Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

Universal inverse design of 2D nematic elastomers

Dr. Hillel Aharoni,
Faculty of Physics,
Department of Physics of Complex Systems,
Weizmann Institute of Science
hillel.aharoni@weizmann.ac.il

Abstract:

Thin nematic elastomer sheets can be programmed, via the nematic director field embedded into them, to take different shapes in different environments. Recent experiments from various groups demonstrate excellent control over the director field, thus opening a door for achieving accurate and versatile designs of shape-shifting surfaces. At the crux of any effort to implement this design mechanism lies the inverse design problem—given an arbitrary surface geometry, constructing the director field that would induce it upon actuation. In this talk, I describe several aspects of this inverse problem. I present a numerical algorithm for finding approximate global solutions to the inverse problem for any 2D geometry. I show analytically the existence of many local solutions for any smooth geometry, provide an algorithm for their integration, and show a convenient classification useful for finding optimized director fields for a given surface geometry. I further discuss non-smooth surface geometries, and how these can be realized via topological defects and domain walls in the nematic director field.

Date & Location:

Monday, May 11, 2021, 11:00