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Research Interests

- Theoretical and Applied Mechanics
- Contact Mechanics of Thin Structures
- Lipid Bilayer Membrane

Brief Summary of Research

Main focus of our group is developing and/or applying continuum theory based models and perform experiments to elucidate the role of cell membrane and its mechanical properties in various cell-biological processes. Membranes in a cell are primarily made of lipid bilayer. It is believed that the membrane actively controls its curvature and composition to influence cellular processes such as signaling between proteins, sorting of proteins and lipids, adhesion. We employ mechanics-thermodynamics based models for curvature dependent sorting of proteins and macromolecules.

Another important question in mechanics is how adhesion influences the physical behavior of thin structures like membranes of vesicles and cells. To adress this we study adhesive contact of soft structures (not just limited to biological membrane) that can deform and rotate by large amounts. Our study will find use in many other areas such as contact of polymers, thin optical fibers, design of novel adhesivees.

Projects (Full list of projects: http://www.vinodap.co.nf/projects.html)

- Contact mechanics of soft and thin adhesive structures, DST, 2018-2021 (with I Sharma, IIT Kanpur).
- Membrane curvature sensing and generation by proteins in lipid bilayer membrane, DBT, 2015-2018, (with P. B. Sunil Kumar, IIT Madras and S. Matheshwaran, IIT Kanpur).
- Motion and Interactions of Domains in Fluid Lipid Membranes, SERB, DST, 2012-2015.

Recent Publications

- 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*, DOI: 10.1039/C8SM02623H, 2019
- 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.
- 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
- 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 and Engineering*, 122, 37, 2017