

Saikat Basu, Ph.D.

Curriculum Vitae: Updated 08/2024

Assistant Professor

Department of Mechanical Engineering, South Dakota State University
Crothers Hall 216, ME Box 2219, Brookings, SD 57007, USA

k Sai kat. Basu@sdstate. edu

605 688-6868 | [Linked](#) | [YouTube](#)
m Basu Lab: [Biomedical & Bioinspired Fluids](#)

Research Interests Focus: Theoretical and Computational Fluid Mechanics modeling, with 'table-top' experiments
Specific interests: Biofluid Mechanics; Vortex Dynamics; Interfacial Mechanics; Respiratory Flow Physics; Aerial and Inhaled Transmission of Pathogens; Tumor Perfusion; Drug Delivery

Teaching Interests Undergraduate level: Statics, Dynamics, Fluid Mechanics, Biomechanics, Numerical Methods
Graduate level: Advanced Fluid Dynamics, Biomedical Applications, Nonlinear Dynamics

Education

08/2009 – 05/2014 Ph.D. in Engineering Mechanics Virginia Tech
Specialization: Fluid Mechanics Department of Engineering Science & Mechanics
Dissertation: Dynamics of complex laminar wakes: modeling, analysis, and experiments. [Link](#)
Advisor: Dr. Mark A Stremler | [Link to academic genealogy \(Mathematics Genealogy Project\)](#)

07/2005 – 05/2009 B.E. in Civil Engineering Jadavpur University (India)
First Class with Honors | Electives: Wind Engineering, Structural Dynamics

Appointments

01/2019 – Present Assistant Professor (tenure track) South Dakota State University (SDSU)
Department of Mechanical Engineering, Jerome J Lohr College of Engineering

02/2021 – 01/2024 Associate (external member) University of North Carolina (UNC) at Chapel Hill
UNC Chapel Hill – NC State University Joint Department of Biomedical Engineering

04/2016 – 12/2018 Postdoctoral Fellow UNC Chapel Hill
Department of Otolaryngology / Head and Neck Surgery, School of Medicine
Area: Respiratory transport, topical drug delivery – computational modeling
Added appointment: Instructor, UNC-NCSU Joint Dept. of Biomedical Engineering

06/2014 – 03/2016

08/2009 – 05/2014

12. NSF Supplemental Award for Travel (an NSF – European Research Council Mechanism)
 CAREER supplement: The Contagion Science: Integration of inhaled transport mechanics principles inside the human upper respiratory tract at multi scales
 Global Venture Fund | European Collaborator Site: Leiden University Medical Center, The Netherlands
 Period: 01/2024 – 12/2028 | Amount: \$17,058 | Grant Role: Principal Investigator
11. NIH-NIGMS COBRE RPL Grant | Project Number 5P20GM109024-07
 Computational and theoretical fluid mechanics modeling for transport in dense tumors
 Period: 03/2023 – 02/2026 | Amount: \$450,000 | Grant Role: Principal Investigator
10. Industry-sponsored project
 Sponsored collaboration with Aptar Pharma: In silico design of muco-adhesive depot solutions and delivery devices for targeted intranasal vaccines
 Period: 08/2022 – 05/2024 | Amount: \$66,066 | Grant Role: Principal Investigator
9. NSF CBET RAPID Grant for COVID-19 | Award Number 2028069
 Collaborative Research: New generation of a bio-inspired protective mask based on thermal & vortex traps
 Period: 05/2020 – 04/2022 | Amount: \$199,712 (Basu's spending authority: \$62,824)
 Grant Role: Co-Principal Investigator (with S Jung at Cornell University and LP Chamorro at UIUC)
8. NIH-NIGMS COBRE Pilot Grant from North Dakota State University (PI: S Mallik, Ph.D.)
 Computational tracking of perfusion in solid tumors
 Period: 04/2021 – 07/2022 | Amount: \$49,999 | Grant Role: Subaward Principal Investigator
7. NIH R01 Subcontract # SA1900491 | Grant HL122154 at UNC Chapel Hill (PI: JS Kimbell, Ph.D.)
 Improving topical drug delivery for treatment of chronic rhinosinusitis
 Period: 04/2019 – 03/2020 | Amount: \$20,021 | Grant Role: Subaward Principal Investigator

