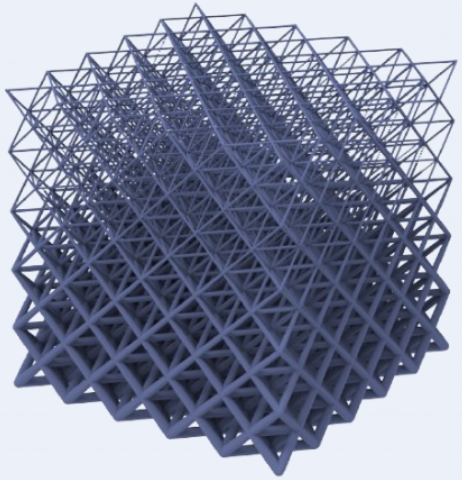
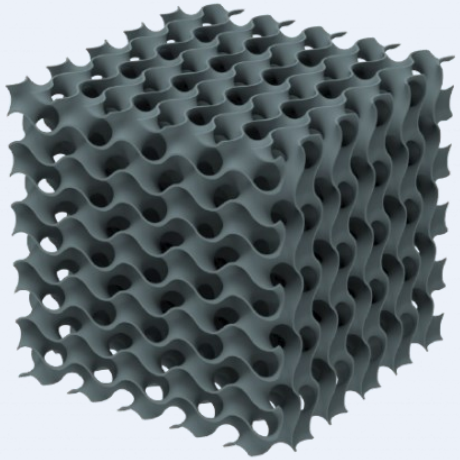
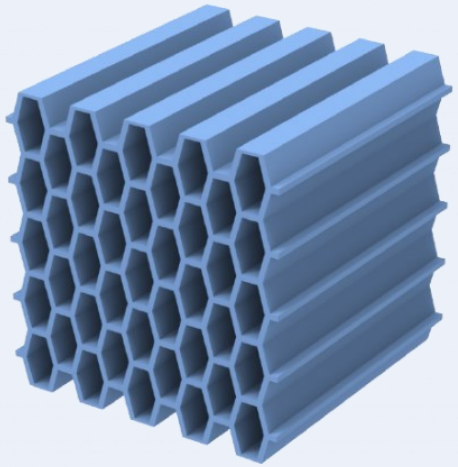
Metamaterials

