COLLOQUIUM
MECHANICAL ENGINEERING

The Department of Mechanical Engineering presents:

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Sandia National Laboratories
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Drop Spreading Dynamics on Solid Surfaces and the Interfacial Rheology of Fluid-Fluid Interfaces

The motion of interfaces are of fundamental importance in numerous processes, such as printing, coating, encapsulation, lubrication, oil recovery, painting, and many others. As we continue to shrink the critical length scales of our manufacturing processes, interfacial forces and wetting play an increasingly important role, and developing an improved understanding of these interfacial dynamics will be paramount. In this talk, experiments will be described that examine two types of interfacial dynamics. A feed-through goniometer is used to study the motion of the three-phase contact line on solid surfaces and the dynamic mechanical properties of surfactant films are explored using shear and dilatational interfacial rheometers. Examples will be given to show the effects of surface roughness on the spreading of sessile drops of viscous polymeric liquids. Results on patterned arrays of circular posts and holes as well as trenches (10-250μm scale) will demonstrate that surface topography can dramatically affect the wetting response. At fluid-fluid interfaces adsorbed surfactants can form viscoelastic monolayers that depend on their molecular structure and interactions. Examples of the interfacial rheology of protein solutions, non-ionic surfactants, and insoluble Langmuir films will also be discussed.

Bio: Carlton Brooks received his B.S. in chemical engineering from Cornell University in 1994, and his M.S and Ph.D. degrees in chemical engineering from Stanford University in 1995 and 1999, respectively. For his thesis he developed a tool to measure the mechanical shear properties of Langmuir monolayers. After graduating, he worked for Caliper Lifesciences from 1999-2003 to develop microfluidic-based instrumentation for biomolecular assays. He designed and characterized microfluidic devices incorporating rapid thermal cycling to perform the polymerase chain reaction (PCR) at small scales. In 2004 he joined Sandia National Laboratories to investigate the dynamic wetting of liquids spreading on surfaces, exploring the effects of surface roughness and surface energy. He is also studying the effects of interfacial rheology on the stability of foam materials. He has authored 17 papers, received the 2008 publication award from the Journal of Rheology, and is co-inventor on 4 patents.