Soft Living Active and Adaptive Matter

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Better energies for low-dimensional elastic systems under combined bending and stretching

Eduardo Vitral

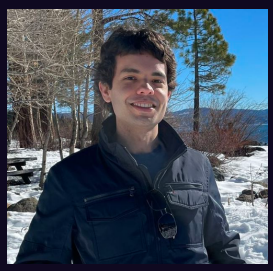
Abstract:

We present new kinematic bending measures and quadratic energies for isotropic elastic plates and shells, with certain desirable features not present in commonly employed models in mechanics and soft matter. These are justified both by simple physical arguments related to the through-thickness variation in strain, and through a detailed reduction from a three-dimensional energy quadratic in stretch. The measure of plate bending is a dilation-invariant surface tensor that couples stretch and curvature in a natural extension of primitive generalized bending strains for straight rods. The extension to naturally-curved rods and shells, for which the pure stretching of a curved rest configuration is not a dilation, contrasts with previous ad hoc postulated forms. Our results provide a clean basis for simple models of low-dimensional elastic systems, and should enable more accurate probing of the structure of singularities in soft sheets and membranes.

Date:
04/11/2022

Time:
9:00 AM-10:15 AM (PT)
12:00 PM-1:15 PM (ET)

About the speaker:



Dr. Eduardo Vitral is a postdoctoral scholar at the University of Nevada, Reno working with Prof. James Hanna on nonlinear elasticity and crumpling. His research interests include continuum mechanics, soft matter, and the interplay between geometry, mechanics, and pattern formation.

Dr. Vitral earned his Ph.D. in Mechanics from the University of Minnesota, where he was supervised by Profs. Perry Leo and Jorge Viñals. His previous works deal with pattern formation in nonequilibrium systems, including phase-field modeling of smectic liquid crystals under sintering, spiral defect chaos in the Rayleigh-Bénard convection and nanopatterning of surfaces by ion beam sputtering.

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