Awarded intramural funding:

6. Haarberg Drug, Disease and Delivery (3D) Center Exploratory Grant
 Development of a digital platform to assess targeted regional drug delivery for airway sites
 Period: 04/2023 – 06/2024 | Amount: \$99,710 | Grant Role: Principal Investigator
5. Haarberg 3D Center Award for Undergraduate Research Support
 'Peak band' vs. 'Monotonic decay': exploring particle deposition and penetration in anatomic cavities
 Period: 02/2023 – 06/2023 | Amount: \$3,000 | Grant Role: Principal Investigator
4. Scholarly Dissemination Award from the SDSU Office of Academic Affairs
 Use of computational fluid dynamics to track respiratory transport in the throat
 Period: 11/2019 – 05/2020 | Amount: \$500 | Grant Role: Principal Investigator
3. TraCS Pilot Grant 2KR971701, supported by NIH-NCATS Award UL1TR002489 at UNC Chapel Hill
 CFD-based identification of optimal particle sizes for targeted drug delivery at laryngeal granulomas
 Period: 02/2018 – 05/2019 | Amount: \$2,000 | Grant Role: Principal Investigator (prior to SDSU)

Invited full proposal(s):

2. ARPA-H BREATHE
 Adaptable biosensing system coupled with multiscale risk modeling integrated into HVAC building controls
 Post-evaluation of a 6-page solution summary, a full proposal has been invited.
 Period: 2024 – 2025 | Invited budget: \$52 million (Basu's spending authority: \$1.295 million)
 Grant Role: Senior Personnel (Lead institutions: MIT; Triple Ring Technologies)

1. America's Seed Fund: NSF SBIR/STTR Phase I – Biomedical Technologies (BM)
Mechanics-informed prompt estimation of drug delivery efficiency at target tissue regions to fast-track the design and development of airway therapeutics
Post-evaluation of an extended project pitch, a full proposal has been invited.
Period: 2024 – 2025 | Invited budget: \$275,000 | Grant Role: Company Founder and Chief Scientist
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Industry Collaborations (with Non-Disclosure Agreements in place, as of 08/2024)

- Carrier Corporation (East Syracuse, NY)
 - Triple Ring Technologies (Newark, CA)
 - Well Living Lab (Rochester, MN)
 - Aptar Pharma (Congers, NY)
 - NextBreath (Baltimore, MD)
 - Applied Research Associates (Raleigh, NC)
 - Dr. Ferrer Biopharma (Hallandale Beach, FL)
 - Environmental Medicine, Inc. (Westwood, NJ)
 - Fractal Therapeutics (Lexington, MA)
 - Innoveyda (Foothill Ranch, CA)
 - MedScience Research Group, Inc. (West Palm Beach, FL)
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Publications, including preprints h-index = 14, i10-index = 19 (as of 08/2024) [Google Scholar link](#)

Note: Underline denotes students supervised by Dr. Basu | * = Basu is corresponding author.

33. * S Basu, LP Chamorro, M Yeasin, MA Stremmler
[Modeling the effect of vorticity on inhaled transport in the upper airway](#)
arXiv:2406.09708, under review, 2024 | [Download PDF](#)
32. M Singh, S Basu, D Samanta
Viscoelastic fluid droplet impact on thin liquid films: Suppression of secondary droplets
Under review, 2024 | [Download PDF](#)
31. * S Basu
[On the mechanics of inhaled bronchial transmission of pathogenic microdroplets generated from the upper respiratory tract, with implications for infection onset](#)
arXiv:2406.17895, under review, 2024 | [Download PDF](#)
30. Z Wu, S Basu, S Kim, M Sorrells, FJ Beron-Vera, S Jung
[Coherent spore dispersion via drop-leaf interactions](#)
Science Advances, Volume 10(5), eadj8092, 2024 | [Download PDF](#)
Media attention: [Yahoo! News](#), [Science Daily](#)
29. * MMH Akash, Y Lao, PA Balivada, P Ato, NK Ka, A Mituniewicz, Z Silfen, J Suman, A Chakravarty, D Joseph-McCarthy, S Basu
[On a model-based approach to improve intranasal spray targeting for respiratory viral infections](#)
Frontiers in Drug Delivery, Sec. Respiratory Drug Delivery, Volume 3, 1164671, 2023 | [Download PDF](#)

