PHYSICAL MATHEMATICS SEMINAR

PHYSICS OF HELICES

BUDDHAPRIYA CHAKRABARTI
Harvard University

ABSTRACT:

What is the minimal model that describes the elasticity of biopolymers, proteins in particular? In this talk, I would describe some aspects of my work in order to understand this question.

I explore the highly nonlinear mechanical response of alpha helical polypeptides using a simple extension of the worm-like chain model. This model incorporates the coupling of chain conformational degrees of freedom to "internal" secondary structure variables. I would discuss both the nonlinear extensional and bending behavior of the polymer and its response to combinations of applied forces and torques. In particular, the molecule undergoes a denaturation transition under tensile forces and a buckling transition under applied torque. This inherently nonlinear mechanical response of alpha helical polypeptides may help in understanding conformational changes in proteins.

I conclude by describing my work on curling of ribbons using inhomogenous deformations and subsequent stress release. A crucial result that comes out of this study is the importance of nonlinear coupling between bend and twist modes of deformations. Since most biological polymers exist in ribbon like forms, an understanding of such a coupling is crucial to describing their mechanical and statistical mechanical properties.

TUESDAY, FEBRUARY 27, 2007
2:30 PM
Building 2, Room 146

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