Special
PHYSICAL MATHEMATICS SEMINAR

THE UNZIP INSTABILITY: STRAIGHT-TO-OSCILLATORY TRANSITIONS IN THE FRACTURE OF THIN SHEETS

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ABSTRACT:

Opening the thin packaging film of packets of biscuits or CD cases has never been easy, especially if one lacks a sharp knife. One way out is to use a key or a pen. If we use such a blunter object to tear open the plastic, the resulting crack follows a remarkably well defined and highly reproducible oscillatory path, rather than being straight. We have built a well controlled experiment to study this phenomena. Moreover, we have developed a geometrical 2D model based on the coupling of thin sheets elasticity with fracture theory, which yields results in excellent agreement with the experiments. We have also uncovered two novel straight-to-oscillatory (Unzip) instabilities in this system as the angle of the cutting tool (with respect to the horizontal) or the speed of cutting are varied. The respect to the horizontal) or the speed of cutting are varied. The latter is a compelling example of a ductile-to-brittle transition. Finally, we briefly present some open problems of coupling thin sheets elasticity with other phenomena: pealing, localization in solid foams, delimitation from adhesive substrates and fluid flow.

TUESDAY, JANUARY 9, 2007
2:30 PM
Building 2, Room 105

Reception at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)