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# MACROSCOPIC LENGTH SCALE PARAMETER IN SECOND-ORDER COMPUTATIONAL HOMOGENISATION

**Igor A. Rodrigues Lopes[1*] and Francisco M. Andrade Pires[1]**

[1] Faculty of Engineering, University of Porto, Porto, Portugal, {ilopes fpires}@fe.up.pt

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Second-order computational homogenisation allows to overcome some limitations of conventional first-order homogenisation. In particular, a macroscopic length scale parameter related to the length of the Representative Volume Element (RVE) is introduced by second-order homogenisation, including size effects in the scale transition. Kouznetsova et al. [1] determined that the resulting macroscopic characteristic length can be related to the RVE length by

$$l^2 = \frac{l_{RVE}^2}{12}. \tag{1}$$

This relation is valid under small strain assumption and for square (or cubic) RVEs.

In this contribution, the effect of employing more general rectangular (or hexahedral) RVE models is analysed. In particular, it is shown that the macroscopic length scale parameter becomes dependent on the RVE orientation, i.e., orthotropy is observed for the macroscopic characteristic length parameter. By resorting to the classical boundary shear layer problem, the evolution of the macroscopic length scale parameter with ongoing deformation is evaluated. RVE models considering either elastic or elasto-plastic constituents are considered in this study to assess the influence of inelastic phenomena. Moreover, the behaviour of RVEs consisting of a unit cell or encompassing several randomly placed constituents is compared. Finally, the evolution of macroscopic consistent tangents is also evaluated. These studies are performed with a multi-scale model based on second-order homogenisation formulated with the Method of Multi-Scale Virtual Power, under the assumption of finite strains [2].

## REFERENCES

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