Experimental strain gradient evidence in non-central symmetric lattice

Martin Poncelet, Nicolas Auffray, Clement Jailin, Audrey Somera & Claire Morel

The current work is an attempt of experimental study of high-order behaviors. It comes from the noticing that such behaviors are up to now nearly exclusively studied from a theoretical and numerical point of view.

Materials with coarse inner architecture can easily be design with modern production process (3D printing, 2D and 3D corrugation). The question of the actual behavior of those architectured media rises. Do they behave like classical elastic continua, or do they exhibit extraneous high-order effects ? Further, if present are those effects stable with respect to imperfections (geometry, constitutive material …).

In the present study a non-centro symmetric sample has been process. The geometrical anisotropy of the elementary cell has been chosen in order to detect strain-gradient effect. Samples are obtained by 3D printing and are representative of industrial honeycombs used for aeronautic/aerospace composite material.

To that aim, simple experiments based on load controlled tests with full-field kinematic measurement have been designed. The distributed load control reveals that the architectured material behave as an effective genuine strain-gradient material (fig 1).

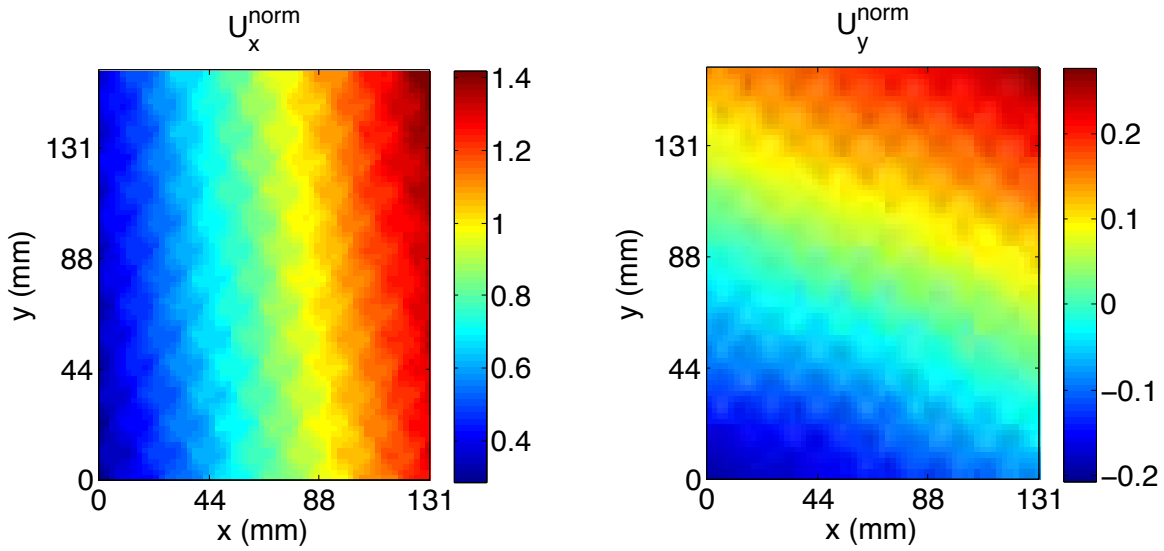

Fig 1 : Displacement fields during a tensile test along *x* with homogeneous tensile load distribution on the x=0 and x=131 boundaries.