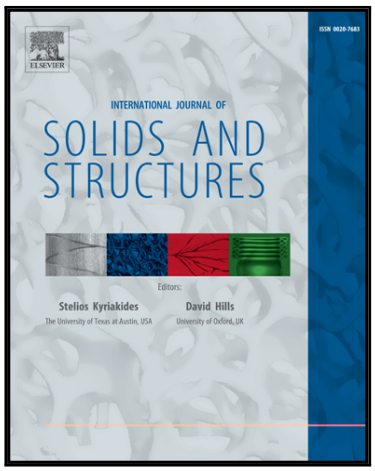

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Experimental investigation of higher-order homogenization schemes under large strain

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Abstract

Multiscale methods and homogenization techniques are usually compared to *full field* simulations. The accuracy of the *full field* simulations is well controlled in the linear elastic regime and for small strain. With non linear behaviour, large strain or multi-axial strain states the comprehension is hampered by the lack of experimental results. In this study, the way to enforce the microscopic boundary conditions from the macroscopic scale is investigated by comparison to experimental results. A series of tests has been carried out on a model multiscale structure over which the displacement field is captured at microscopic and macroscopic scales. These experimental results allow to analyze the results of different homogenization methods such as classical or higher order ones. The study focuses and exhibits different conclusions about the unit cells with periodic or non periodic kinematics.

Keywords : Large strain, multiscale method, higher order continuum, homogenization, digital image correlation.

1. Introduction

Homogenization methods are widely used to describe the behaviour of a material at the macroscopic scale with the help of a model representing the microscopic scale. Traditionally, methods based on analytical or semi analytical techniques give the equivalent material properties of the unit cells [1, 2]. These methods are efficient in the elastic domain and for a limited complexity of the phase geometry but, in presence of non linearities such analyses are not accurate enough [3, 4].

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