Meso-scale mechanical tests and FE modelling of micro-concrete

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ABSTRACT

This work aims at studying the impact of the meso-scale heterogeneities of concrete to its macroscopic response. More specifically, concrete is studied at meso-scale [mm] (aggregates and macropores embedded within a mortar matrix), where the local failure mechanisms are known to drive the macroscopic behaviour of the material. In recent years, development of numerical models, explicitly representing the meso-scale, has become a common approach to analyse the impact of the mechanical and morphological properties of each phase (along with their interfaces) on the macroscopic behaviour.

Following this spirit, in this work, real meso-morphologies are reliably obtained by taking advantage of the use of x-ray tomography combined with image analysis ([**?**]). These morphologies are given then as an input to a 3D FE meso-model with enhanced discontinuities ([**?**]) and uniaxial tensile and compressive tests are simulated. In parallel, a suitable experimental set-up is developed, allowing the micro-concrete specimens to be scanned while they are under load, providing thus a direct validation of the meso-model. Meanwhile, a valuable insight of the 3D fracture mechanisms while the load progresses is obtained, with a DVC analysis performed by a newly developed software called SPAM [**?**].

After identification of the numerical parameters, it is shown that starting from an x-ray scan in meso-scale, the 3D meso-model is capable to predict the macroscopic behaviour and the failure patterns of the material under tension [**?**] and to fairly follow the more complex failure patterns observed in compression.

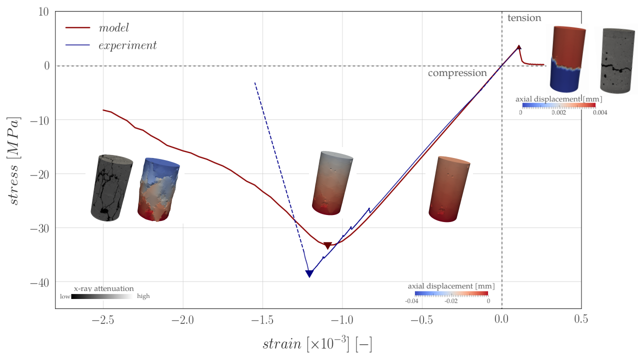

Figure 1: Comparison between experimental and numerical macroscopic stress-strains curves under uniaxial tension and compression. Indicative displacement fields coming from the simulations are also shown together with the x-ray images of the post-peak scans

REFERENCES

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[4] SPAM – Software for Practical Analysis of Materials https://ttk.gricad-pages.univ-grenoble-alpes.fr/spam/intro.html