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VEM-BASED ADAPTIVE MESH REFINEMENT FOR MESO-HETEROGENEOUS MATERIALS

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Abstract. Capturing the macroscopic mechanical behaviour of mesoheterogeneous materials by modelling and simulation is of utmost importance from an engineering perspective. Due to the overwhelming geometric complexity and detail of the meso-structure computational challenges typically arise. This mind-set urgently asks for methods that enable reducing the computational cost of simulations at the engineering scale without sacrificing accuracy when capturing the influence of the meso-structure on the macroscopic mechanical response. The use of the Virtual Elements Method (VEM) in problems of complex geometries has become a widely used tool since it presents different significant advantages. Despite this, for a good analysis it is necessary to carry out refinement processes to be able to accurately follow the evolution of stress or damage location processes.

In this work we present a first advance in the refinement process of VEM meshes, focusing on the formulation and implementation which involves novel and complex aspects. The method takes advantage of VEM concerning mesh flexibility to have heterogeneous refinement and coarsening. We present different proposal for the refinement criteria and their respective application in the analysis of BVP of media with inclusions. Numerical results are complemented with comparative analysis of the convergence rate and degrees of freedom involved.