Associate Professor
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Sovan Lal Das

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Physical and Chemical Biology Laboratory
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Education

CORNELL UNIVERSITY, College of Engineering, Ithaca, NY
PHD - Theoretical and Applied Mechanics: January 2007
Minor: Mathematics, **Advisor:** Prof. James T. Jenkins
Thesis: Studies of Axisymmetric Lipid Bilayer Vesicles: Parameter Estimation, Micropipette Aspiration, and Phase Transition.

INDIAN INSTITUTE OF SCIENCE, Bangalore, India
M. SC (ENGG). - Mechanical Engineering: June 2002
Advisor: Prof. Anindya Chatterjee
Thesis: Dynamics and Bifurcations of Some Nonlinear Systems: Analytical and Numerical Studies.

JADAVPUR UNIVERSITY, Kolkata, India
B. E. - Mechanical Engineering: July 1999

Academic Distinctions

Graduate School Fellowship, Cornell University, 2002−2003.
Best Master's Thesis of the Year, Indian Institute of Science, 2004.
National Talent Search Scholarship, West Bengal, India, 1993-1999.

Work Experience

Dec. 2018 - Present ASSOCIATE PROFESSOR, Indian Institute of Technology, Palakkad, India.

Dec. 2016 - Dec. 2018 ASSOCIATE PROFESSOR, Indian Institute of Technology, Kharagpur, India.

Jun. 2014 - Dec. 2016 ASSOCIATE PROFESSOR, Indian Institute of Technology, Kanpur, India.

Jan. 2015 - Jul. 2015 ASSOCIATE PROFESSOR (visiting), Indian Institute of Technology, Delhi, India.

Nov. 2009 - Jun. 2014 ASSISTANT PROFESSOR, Indian Institute of Technology, Kanpur, India.

Oct. 2008 - Oct. 2009 SENIOR RESEARCH ENGINEER, Goodyear Tire & Rubber Company.
Worked on tire manufacturing and performance modeling to improve tire uniformity. Released one research report and submitted an invention disclosure.

Jan. 2007 - Sep. 2008 POSTDOCTORAL SCHOLAR, Department of Mathematics, Penn State University.
Worked on the adhesion of lipid bilayer vesicles (under the supervision of Prof. Qiang Du).

Oct. - Dec. 2005 VISITING SCHOLAR, Department of Chemistry, University of Pennsylvania.
Conducted experimental studies on lipid bilayer vesicles. (under the supervision of Prof. Tobias Baumgart).

Aug. 1999 - Jul. 2000 GRADUATE TRAINEE ENGINEER, Larsen & Toubro Limited, India.
Involved in designing equipments for a project for building a Milk Processing Plant.

Teaching Experience

UG Courses: Mechanics, Dynamics, Engineering Drawing, Engineering Thermodynamics, Design of Machine Elements, Theory of Mechanisms and Machines, Biomechanics, Calculus, Matrices. (Recipient of top five feedback in first year courses at IIT Kharagpur)

PG Courses: Introduction to Continuum Mechanics, Introduction to Solid Mechanics, Theory of Elasticity, Theory of Plasticity, Mathematics for Engineers, Approximate Methods in Engineering Mathematics, Principles of Dynamics, Mechanics of Biological Membranes.

Tutorial: Dynamics, Mechanics of Solids, Engineering Mechanics, Design of Machine Elements, Mechanisms, Calculus, Ordinary and Partial Differential Equations.

Sponsored Research

Motion and Interactions of Domains in Fluid Lipid Membranes, SERB, DST, 2012-2015, INR 25.66 lakhs.

Membrane curvature sensing and generation by proteins in lipid bilayer membrane, DBT, 2015-2018, INR 67.35 lakhs.
Other members: Prof. P. B. Sunil Kumar, IIT Madras (Co-PI), Dr. S. Matheswaran (Co-PI).

Contact mechanics of soft and thin adhesive structures, DST, INR 46.44 lakhs, 2018-2021.
Other member: Prof. Ishan Sharma(Co-PI).

Professional Activities

Dean (Academics), IIT Palakkad (October 2020 − Present)

Chairman, Library Affairs Committee (January 2021 − Present)

Faculty-in-Charge, Career Development Cell, IIT Palakkad (June 2019 − August 2021)

Faculty-in-Charge, International Relations, IIT Palakkad (November 2021 – September 2022)

Member, Institute Disciplinary Committee, IIT Palakkad, (January 2019 – Present)

Served as external examiner and Doctoral Committee member of several Ph. D. theses.

