Ph.D. position @ University of Trento (Italy)

“New loadings for structural elements and homogenization of elastic periodic materials”

within the context of the

ERC Advanced Grant project "Beyond hyperelasticity: a virgin land of extreme materials"

HORIZON2020-PEOPLE-IDEAS-ERC-2021-AdG (2022-2027)

PI: Davide Bigoni (webpage: https://bigoni.dicam.unitn.it)

1 Ph.D. position (36 months) within the research activity relative to the **PI ERC AdG Grant "Beyond"** will be funded by and available at the University of Trento (Italy). The student will be supervised by PI and his collaborators Francesco Dal Corso, Diego Misseroni, Andrea Piccolroaz, and Roberta Springhetti.

The financial conditions offered with this Ph.D. position are those of all Italian Ph.D. schemes, designed to be compatible with the costs of living in Italy, where medical care is free and accommodation costs are reasonable.

The research group offering this position is one of the most active and visible in mechanics and is coordinated by Davide Bigoni (https://bigoni.dicam.unitn.it/)

Ph.D. topic: Instabilities and nonlinear behavior in solids and structures

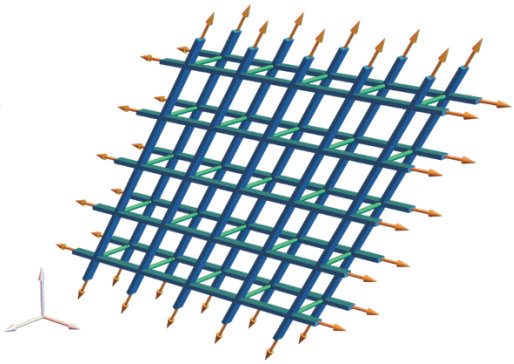
Dates: 36 months (three years) duration, starting from November 1, 2022

Research Supervisors: Davide Bigoni, Francesco Dal Corso, Diego Misseroni, Roberta Springhetti, Andrea Piccolroaz, all working at the University of Trento

Title: New loadings for structural elements and homogenization of elastic periodic materials

Objective: The combination between tensile bifurcation and non-holonomic constraints is planned to yield materials absorbing energy both for tensile and compressive strain cycles. The theoretical analysis of these systems is in its infancy, as only the PI and his co-workers have contributed to. However, the structures analyzed in these preliminary works are the simplest possible, while now the complexity has to be attacked. In fact, complexity becomes necessary to achieve structural elements representing the building blocks of the microstructure of an architected material with extreme characteristics. From a theoretical perspective, the chief methodology here is homogenization via Floquet-Bloch wave asymptotics. Periodic lattices of elastic rods will be analyzed, organized in parallelepiped geometries, axially loaded up to an arbitrary amount, and then subject to incremental time-harmonic dynamic motion. How a structure is loaded is a concept of chief

importance in determining its deformation capabilities. It will be investigated how to generate special forces in a microstructure that will become the basis for a material design capable of attaining, surpassing, and exploiting bifurcations and instabilities. Control of loading on a structure that can suffer highly nonlinear deformation is a crucial but difficult task, a concept usually not given sufficient importance in mechanics. The search for new structural forces will take the research into unexplored territory, linked to the design of soft fluidic robot manipulators, but also essential to analyse possibilities of extracting energy from interaction with a fluid or a gas, an important point in the quest for non-hyper-elasticity. A side result of this activity will be a new design of soft fluidic robot manipulators.



Application deadline: August 25, 2022 at 4:00 PM (Italian time)

For application, please, refer to the website:
https://www.unitn.it/en/ateneo/1954/announcement-of-selection
read the specific pdf call for application announcement and follow carefully the instructions therein to apply.

In your application do not forget to explicitly declare that the application refers to:

- **Curriculum C**: Modelling and Simulation
- **Research project Title**: "New loadings for structural elements and homogenization of elastic periodic materials"
- **Reference**: Davide Bigoni

Remark: the above research project is one of the “research subjects” listed in the file “Research subjects-ICAM-38.pdf” available on the above website.

We understand that the application is complicated, so for help, please contact the PI by email:

davide.bigoni@unitn.it