UNIVERSITÀ DI TRENTO

Programming and Reprogramming the Nonlinear Response of Structures

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Time	**16.00–17.00**
Room	**2R, DICAM, Mesiano**

Materials and structures with tailored nonlinear mechanical responses enable the development of innovative technologies such as soft robots, wearable devices, advanced footwear, and energy-absorbing systems. However, realizing such designs remains a significant challenge. Moreover, there is a growing demand for reprogrammable architectures capable of adapting to multiple tasks.

In this talk, we first demonstrate the potential of leveraging elastic instabilities in hyperelastic shells to induce complex deformation patterns. This approach facilitates the creation of soft machines capable of executing a programmable sequence of movements with a single input, as well as architected fluids with programmable response.

We then introduce an inverse-design framework for discovering flexible mechanical metamaterials with specific nonlinear responses. By encoding the desired functionality into the design process, this framework optimally tunes the metamaterial's full-scale geometry using a fully differentiable simulation environment. Through this strategy, we design mechanical metamaterials tailored for tasks such as energy focusing, energy splitting, dynamic protection, and nonlinear motion conversion.

The seminar is organized by the Solid and Structural Mechanics Group [D. Bigoni, F. Dal Corso, L. Deseri, D. Misseroni, M.F. Pantano, A. Piccolroaz, N.Pugno, R. Springhetti]