Co-opted member of the UG curriculum committee of Indrasheel University.

Co-Chair, Session on Surfactants and Membranes in CompFlu2019, December 5-7, 2019, IISER, Bhopal, India.

Organizing Committee Member, *TEQIP School on Mechanics and Applied Mathematics for Engineers*, February 19-25, 2015, IIT Kanpur.

Organizing Committee Member, *Pravartana: Workshop on Mechanics and Applied Mathematics*, for four successive years 2013-2016, 2019, IIT Kanpur.

Organizer and International Coordinators Board Member of KITPC 2012 Program, *Membrane Biophysics: Theory and Experiment*, May 7-June 1, 2012, Beijing, China.

Organizer of a symposium in SIAM conference on Life Science (LS10), *Mechanics and Biophysics of Lipid Bilayer Membranes*, July 12, 2010, Pittsburgh, USA.

Served as a reviewer for *Nature Communications*, *Nature Physics*, *Biophysical Journal*, *Journal of Chemical Physics*, *Langmuir*, *Applied Physics Letters*, *Physical Review Letters*, *Physical Review E*, *PLoS ONE*, *Biological Chemistry*, *Philosophical Magazine & Philosophical Magazine Letters*, *Proceedings of the Royal Society of London A*, *Nonlinear Dynamics*.

Convener of Departmental Undergraduate Committee, Departmental Cordinater for the Computer Center, Member of BTech Project Evaluation Committee, Member of Departmental Postgraduate Committee, Mechanical Engineering, IIT Kanpur, 2010-2012.

Member of Vision 2020 Team, IIT Kanpur, 2010.

Organizer of the Inhouse Symposium, Mechanical Engineering Dept, IISc Bangalore, 2002.

Publications

1. Islam, M. U., Jenkins, J. T. and Das, S. L.: **Extended kinetic theory for granular flow in a vertical chute**. *Journal of Fluid Mechanics* , accepted, 2022
2. Krishnan S, Sharma, S. and Das, S. L.: **Indentation of geometrically exact beams**. *International Journal of Solids and Structures* **254-255**, 111905, 2022
3. Nayak, A. K., , Gou, Z., Das, S. L., Barakat, A. I. and Misbah, C.: **Mathematical model of intracellular calcium in presence of receptor: a homeostatic model for endothelial cells**. *Biomechanics and Modeling in Mechanobiology* , accepted, 2022
4. Has, C., Sivadas, P., and Das, S. L.: **Insights into membrane curvature sensing and membrane remodeling by intrinsically disordered proteins and protein regions**. *Journal of Membrane Biology* **255**, 237, 2022
5. Kumar, A., Das, S. L., and Wahi, P.: **On the stability of thin-walled circular cylindrical shells under static and periodic radial loading**. *Journal of Sound and Vibration*, **527**, 116872, 2022
6. Vyas, P., Sunil Kumar, P. B and Das, S. L.: **Sorting of proteins with shape and curvature anisotropy on a lipid bilayer tube**. *Soft Matter*, **18**, 1653, 2022
7. Has, C. and Das, S. L. :**Recent developments in membrane curvature sensing and induction by proteins**. *Biochimica et Biophysica Acta (BBA) - General Subjects* **1865(10)**, 129971, 2021
8. Sachin Krishnan, T. V., Das, S. L. and Sunil Kumar, P. B:**Models for membrane curvature sensing of curvature generating proteins**. *Pramana - Journal of Physics* **94 (47)**, 1, 2020
9. Sachin Krishnan, T. V., Das, S. L. and Sunil Kumar, P. B: **Transition from curvature sensing to generation in a vesicle driven by protein binding strength and membrane tension**. *Soft Matter*, **15**, 2071, 2019
10. Mahata, P. and Das, S. L.: **Generation of wavy structure on lipid membrane by peripheral proteins: A linear elastic analysis**. *FEBS Letters*, **591**, 1333, 2017
11. Kumar, A., Das, S. L., and Wahi, P.: **Effect of radial loads on the natural frequencies of thin-walled circular cylindrical shells,**. *International Journal of Mechanical Sciences*, **122**, 37, 2017
12. Laxminarsimha Rao V., Roy S., and Das, S. L.: **Diffusion mediated coagulation and fragmentation based study of domain formation in lipid bilayer membrane**. *Physica B*, **505**, 74, 2017