19. S Treat, CS Ebert Jr., Z Farzal, S Basu, AM Zanation, BD Thorp, JS Kimbell, BA Senior, AJ Kimple
[Intranasal corticosteroids: patient administration angles and impact of education](#) ²
Rhinology Online, Volume 3, 160-166, 2020 | [Download PDF](#)
18. BM Brandon, WH Stepp, S Basu, JS Kimbell, BA Senior, WW Shockley, J Madison Clark
[Nasal airflow changes with bioabsorbable implant, butterfly and spreader grafts](#)
The Laryngoscope, Volume 130(12), E817-E823, 2020 | [Download PDF](#)
17. Z Farzal, S Basu, A Burke, O Fasanmade, E Mamuyac, W Bennett, C Ebert Jr., A Zanation, B Senior, JS Kimbell
[Comparative study of simulated nebulized and spray particle deposition in chronic rhinosinusitis patients](#)
International Forum of Allergy and Rhinology, Volume 9(7), 746-758, 2019 | [Download PDF](#)
16. LF Tracy, S Basu, P Shah, DO Frank-Ito, S Das, AM Zanation, JS Kimbell
[Impact of endoscopic craniofacial resection on simulated nasal airflow and heat transport](#)
International Forum of Allergy and Rhinology, Volume 9(8), 900-909, 2019 | [Download PDF](#)

Working preprints and spray

8. BM Brandon, GK Austin, G Fleischman, S Basu, JS Kimbell, WW Shockley, J Madison Clark
[Comparison of airflow between spreader and butterfly grafts using computational fluid dynamics in a cadaveric model](#)
 JAMA Facial Plastic Surgery, Volume 20(3), 215-221, 2018 | [Download PDF](#)

7. JS Kimbell, S Basu, Z Farzal, BA Senior
[Characterizing nasal delivery in 3D models before and after sinus surgery](#)
 Respiratory Drug Delivery, Volume 1, 181-188, 2018 | [Download PDF](#)

- 6.* S Basu, A Yawar, A Concha, MM Bandi
[On angled bounce-off impact of a drop impinging on a flowing soap film](#)³
 Fluid Dynamics Research, Volume 49(6), 065509, 2017 | [Download PDF](#)

- 5.* S Basu and MA Stremmler
[Exploring the dynamics of '2P' wakes with reflective symmetry using point vortices](#)
 Journal of Fluid Mechanics, Volume 831, 72-100, Cambridge University Press, 2017 | [Download PDF](#)

- 4.* S Basu and MA Stremmler
[On the motion of two point vortex pairs with wake-inspired glide-reflective symmetry in a periodic strip](#)
 Physics of Fluids, Volume 27(10), 103603, 2015 | [Download PDF](#)

3. MA Stremmler and S Basu
[On point vortex models of exotic bluff body wakes](#)
 Fluid Dynamics Research, Volume 46(6), 061410, 2014 | [Download PDF](#)

2. MA Stremmler, A Salmanzadeh, S Basu, and CHK Williamson
[A mathematical model of 2P and 2C vortex wakes](#)
 Journal of Fluids and Structures, Volume 27(5-6), 774-783, 2011 | [Download PDF](#)

- Working preprint
1. SB Sreenath, JS Kimbell, S Basu, AJ Coniglio, TE Fontenot, BD Thorp, CS Ebert, BA Senior, AM Zanation
[Comparative Analysis of the Main Nasal Cavity and the Paranasal Sinuses in Chronic Rhinosinusitis: An Anatomic Study of Maximal Medical Therapy](#)
 arXiv:1811.00649, uploaded 2018 | [Download PDF](#)

Peer-reviewed [✓] Conference Articles

[✓]Acceptance for oral presentation based on review of extended abstracts / short papers

Note: Lead author is the presenter, unless otherwise mentioned.