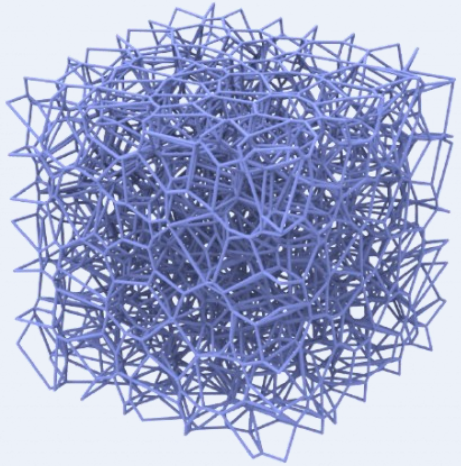
PhD student: Matteo Montanari

Supervisors: Prof. Andrea Spagnoli, Prof. Roberto Brighenti

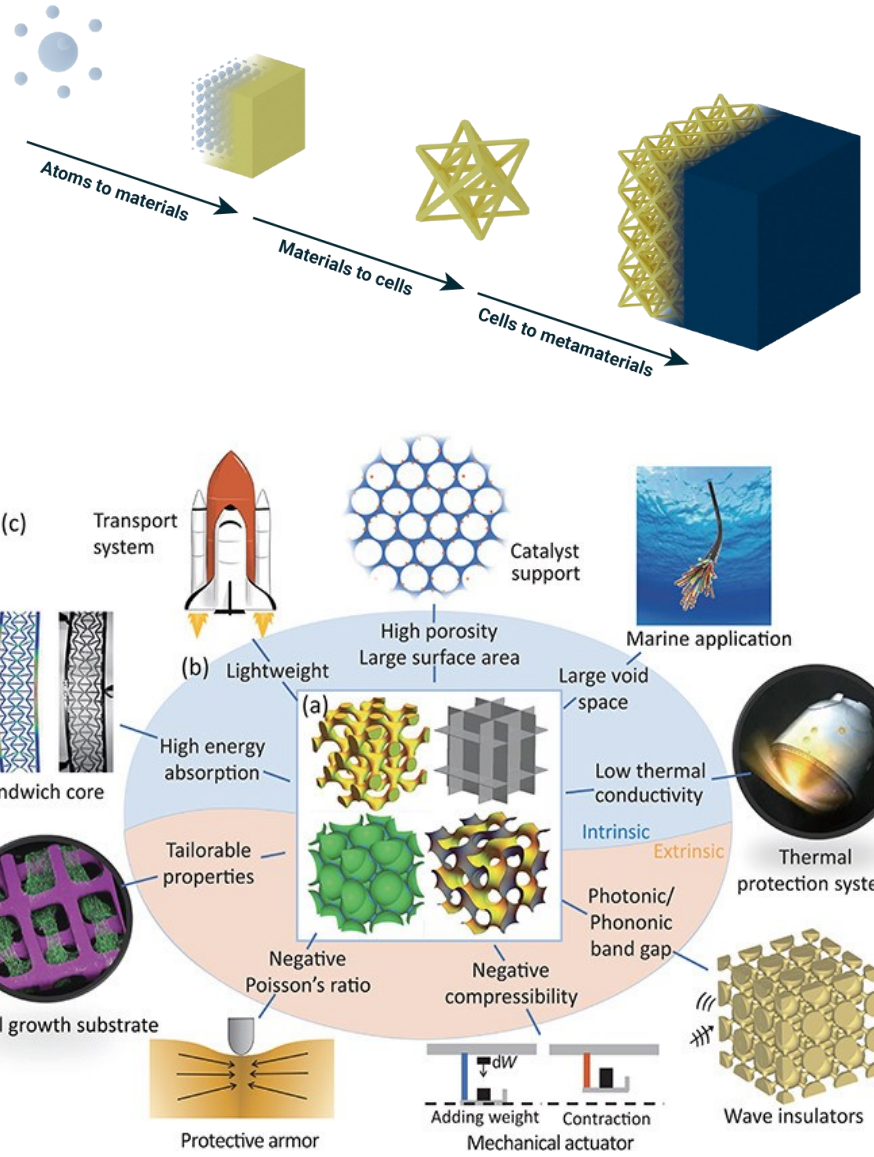








Introduction

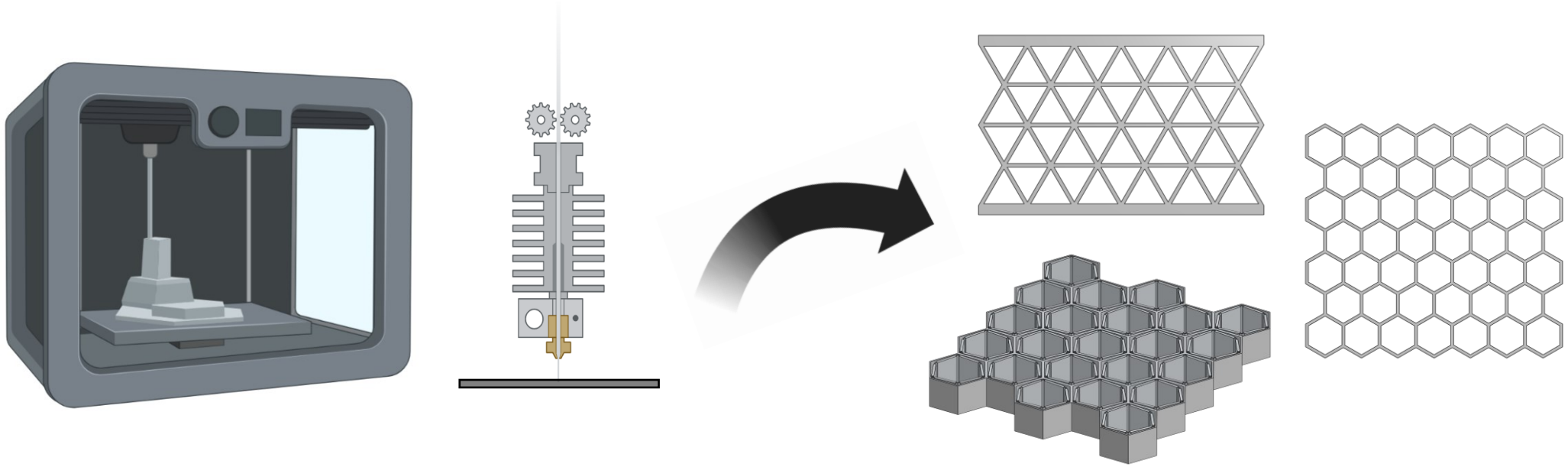


Simply put, ***metamaterials*** are artificially engineered materials that are structured to have extraordinary properties beyond those of most naturally occurring materials.

Conventional materials have mechanical, thermal, and optical properties that are determined by their atomic composition and material science usually focuses on how this composition affects overall material properties. The building blocks for material science are usually atoms and molecules.
Instead, metamaterials take this idea one step further. In fact, the word "meta" comes from the ancient Greek that can mean "further" or "beyond", and it refers to the fact that metamaterials are carefully structured with building blocks beyond the atomic scale.

With metanaterials, you can change a product's behavior by altering its geometry at a macroscale level instead of its internal microstructure.

Research metodology



The activities of my research are organized according to the following logical order:

1. Decide the goal of the designed metamaterial in terms of its structural performances;
2. Come up with a design of the specific building block;
3. Run a high number of finite element simulations in order to optimize the design space and capture the mechanical behavior;
4. Develop reduced-order theoretical models;
5. Perform experimental tests on 3D-printed full-scale specimens in order to validate the numerical results.