro, and Movavi Video Suit. Active user of Adobe Photoshop.

- *Social Activities:* Currently engaged as President of an NGO, "Praktan Chatra Bharati SSNK," working in various sectors of rural health and education. The NGO has successfully conducted various social activities such as blood donation drive, cleanliness campaigns (Swachh Bharat mission), fundraiser activities for flood victims of Assam, rural school development, to name a few.

Leadership, professional involvement and community outreach:

- Represented Maruti-Suzuki India Limited with a group of 5 members in the drama category for the inter-corporate cultural competition in 2013.
- An official of the Gymkhana Union Body, NIT Silchar (2012), the official union body of students. Led in the post of "Drama Secretary" and organized first-ever "Inter Hostel Drama Competition."
- Executive member of the core committee of Incandescence, a biggest cultural extravaganza in the Barak Valley, Assam- responsible for sponsorship and event management that involved a budget of over $40,000.
- Executive member of the core committee of Techniche, a flagship national level technical festival, NITS-responsible for event management that involved a budget of over $20,000.
- Founder of *Dramatics Club, NIT Silchar* and acted as president for two years.
- Organizing Secretary of "POSUA 2013"- a flagship event held at NIT Silchar showcasing the rich cultural heritage of the North-Eastern part of India.

- Editorial member of the assamese section of the annual magazine of NIT Silchar- “IGNITS” in the year 2010 and 2013.
- Actively participated in the social activities such as cloth donation, voluntary teaching, cleanliness drive, etc. of National Service Scheme group of NIT Silchar
- One of the founding members of “Eco Club,”- a green club initiative of NIT Silchar, in 2011.

Membership of Professional Bodies

- **International Society for Porous Media** (Student Membership)
- **American Physical Society** (Student Membership, **ID: 61316895**).
- **American Society of Mechanical Engineers** (Student Membership, **ID: 100122666**).