AEROSPACE & MECHANICAL ENGINEERING

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INFORMAL COFFEE PERIOD BEFORE THE SEMINAR IN ROOM 365 FITZPATRICK HALL

UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

MIDWEST MECHANICS SEMINAR

SPEAKER: **Professor Gareth H. McKinley**
Hatsopoulos Microfluids Laboratory (HML)
Department of Mechanical Engineering
Massachusetts Institute of Technology
Cambridge, Massachusetts

TOPIC: **STRUCTURE FORMATION, DYNAMICS AND APPLICATIONS OF MAGNETO-RHEOLOGICAL FLUIDS (MRFs) IN ENERGY ABSORPTION, MICROFLUIDICS AND ROBOTICS**

DATE: Tuesday, September 27, 2011

TIME: 3:30 p.m.

PLACE: 138 DeBartolo Hall

ABSTRACT

The dynamic response of MR fluids is a multi-scale problem in which micron-size particles align under the action of an external magnetic field to form chainlike structures that modify the bulk fluid motion. These field-responsive or 'smart' fluids can reversibly generate large viscoelastic stresses that can be exploited to produce dramatic changes in modulus and viscosity that impact device-level performance metrics such as adhesion and energy dissipation. In the present work, we focus on the formation and evolution of chainlike microstructures in magnetorheological fluids flowing in microchannels. High-speed video microscopy is used to elucidate the dynamics of chain formation and the structural evolution with time and flow. Particle Image Velocimetry (μPIV) techniques are used to characterize fluid velocity profiles in various channel geometries as well as to explore wall-particle interactions and slip. This interaction is often enhanced in commercial actuators by the use of ferromagnetic walls which generate an attractive force on the particles in the field-on state. To explore the aggregation dynamics of MR fluid particles and changes in the evolution of microstructure we use custom-fabricated microfluidic devices with ferromagnetic side walls. Bulk rheological measurements under shear, creep and large amplitude oscillatory shear (LAOS) flow are also used to characterize the plastic collapse and the structural flow response of the fluids to different magnetic fields and to guide development of appropriate rheological constitutive equations for these materials.

NOTE: ***If you are interested in meeting individually with Prof. McKinley please contact Evelyn at 631-5431.***