

Determination of Homogenized Continua Behaviors From Actual Printed Microstructures

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Abstract:

In recent years, architected materials and 3D printing technologies have become important research topics for industries. Numerous models have been developed to design and model these materials, yet there are large discrepancies between CAD geometries and actual parts in terms of geometric and mechanical properties ([1]).

The objective of this work is to develop an experimental device (**Fig. 1**) and an associated methodology to measure the effective mechanical behavior of architected materials directly from a specimen without using numerical models.

The concept of the proposed experimental device, initiated by the work of [2], is based on an arrangement of pantographic structures which allows performing first-order kinematic homogenization tests (KUBC) on plate structures. The homogenized behavior is measured by the dedicated device of the machine.

In addition to the macroscopic components of the first-order elasticity tensor, some components from generalized continua can be measured. Moreover, the device allows measuring directly the invariants of the elasticity tensor of a structure.

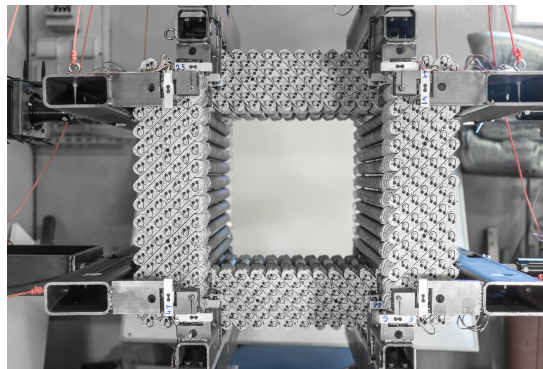


Figure 1: KUBC testing machine

References

- [1] Y. Wang and D. L. McDowell, *Uncertainty Quantification in Multiscale Materials Modeling*. Woodhead Publishing, 2020.
- [2] T. Dassonville, M. Poncelet, and N. Auffray, “Toward a homogenizing machine,” *International Journal of Solids and Structures*, vol. 191-192, pp. 534–549, 2020.