13. Mohanty, D. P., Laxminarsimha Rao V., Das, S. L., and Ghatak, A.: **Polygonal deformation of a metallic foil subjected to impact by an axisymmetric indenter**. *Journal of Adhesion Science and Technology*, **31**, 1647, 2017
14. Rizvi, Md., S., Pal A., and Das, S. L.: **Structure-induced nonlinear viscoelasticity of non-woven fibrous matrices**. *Biomechanics and Modeling in Mechanobiology*, **15**, 1641, 2016
15. Kumar, A., Das, S. L., and Wahi, P.: **Instabilities of thin circular cylindrical shells under radial loading**. *International Journal of Mechanical Sciences*, **104**, 174, 2015
16. Laxminarsimha Rao V. and Das, S. L.: **Drag force on a liquid domain moving inside a membrane sheet surrounded by aqueous medium**. *Journal of Fluid Mechanics,* **779**, 468, 2015
17. Božič, B., Das, S. L., and Svetina, S: **Sorting of integral membrane proteins by curvature-dependent protein- lipid bilayer interaction**. *Soft Matter*, **11**, 2479, 2015
18. Mahata, P. and Das, S. L.: **Two-dimensional convex-molecule fluid model for surface adsorption of proteins: Effect of soft interaction on adsorption equilibria**. *Physical Review E*, **90**, 062713, 2014
19. Das, S. L., Mandal, T., and Gupta, S. S.: **Inextensional vibration of zig-zag single walled carbon nanotubes using nonlocal elasticity theories**. *International Journal of Solids and Structures* **50**, 2792, 2013
20. Rizvi, Md., S. and Das, S. L.: **Role of membrane addition in animal cell cytokinesis**. *Journal of Theoretical Biology* **315**, 139, 2012
21. Singh, P., Mahata, P., Baumgart, T., and Das, S. L.: **Curvature sorting of proteins on a cylindrical lipid membrane tether connected to a lipid reservoir**. *Physical Review E* **85**, 051906, 2012
22. Zhu, C., Das, S. L., and Baumgart, T.: **Nonlinear sorting, curvature generation, and crowding of Endophilin N-BAR on tubular membranes**. *Biophysical Journal* **102**, 1837, 2012
23. Baumgart, T., Capraro, B. C., Zhu, C., and Das, S. L.: **Thermodynamics and mechanics of membrane curvature generation and sensing by proteins and lipids**. *Annual Reviews in Physical Chemistry* **22**, 483, 2011
24. Das, S.: **Influence of the bending rigidity and the line tension on the mechanical stability of micropipette aspirated vesicles**. *Physical Review E* **82**, 021908, 2010 (Also appearing in the August 15, 2010 issue of Virtual Journal of Biological Physics Research)
25. Zhao, Y., Das, S., and Du, Q.: **Adhesion of multi-component vesicle membranes**. *Physical Review E* **81**, 041919, 2010 (Also appearing in the May 1, 2010 issue of Virtual Journal of Biological Physics Research)
26. Zhang, J., Das, S. L., and Du, Q.: **A phase field model of vesicle substrate adhesion**. *Journal of Computational Physics* **228**, 7837, 2009
27. Das, S. L., Jenkins, J. T., and Baumgart, T.: **Neck geometry and shape transitions in vesicles with co-existing fluid phases: Role of Gaussian curvature stiffness versus spontaneous curvature**. *Europhysics Letters,* **86**, 48003, 2009
28. Das, S. L., Tian, A., and Baumgart, T.: **Mechanical stability of micropipette aspirated giant vesicles with fluid phase coexistence**, *Journal of Physical Chemistry B,* **112**, 11625–11630, 2008
29. Das, S. L. and Du, Q.: **Adhesion of vesicles to curved substrates**, *Physical Review E,* **77**, 011907, 2008 (Also appearing in the January 15, 2008 issue of Virtual Journal of Biological Physics Research)
30. Das, S. L., and Jenkins, J. T.: **A higher-order boundary layer analysis for lipid vesicles with two fluid domains**, *Journal of Fluid Mechanics,* **597**, 429–448, 2008
31. Baumgart, T., Das, S. L., Webb, W. W., and Jenkins, J. T.: **Membrane elasticity in giant vesicles with fluid phase coexistence**, *Biophysical Journal,* **89**, 1067–1080, 2005
32. Das, S. L. and Chatterjee, A.: **Second order multiple scales for oscillators with large delay**, *Nonlinear Dynamics,* **39**, 375–394, 2005
33. Das, S. L. and Chatterjee, A.: **Multiple scales via Galerkin projections: approximate asymptotics for strongly nonlinear oscillators**, *Nonlinear Dynamics,* **32**, 161–186, 2003
34. Das, S. L. and Chatterjee, A.: **Multiple scales without center manifold reductions for delay differential equations near Hopf bifurcations**, *Nonlinear Dynamics,* **30**, 323–335, 2002
35. Das, S. L. and Chatterjee, A.: **An alternative stability analysis technique for the simplest walking machine**, *Nonlinear Dynamics,* **28**, 273–284, 2002