2. MA Stremler and S Basu
Mathematical modeling of exotic vortex wakes
SES Annual Technical Meeting, October 2011, Northwestern University, Evanston, IL
 1. MA Stremler, S Basu, T Schnipper, A Andersen
A mathematical model of the vortex dynamics in 2P and 2C wakes
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31. MMH Akash, Z Silfen, D Joseph-McCarthy, A Chakravarty, S Basu
Can Machine Learning predict particle deposition at specific intranasal regions based on computational fluid dynamics inputs/outputs and nasal geometry measurements?
SDSU Data Science Symposium, February 2023, Brookings, SD

30. MMH Akash, A Tummala, S Basu

30.AkashTummalaSS3

19. Z Wu, S Basu, S Jung
Particle dispersal induced by coherent flow structures near oscillating leaves
APS DFD Annual Meeting, November 2020, Virtual Conference
18. A Chakraborty, A Jorgensen, J Yuk, C Chung, LP Chamorro, S Jung, S Basu
Simulating inhaled transport through bio-inspired pathways in mask filters
APS DFD Annual Meeting, November 2020, Virtual Conference
17. J Yuk, B Cooke, K Frohlich, D Morton, CI Chung, A Jorgensen, S Basu, L Chamorro, S Jung
3D-printing mask filters inspired by animal nasal cavity
APS DFD Annual Meeting, November 2020, Virtual Conference
16. CI Chung, J Yuk, A Jorgensen, S Basu, S Jung, LP Chamorro
Vortex traps to capture particles with reduced pressure loss in respiratory masks
APS DFD Annual Meeting, November 2020, Virtual Conference
15. S Basu, R Shah, A Pappa, J Wu, A Burke, W Bennett, W Bodnar, JS Kimbell
Can we use CFD to improve targeted drug delivery in throat?
APS DFD Annual Meeting, November 2019, Seattle, WA
14. S Basu, GJM Garcia, Z Farzal, DO Frank-Ito, JS Kimbell
Exploring nasal spray positioning to improve targeted drug delivery
SCONA Meeting, June 2019, Chicago, IL
- [Prior to SDSU]
13. S Basu, CS Ebert Jr., JS Kimbell
Topical drug delivery: how CFD can “revolutionize” the usage protocol for nasal sprays
APS DFD Annual Meeting, November 2018, Atlanta, GA
12. S Basu, Z Farzal, JS Kimbell
“Magical” fluid pathways: inspired airflow corridors for optimal drug delivery to human sinuses ⁴
APS DFD Annual Meeting, November 2017, Denver, CO
11. S Basu, JS Kimbell, AM Zanation, CS Ebert Jr., BA Senior
Clinical questions and the role CFD can play
APS DFD Annual Meeting, November 2016, Portland, OR
10. S Basu, A Yawar, A Concha, MM Bandi
Modeling drop impacts on inclined flowing soap films
APS DFD Annual Meeting, November 2015, Boston, MA
9. A Yawar, S Basu, A Concha, MM Bandi
Experimental study of drop impacts on soap films
APS DFD Annual Meeting, November 2015, Boston, MA
8. S Basu and MA Stremmer
Mathematical models for exotic wakes
APS DFD Annual Meeting, November 2014, San Francisco, CA

⁴ Featured in a press conference arranged by the American Institute of Physics (AIP), dated 20-November-2017.

