NSF Workshop on Friction

A Grand Challenge at the Interface of Solid and Fluid Mechanics


WELCOME!

National Science Foundation: CMMI & CBET
Adnan Akay
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Organizing Committee
Beverley McKeon
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The problem

Medium 2

Lubricating layer?

Medium 1

FRICTION

Multiscale phenomena

Constitutive laws

Noise
Vibration
Wear

Emissions
Environment
Climate

FRICTION
Background

WHY FRICTION?

- Common phenomenon across several disciplines
- Workshop driven by NSF

_Solid and fluid friction: How are these problems the same? How are they different? What can the communities learn from each other?_

- Aim is to initiate collaboration and exchange
- Highly interactive workshop
Aims of the workshop

• Validate/confound the working hypothesis
  “A new generation of models for the mechanical processes where either momentum is transferred in a fluid near a rough solid boundary or where strain energy is distributed in two solids in sliding contact at a rough interface can be constructed using a common mathematical framework formulated in a phase-space”

• Make links between communities who encounter friction

• Discuss/develop collaborative approaches to frictional problems
  – Modeling
  – Characterization of roughness
  – Measurement techniques

• Visible outcomes:
  – Report
  – Email discussion group?
  – Website?
  – Joint conference sessions, e.g. APS?
  – Identification of funding opportunities?
Who are we?

An international collection (5 countries represented) of researchers interested in the dynamics of, and response to, friction at different types of interface.

“Solid Mechanics” + “Dynamical systems” + “Fluid Mechanics”

George Adams + Jerzy Blawzdziewicz + Karen Flack
Adnan Akay + (Dan Joseph) + Javier Jimenez
Laurent Baillet + John McCoy + Ivan Marusic
Yves Berthier + Beverley McKeon
Antonio Carcaterra + Bill Schultz
George Mavroeidis + Lex Smits

(Katepalli Sreenivasan)
Thoughts from the fluid side…

- Tend to view the effect of friction from the system response (at least in turbulent boundary layers)
- Friction as a boundary condition
- “No-slip” assumption
- No such thing as “static” friction in fluids
- But must consider viscous and pressure drag
- What is really going on at the interface (how important are the details and how should we model them)?