Stability and Bifurcation of Flexible Loop Spanned by a Fluid Film

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Abstract:

We will consider a variational problem that combines the challenges familiar from the fairing of space curves and the construction of area minimizing surfaces. The problem consists of finding energetically preferred equilibrium configurations of a system consisting of a closed, locally inextensible loop endowed with elastic resistance to bending that is spanned by a fluid film with constant surface tension. Aside from presenting results from detailed bifurcation and stability analyses based on the first and second variations of the underlying free-energy functional, we will discuss various physically relevant generalizations of the problem. In particular, we will describe the consequences of generalizing the variational problem to incorporate elastic resistance to twisting the bounding loop and bending the film. We will also highlight issues that we hope will be of interest to researchers in the fields of computational geometry and computer graphics.

About the Speaker:

Eliot Fried obtained his Ph.D. in Applied Mechanics from the California Institute of Technology in 1991. He received a National Science Foundation Mathematical Sciences Postdoctoral Fellowship, a Japan Society for the Promotion of Science Postdoctoral Research Fellowship, and a National Science Foundation Research Initiation Award. Currently he is a Professor at the Okinawa Institute of Science and Technology Graduate University, where he directs the Mathematical Soft Matter Unit. He was previously a Professor of Mechanical Engineering and the Tier 1 Canada Research Chair in Interfacial and Defect Mechanics at McGill University. Before that he held tenured positions at the University of Illinois at Urbana-Champaign and Washington University in St. Louis. At Illinois, he was a Fellow of the Center of Advanced Study and was awarded a Critical Research Initiative Grant. His research focuses on focuses on theoretical and applied problems involving soft matter systems, which he approaches with a combination of techniques from statistical and continuum mechanics and thermodynamics, differential geometry, asymptotic analysis, bifurcation theory, and large-scale scientific computing.

All are welcome!
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