Conference proceedings

Kumar, A., Das, S.L., Wahi, P.: **Effect of radial loading on the beam mode vibration of circular cylindrical shells**, *Indian Conference on Applied Mechanics,* 2015, New Delhi, India.

Kumar, A., Das, S. and Wahi, P.: **Effect of radial loads and boundary conditions on the natural frequencies of a thin walled circular cylindrical shell**, *20th International Conference on Sound and Vibration,* 2013, Bangkok, Thailand.

Kumar, A., Das, S. and Wahi, P.: **Dynamic buckling of thin-walled circular cylindrical shells subjected to fluctuating radial loads**, *SMiRT 21,* 2011, New Delhi, India.

Buskohl, P., Das, S. L., Jenkins, J. T.: **Micropipette aspiration of lipid vesicles: A 2D approach**, *IASS-IACM 6th International Conference on Shell and Spatial Structures,* 2008, Ithaca, USA.

Das, S. L., Zhang J., and Du Q.: **Adhesion of lipid vesicles on patterened substrates**, *Biophysical Journal, 94, 1183, Meeting Abstract, 52nd Annual Meeting,* 2008, Long Beach, USA.

Das, S. L. and Jenkins, J. T.: **An analysis of micropipette aspiration of one-phase and two-phase vesicles**, *Biophysical Journal, 584A-584A, Meeting Abstract, 51st Annual Meeting,* 2007, Baltimore, USA.

Das, S. L. and Jenkins, J. T.: **Collisional flows of identical, smooth, nearly elastic spheres in a vertical chute**, *Powders and Grains,* 2005, Stuttgart, Germany.

Das, S. L. and Chatterjee, A.: **Stability analysis of the simplest walking machine**, *National Conference on Mechanisms and Machines,* 2001, Kharagpur, India.

Seminars

2022 Sep. Biomembranes 2022, IISc Bangalore, India.
Invited Talk: Interaction Between Natural and/or Synthetic Macromolecules and Liposomal Membranes

2020 Dec. IIT Bombay, India, CompFlu2020 (online).
Invited Talk: Sorting of Proteins with Shape and Curvature Anisotropy

2020 Aug. Institute of Smart Structures and Systems Public Lecture (online), IISc Bangalore, India.
Invited Talk: How proteins interact with cell membranes? A biophysical study

2018 Dec. IUTAM Symposium on Dynamics of Complex Fluids and Interfaces, IIT Kanpur, India.
Invited Talk: Sorting of proteins with shape and curvature anisotropy on a lipid bilayer tube

2018 Mar. Government Engineering College, Purulia, West Bengal, India.
Invited Talk: Mechanics in Engineering

2018 Feb. San Francisco, California 62nd Annual Biophysical Society Meeting.
Poster presentation: Interplay of membrane curvature sensing and generation mediated by peripheral membrane proteins. (Presented by T. V. Sachin Krishnan)

2017 Dec IIT Madras, India, CompFlu2017
Invited Talk: Drag Force on a Liquid Domain Moving in a Two Dimensional Liquid Sheet

2017 Sep IIT Palakkad, India
Seminar: Two Problems Interfacing Mechanics and Biology: Fibrous Composites and Domain Diffusion

2017 Jan IISc Bangalore, India Biosystems Science and Engineering Symposium
Invited Talk: Mechanics of Non-woven Fibrous Matrices and Their Interactions With Cells