7. S Basu and MA Stremler
Point vortex modeling of symmetric four-vortex wakes
APS DFD Annual Meeting, November 2013, Pittsburgh, PA
6. S Basu and MA Stremler
Exotic wake dynamics
Virginia Tech Fall Fluid Mechanics Symposium, Nov. 2013, Blacksburg, VA
5. S Basu, MA Stremler, T Schnipper, A Andersen
Modeling the dynamics of four vortex bluff body wakes
APS DFD Annual Meeting, November 2012, San Diego, CA
4. S Basu and MA Stremler
A mathematical model of laminar wakes with four vortices per period
APS DFD Annual Meeting, November 2011, Baltimore, MD
3. S Basu, MA Stremler, T Schnipper, A Andersen
Mathematical modeling of 2P mode vortex wakes
APS DFD Annual Meeting, November 2010, Long Beach, CA
2. S Basu, MA Stremler, T Schnipper, A Andersen
Point vortex dynamics in exotic wake formations
Virginia Tech Fall Fluid Mechanics Symposium, November 2010, Blacksburg, VA
1. S Basu
Optimizing buckling load carrying capacity of a column
Cochin University of Science and Technology Annual Symposium, March 2008, Cochin, India

Select Poster Presentations

Note: Lead author is the presenter, unless otherwise mentioned. Underline denotes students mentored by Basu.

12. MMH Akash, M Yeasin, S Basu
Integrative modeling of solute transport phenomena in solid tumor microvasculature

8. _____

- 2009 Pratt Presidential Graduate Fellowship (Virginia Tech)
- 2008 Indian Academy of Science Summer Research Fellowship (India)
- 2008 Graduate Record Examination (GRE) General Test: 1510 / 1600 (800/800 in Quants, 710/800 in Verbal; highest from Basu's undergraduate institution in 2008)
- 2007 Jawaharlal Nehru Center For Advanced Scientific Research (JNCASR) Summer Research Fellowship (India)
- 2004 National Scholarships Scheme – Merit Certificate (India)
- 2002 State Government of West Bengal Award for performance in the Secondary Examination (Madhyamik Pariksha, i.e., 10th grade examination; Basu ranked 49th in the state, out of approximately 6,50,000 examinees)
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Selected Media Coverage

- On News in

- On SD Public Broadcasting, dated 20-May-2021 and 24-April-2020
In the Moment: Flow physics for COVID-19 | [Podcast link 1](#), [Podcast link 2](#)
- On The Brookings Register, dated 18-May-2021
SDSU professor improves COVID-19 prevention spray protocol | [News link](#)
- On Newswise, dated 23-March-2021
Aerosol modeling detects SARS-CoV-2 infectious dose, droplets | [News link](#)
- On Chemical & Engineering News, dated 12-August-2020
COVID-19 pandemic has spurred materials researchers to develop antiviral masks | [News link](#)
- On Newswise, dated 21-July-2020
Aerosol modeling targets sinus inflammation | [News link](#)
- On Newswise, dated 20-April-2020
New reusable respirator will trap, kill coronavirus | [News link](#)
- On Science Daily, dated 20-November-2017
'Magic' sinus paths could mean new instructions for nasal sprays | [News link](#)

Invention Disclosures and Patents

4. A bioreactor to study solid tumor metastasis
Invention Disclosure, filed May 2024
Co-Inventors: S Mallik (North Dakota State University), K Van Hosen (North Dakota State University), S Mithul (North Dakota State University), MMH Akash (SDSU), S Basu (SDSU)
3. A digital platform to assess targeted regional drug delivery inside respiratory airway
Provisional patent application, in review, filed 02/2024
Inventor: S Basu (SDSU)
2. A digital platform to assess targeted regional drug delivery inside respiratory airway
Invention Disclosure, filed March 2023 | Approved by the SDSU Tech Transfer Team
Inventor: S Basu (SDSU)
1. A mechanism for extracting mechanical energy from flowing fluid using vortex-induced vibrations
Provisional patent, 09/2013 – 09/2014
Co-Inventors: MA Stremmer (Virginia Tech), S Basu (then at Virginia Tech), P Vlachos (Purdue University), GK Nave, Jr. (Colorado School of Mines)

Invited / Keynote Talks

28.

