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MODELLING MECHANICAL BEHAVIOR OF ALUMINIUM FOAM UNDER COMPRESSIVE LOADING USING REPRESENTATIVE VOLUME ELEMENT METHOD

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Due to the superior mechanical characteristics of close cell aluminium foams, i.e., light weight and energy absorption, they are very competitive to be used in engineering structures where weight and impact resistance are the main concerns, such as aircraft wing structures [1],engine fan propeller blades [2], telescope lifting systems[3], trucks and trains [3] and space structures [4]. These potential uses result in a number of studies of mechanical behaviour of aluminium foams, especially finite element modelling based on representative volume element (RVE), including the random Voronoi method[5], X-ray tomography[6] and utilising repeating cells such as tetrakaidecahedrons [7].

In this paper, a numerical study is conducted to model the mechanical behaviour of an aluminium foam under compressive loading using the RVE method. Tetrakaidecahedrons are selected as cells to form the RVE model for modelling of the mechanical properties of the aluminium foam. The study is conducted via the commercial code Ansys-LS Dyna. 3D solid element 164 is used to mesh the RVE model.This micro-structured RVE model is first used to model the mechanical behaviour of the aluminium foam under quasi-static compressive loading (2 mm/min). The numerical results are compared to experimental data from literature for validation of the RVE model. Then parametric studies are conducted to investigate the effect of the cell size, thickness of cell wall of the RVE model on the mechanical properties of the aluminium foam. The size effect of the RVE model is also studied.

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