

International Seminar on Applied Geometry in Andalusia

Granada (Spain) September 4-8, 2006

J. ARROYO (UPV/EHU), O. J. GARAY (UPV/EHU) AND R.
LIPOWSKY (MAX PLANCK INST.)

Curvature energy minimizers. Shaping elastic rods and flexible membranes

The main goal of the seminar is to give an introduction to some variational aspects of curvature energy functionals and their applications in Physics and Biophysics.

First, we will compute the variation formulas and we will discuss the solutions to the Euler-Lagrange equations. In particular, critical points of this functionals include Benoulli elastica, minimal and constant mean curvature surfaces, Willmore surfaces etc. We'll pay special attention to the spontaneous curvature and couple-bilayers energy models used in Biophysics to study the morphology of membranes and vesicles. We will give a brief overview of the relation between the theoretical predictions of these models and the experimental results. Also, we'll show the relation of this model with the Euler-Bernoulli model of elastic curves and rods. We will concentrate mainly on closed submanifolds (vesicles) because of the computational simplicity.

Secondly, we'll talk about elastic curves in the two and three dimensional Euclidean spaces, focusing on classification results and their importance in the construction of methods to provide examples of stationary curvature energy submanifolds and surfaces which have been discussed before..

The final part of the seminar will be dedicated more emphatically to the interplay between theory and experiments and it is intended to be a complement of the more theoretical issues analyzed in the previous parts. We will focus on different experimental aspects of the various curvature models used to study the morphology of membranes and vesicles, and their influence in the construction of more realistic models.