PHYSICAL MATHEMATICS SEMINAR

A Geometric Approach to Computation of Elastica in Contact

EITAN GRINSPUN
Columbia University

ABSTRACT:

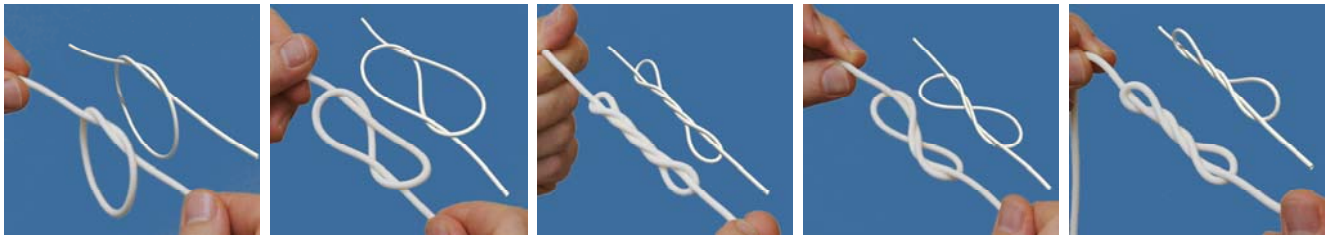
Computer Graphics and Animation applications require mathematical models and simulation software that captures the qualitative, characteristic behavior of a physical system, even at very coarse discretizations. Our research group develops such numerical tools by using ideas from discrete differential geometry and discrete geometric mechanics. We attempt to build a discrete picture from the ground up, mimicking the axioms, structures, and symmetries of the smooth setting. The result is a discrete (hence immediately computable) model of the system, and in particular one that preserves conservation laws.

I will briefly survey our work in this domain, and focus on two specific recent examples: a discrete model of elastic rods with a natural extension to viscous threads, and a computational treatment of mechanical systems in complex contact configurations (crumpling thin shells, granular media, tying knots). Even at coarse discretizations, the resulting simulations capture desirable phenomena such as good long-time energy conservation, energy exchange between coupled modes, and characteristic instabilities.

This is joint work with graduate students Miklós Bergou, David Harmon, and Etienne Vouga, and with investigators Basile Audoly, Rasmus Tamstorf and Max Wardetzky.

BIO:

Eitan Grinspun is Assistant Professor of Computer Science at Columbia University in the City of New York. He was Professeur d'Université Invité at l'Université Pierre et Marie Curie in 2009, a Research Scientist at the Courant Institute of Mathematical Sciences from 2003-2004, and a graduate student at the California Institute of Technology from 1997-2003. He was an NVIDIA Fellow in 2001, an Everhart Distinguished Lecturer in 2003, and an NSF CAREER Award recipient in 2007.



TUESDAY, OCTOBER 13, 2009
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 290
(Math Department - Common Room)

Massachusetts Institute of Technology

Department of Mathematics
Cambridge, MA 02139