Interfaces in Soft Materials

Anand Jagota
Robert W. Wieseman 1916 Professor
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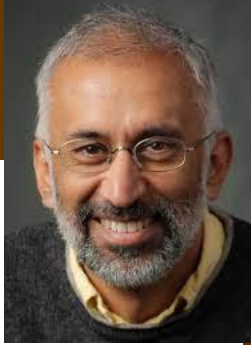
LEHIGH UNIVERSITY | Department of Bioengineering

PI Background



- **Education**
  - Indian Institute of Technology New Delhi, (India). Bachelor of Technology in Mechanical Engineering (1983).
  - Cornell University Ithaca, New York (USA). PhD in Mechanical Engineering (1988).

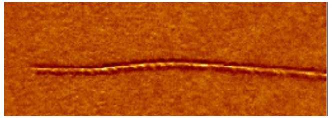
- **Experience** (abbreviated)
  - The DuPont Company, Senior Research Scientist, 1988 – 1994; 1996-2004.
  - Lehigh University, Professor and Founding Chair of Bioengineering and Professor of Chemical & Biomolecular Engineering; Vice Provost for Research.

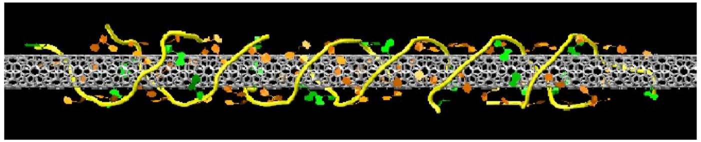
- **Research**: Broadly in *Interfacial Mechanical Properties of Soft Materials.*

- **Keywords**: **Carbon Nanotubes, DNA, Surface stress, Biomimetic Materials, Adhesion, Friction, Viral Adhesion.**

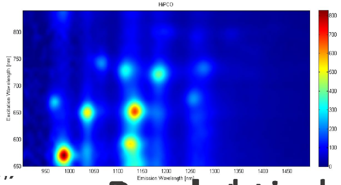
- **Selected Publications**
  - Ming Zheng, Anand Jagota, et al.,“DNA-Assisted Dispersion and Separation of Carbon Nanotubes" Nature Materials, 2 338-342 (2003).
  - Robert W. Style, et al. "Elastocapillarity: Surface tension and the mechanics of soft solids." Annual Review of Condensed Matter Physics 8 (2017): 99-118.
  - A Jagota, CY Hui,” Adhesion, Friction, and Compliance of Bio-mimetic and Bio-inspired Structured Interfaces, Materials Science and Engineering: R: Reports 72 (12) 253-292 (2011).

DNA/Single-Wall Carbon Nanotube Hybrids





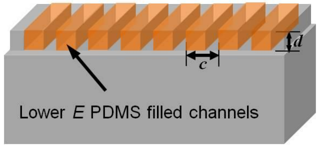
Applications: Near-IR Optical Biosensors (Molecular Perceptron). Fluorescence intensity and wavelength is modulated by analyte. A combination of several hybrids acting together with machine learning tools works as a biosensor.

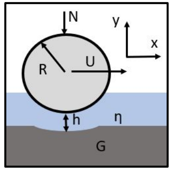


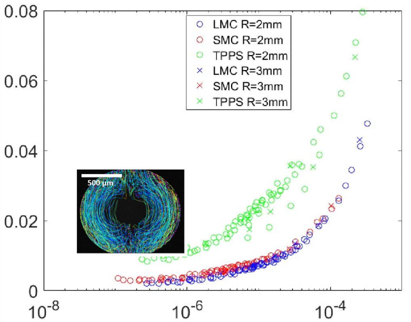
Biomimetic Surface Architecture for Adhesion and Friction

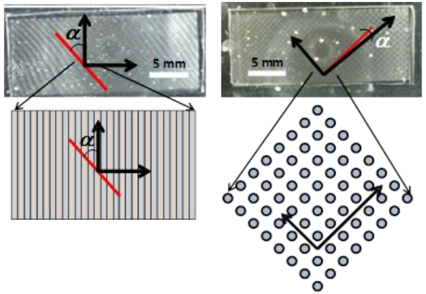
Enhanced Elasto-Hydrodynamic Friction By Biomimetic Surface Design

