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Computational modelling of closed cell metallic foams with microstructural morphological control

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This contribution addresses the computational modelling of closed cell metallic foams by means of an integrated RVE generation strategy. The microstructural geometry is generated by controlling relevant fine scale features such as the distribution of cell sizes, the spatial distribution of cell wall thickness and curvature, or the number of faces per cell and edges per face. The generation of the RVE is built on three computational ingredients: (i) a random close packing algorithm based on random sequential addition assisted by neighbour distance control [1], (ii) a distance field-based shape tessellation (morphing) that allows reproducing cell wall curvatures and varying cell wall thicknesses, (iii) a close control of the size distribution of the cells. The RVE geometry is described using implicit functions, which makes it ideal to exploit a recently developed mesh generation technique for heterogeneous microstructures represented by implicit functions [2]. The methodology is illustrated based on experimental data available in literature for morphological indicators relevant to the foam mechanical behaviour. A qualitative and quantitative agreement between FE results and experimental data is obtained for the mechanical behaviour of the foams. The effect of the different microstructural geometrical features (wall thickness distributions, wall curvatures …) on the average behaviour of the foam is investigated through finite element analyses in quasi static condition.

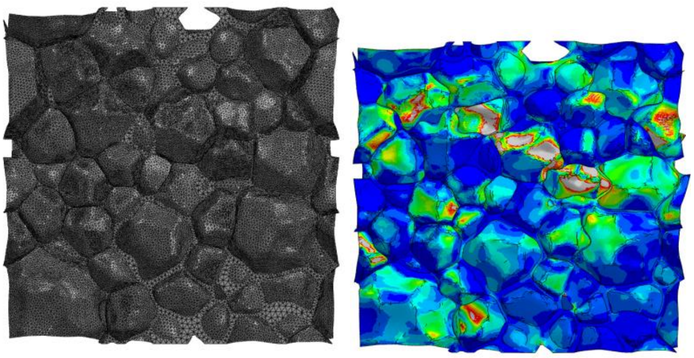

Figure 1: Finite element mesh of the generated RVE, undeformed (Left), deformed configuration (Right)

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