

Challenges in Mechanics

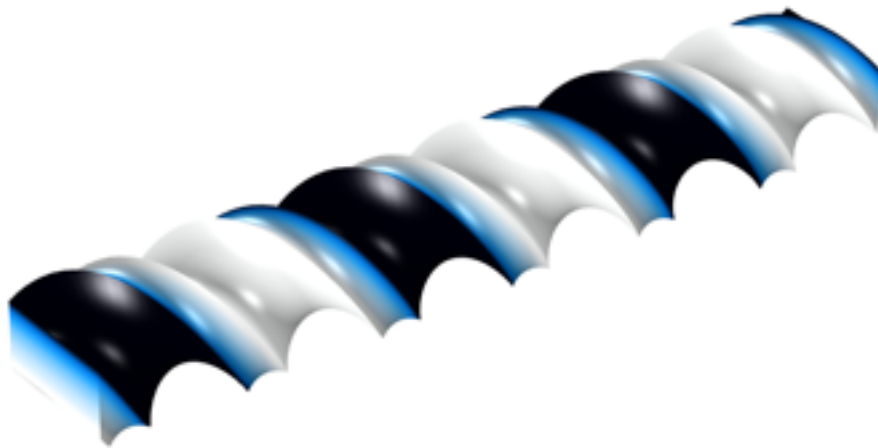
a series of seminars between Pisa and Roma

April 4, 2019, 3:00 pm

Stress-free Morphing of Elastic Bodies

Luciano Teresi

Dept. Mathematics & Physics, University Roma Tre, Italy



Abstract

We study the morphing of soft materials within the framework of non-linear elasticity with large distortions: a distortion field induces a target metric, and the configuration which is effectively realized by a body is the one that minimizes the distance, measured through the elastic energy, between the target metric and the actual one¹. Deformations due to distortions may have a peculiar feature: they can be stress-free; if this is the case, the distortions field is called compatible. We maintain that the morphing through compatible distortions is a key strategy exploited by many soft biological materials, which can exhibit very large shape-change in response to distortions controlled by chemicals or by temperature changes, while keeping their stress state almost null². Thus, the study of compatible distortions, and of the related shape-changes, is quite important. Here, we show how the notions of metric tensor and of Riemannian curvature can be used to assess the compatibility of a distortion field³.

[1] Nardinocchi P., Teresi L., Varano V., *Int. J. Nonlinear Mech.* 56, 34-42, (2013).

[2] Nardinocchi P., Teresi L., Varano V., *J. Mech. Phys. Solids* 60, 1420-1431, (2012).

[4] P.G. Ciarlet, Springer-Verlag, Heidelberg, 2005.

Aula "Piero Villaggio" - sede Ingegneria Strutturale (Edificio A), Largo L. Lazzarino Pisa

contact person: roberto.paroni@uniroma1.it & a.desimone@santannapisa.it

The series of seminars Challenges in Mechanics aims to bring together researchers from diverse backgrounds in structural mechanics, applied mathematics, and materials science. Emphasis will be given to rigorous mechanical theories, and the mechanical design of new materials and structures will also be explored. The series is organized in 6 seminars to be held at the Department of Structural and Geotechnical Engineering (Sapienza Università di Roma), at the Department of Civil and Industrial Engineering (Università di Pisa) and at the Institute of BioRobotics (Scuola Superiore Sant'Anna di Pisa). **Organisers:** Antonio De Simone (a.desimone@santannapisa.it), Paola Nardinocchi (paola.nardinocchi@uniroma1.it), Roberto Paroni (roberto.paroni@unipi.it).