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 Eliot Fried**
Department of Mechanical Engineering
McGill University
Montreal, Quebec, Canada

TOPIC: **STABILITY OF A THIN ELASTIC FILM CLOSE TO A RIGID PLATE**

DATE: Tuesday, April 3, 2012

TIME: 3:30 p.m.

PLACE: 138 DeBartolo Hall

ABSTRACT

We introduce and study a variational model for the formation of patterns induced by bringing the surface of a rigid plate into contact proximity with the surface of a polymeric film strongly bonded to a substrate. We treat the film as a homogeneous, isotropic, hyperelastic solid and account for both attractive and repulsive van der Waals interactions between the film surface and the proximate contractor. Aside from confirming the intuitive expectation that the presence of a repulsive contribution to the van der Waals potential should stabilize patterns that form on the film surface, we elucidate the role of repulsive interactions at the onset of instability. For a recently proposed van der Waals potential involving two parameters, the Hamaker constant A and the equilibrium spacing d_e, our results include estimates for the critical gap d_c at which undulations appear on the film surface, the corresponding wavenumber k_c of the undulations, and a lower bound f for the attractive force needed to induce the undulations. To leading order, $d_c \sim (Ah/\mu)^{1/4}$, $k_c \sim 1/h$, and $f_m \sim (\mu^3 A/h^3)^{1/4}$, where h and μ denote the thickness and infinitesimal shear modulus of the film. Correction terms due to repulsive interactions indicate that, while k_c may be inuenced by μ and A, d_c may also be influenced by d_e. Granted knowledge of μ and A, our results also suggest a simple experimental protocol for determining d_e.

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