21. US National Congress of Theoretical and Applied Mechanics, External Biofluids Session, 06/2022, Austin, TX
 20. IIT Ropar – Department of Mechanical Engineering, 04/2022, Ropar, India
 19. University of Virginia, NSF PREPARE RAPID PI meeting, 12/2021, Online
 18. University of Illinois at Urbana-Champaign – Department of Mechanical Science & Engineering, 10/2021, Online
 17. Dr. Ferrer Biopharma-sponsored event in Dominican Republic for local clinicians, 07/2021, Online | [Recorded talk](#)
 16. Santa Clara University – School of Engineering, 03/2021, Online
 15. South Dakota State University – College of Pharmacy, 02/2021, Online
 14. The Mechanics Discussions Series, 02/2021, Online | [Recorded talk](#)
 13. National Aera Online
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- Ph.D. advisory committee chair (at SDSU):
Mohammad Akash (Mechanical Engineering, projected defense timeline: 2025)
Mohammad Yeasin (Mechanical Engineering, projected defense timeline: 2028)
Md

13. Senior Design Teams at SDSU (2019, 2020, 2021, 2022, 2023, 2024) | Topics: (a) Cardiopulmonary resuscitation simulator; (b) O₃-based sanitization device; (c) Design of cost-effective prosthetic legs; (d) 3D-printing of human airway cavities
14. Senior Design Teams from Boston

- Peer Reviewer:

1. Physics of Fluids
2. Journal of Mathematical Physics
3. Fluid Dynamics Research
4. Journal of Fluids Engineering
5. Experimental and Computational Multiphase Flow
6. PLOS One
7. PLOS Computational Biology
8. Scientific Reports
9. Medical Engineering and Physics
10. The Laryngoscope
11. JAMA Network Open
12. Journal of Biomechanics
13. Computers in Biology and Medicine
14. Meccanica
15. International Forum of Allergy and Rhinology
16. International Journal for Numerical Methods in Biomedical Engineering
17. Energies
18. Nonlinear Science
19. Engineering Computations
20. Biomechanics and Modeling in Mechanobiology
21. Computer Methods in Biomechanics and Biomedical Engineering
22. Computer Modeling in Engineering and Sciences
23. Applied Sciences
24. Journal of Nonlinear, Complex and Data Science
25. Design of Medical Devices Conference (responsibility: reviewing contributed conference papers)
26. Eastern South Dakota Science and Engineering Fair (responsibility: judging contributed posters)

- Editorial Roles:

1. Guest Editor (2021) for "Aerosol Transport in the Biological and Environmental Fluids" special issue at issue

- Faculty Advisor (08/2022 – Present): Biomedical Engineering Society (BMES) Chapter at SDSU. Supervised the reinstatement of SDSU to the national chapter status in Fall 2023.
 - Elected College of Engineering Representative (04/2019 – 04/2020): Faculty Senate at SDSU
 - IIT Ropar MoU: Facilitated signing of a Memorandum of Understanding for academic exchange between SDSU and IIT Ropar, India (formalized in 04/2022; [read media story](#))
 - US-India Partnership: Represented SDSU at the [White House](#), on invitation from President Biden, for the formal State Arrival Ceremony of India's Prime Minister Narendra Modi (06/2023); [read media story](#)
 - Chair, Planning Postdoc Sub-Committee (2017): Smithies Annual Nobel Symposium, UNC Chapel Hill
 - Elected Class Representative (2005 – 2006): Department of Civil Engineering, Jadavpur University, India
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Professional Memberships

- Regular Member (2014 – Present) | Student Member (2010 – 2014): American Physical Society (APS)
 - Faculty Advisor and Member (2022 – Present): Biomedical Engineering Society (BMES)
 - Nominated Member (2023 – Present): Order of the Engineer
 - Nominated Member (2020 – 2021): Sigma Xi – Scientific Research Honor Society
 - Early Career Member (2017 – 2019): International Society for Aerosols in Medicine (ISAM)
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Basu's Undergraduate Research Stints

Summer 2008	Research Intern German Aerospace Center (DLR in Braunschweig, Germany) Institute of Composite Structures and Adaptive Systems, German Aerospace Center Area: Finite volume modeling for active structural acoustic control
Summer 2007	Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR) Fellow Assigned to the Physics Unit, The Institute of Mathematical Sciences (Chennai, India) Area: Theoretical analysis of ciliated torus mechanics at low Reynolds numbers

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Basu Lab Website