2016 Sep JNCASR Bangalore, India
Invited Talk: Mechanics of Non-woven Fibrous Matrices and Their Interactions With Cells

2016 Sep Chemical Engineering, IISc Bangalore, India
Department Seminar: Biological Membrane Structure and Function A Mechanics Perspective

2016 Jan IISER Pune, India CompFlu 2016
Invited Talk: Drag Force on a Liquid Domain Moving in a Two Dimensional Liquid Sheet

2014 Oct. Jülich, Germany Proteins & Nanoparticles Membranes 2014 - SoftComp Topical Workshop
Copresenter: Curvature sorting of integral membrane proteins by curvature-dependent protein- lipid bilayer interaction (Presented by Svetina S.)

2014 Jan. Pondicherry, India Soft Matter - Young Investigators Meet
Short Talk: Curvature Sorting of Proteins in a Cylindrical Membrane

2012 May KITPC, Beijing, China Program on Membrane Biophysics: Theory and Experiment
Short Talk: Role of Membrane Addition in Animal Cell Cytokinesis

2012 May KITPC, Beijing, China Program on Membrane Biophysics: Theory and Experiment
Short Talk: Curvature Sorting of Proteins in a Cylindrical Membrane

2010 Mar. NEHU Shillong, India NPMASS-ISSS Workshop on Microsystems Technology
Invited speaker: Structure and Mechanics of Biological Membranes

2008 Sep. IIT Chennai, India
Special Seminar: Lipid Bilayer Vesicles: Parameter Estimation, Micropipette Aspiration, and Adhesion.

2008 Sep. IISc Bangalore, India
Invited Seminar: Lipid Bilayer Vesicles: Parameter Estimation, Micropipette Aspiration, and Adhesion.

2008 Aug. IIT Kanpur, India
Invited Seminar: Lipid Bilayer Vesicles: Parameter Estimation, Micropipette Aspiration, and Adhesion.

2008 Aug. Jadavpur University, India
Special Seminar: Lipid Bilayer Vesicles: Parameter Estimation, Micropipette Aspiration, and Adhesion.

2008 June University Park, PA Workshop on Multi-Scale Modeling of Immune Responses.
Invited talk: Adhesion of vesicles to curved substrates: Implications to virus entry and nano-particle uptake.

2008 May UT Arlington, TX 7th AIMS International Conference on Dynamical Systems, Differential Equations and Applications.
Invited talk: A boundary layer analysis for two-phase lipid bilayer vesicle and vesicle adhesion.

2008 Feb. Goodyear Tire & Rubber Company, Akron, OH
Invited talk: Lipid Bilayer Vesicles: Parameter Estimation, Micropipette Aspiration, and Adhesion.

2008 Feb. Long Beach, California 52nd Annual Biophysical Society Meeting.
Poster presentation: Adhesion of lipid vesicles on patterned substrates.

2007 Jul.-Aug. UIUC, Urbana, IL CCM Summer Course on Cell Mechano-sensitivity.

2007 June Waterville, Maine Gordon Research Conference on Nonlinear Dynamics.
Poster presentation: Micropipette aspiration of giant vesicles with fluid phase coexistence.

2007 Mar. Baltimore, Maryland 51st Annual Biophysical Society Meeting.
Poster presentation: An analysis of micropipette aspiration of one-phase and two-phase vesicles.

2006 Dec. Bethesda, Maryland NICHD, NIH.
Invited seminar talk: Mechanics of lipid bilayer vesicles.

2006 July Raleigh, North Carolina SIAM Conference on the Life Sciences.
Minisymposium talk: Boundary layer analysis of the shape of two-phase lipid bilayer vesicles.

2005 July Stuttgart, Germany Powders and Grains.
Poster presentation: Collisional flows through a vertical chute.

2005 Jan. Paris, France Trimester on Granular materials.

2004 June Waterville, Maine Gordon Research Conference on Granular & Granular-Fluid Flow.
Poster presentation: Collisional flows through a vertical chute.

2003 Oct. Bristol, UK Geophysical Granular & Particle-Laden Flows.
Poster presentation: Collisional flows through a vertical chute.

2001 Dec. IIT Kharagpur, India National Conference on Mechanisms and Machines.
Contributed talk: Stability analysis of the simplest walking machine.