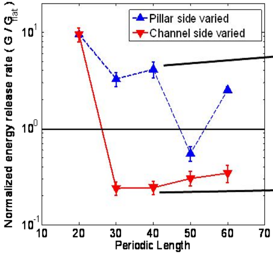
Applications: Synovial joints to tires on a road

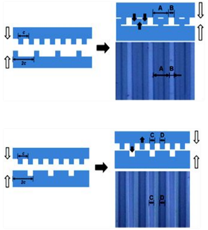




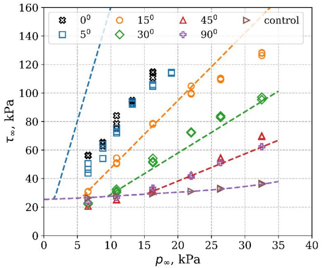






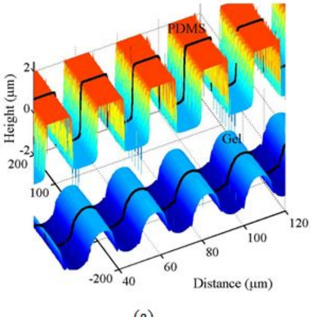


Selective Control of Adhesion and Friction by Biomimetic Shape Complementary Interfaces Results in Arrays of Meso-Scale Screw and Edge Dislocations.



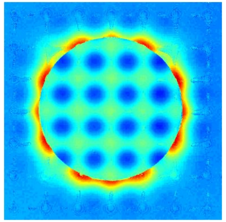
Elastocapillarity of Soft Solids

Soft material surfaces carry surface stress that affects a variety of surface mechanical phenomena. This is a pervasive effect that had been ignored until recently. We are studying a variety of surface mechanical phenomena influenced or dominated by surface stress.



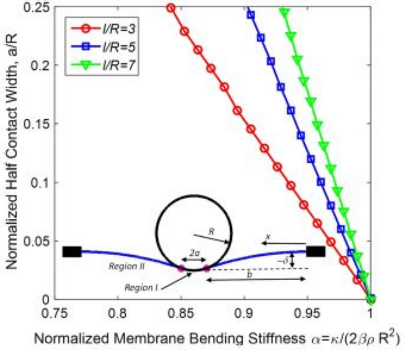
A hydrogel removed from its PDMS mold changes to a relaxed shape under the influence of surface stress.

Partial wetting of drops on a soft surface is changed due to surface stress. Young's equation is no longer valid.



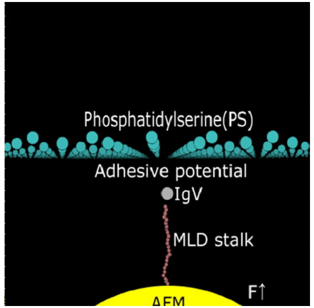
Biomechanics of Viral Adhesion

Initial adhesion of a virus to the cell membrane is a precursor to its entry into the cell. We are working to understand the biomechanics of this process in two ways: (a) by continuum models of virus/membrane interaction, and (b) coarse-grained molecular simulation.



A continuum model for Ebola virus adhesion to the cell membrane reveals that the process is dominated by two dimensionless variables. When one of them, a normalized adhesion, is smaller than a critical value, the virus does not stick to the cell membrane.

A coarse-grained molecular model of the binding between a receptor on the cell membrane (TIM family) and phosphatidylserine (PS) on the virus surface. The model shows how length of TIM makes it easier for it to bind to PS.



Jagota Laboratory

- We combine experiment, theory, and simulation in our work.
- The group is highly collaborative internally, and we also work with a number of other labs at Lehigh and elsewhere.
- Visit our website at https://wordpress.lehigh.edu/anj6/ or write to Prof. Jagota at anj6@lehigh.edu