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QUASI-OPTIMAL ADAPTIVE REMESHING PROCEDURES FOR MESO-HETEROGENEOUS PROBLEMS USING THE VIRTUAL ELEMENT METHOD

Daniel van Huyssteen[a], Felipe L. Rivarola[b], Guillermo Etse[b] and Paul Steinman[a]

[a]*Institute of Applied Mechanics, Friedrich-Alexander-Universität Erlangen-Nürnberg Erlangen, 91058, Germany daniel.van.huyssteen@fau.de / paul.steinmann@fau.de, www.ltm.tf.fau.de*

[b]*Facultad de Ingeniería, Universidad de Buenos Aires, Buenos Aires, C1127AAR, Argentina, flopez@fi.uba.ar / getse@herrera.unt.edu.ar, www.ingenieria.uba.ar*

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Abstract. The virtual element method (VEM) is a recent extension of the finite element method that permits arbitrary polygonal element geometry in two dimensions. This mesh flexibility means that the VEM is well-suited to problems involving adaptive mesh remeshing. However, the VEM function spaces are defined such that quantities are only explicitly known on element edges. Thus, the well-known approaches to mesh adaptivity developed for finite elements cannot be directly applied to problems involving the VEM.

In this work an energy error estimation has been implemented using a super-convergent patch recovery procedure. Using this error estimator elements are flagged for refinement or coarsening. The refinement and coarsening of the elements is performed using novel remeshings procedure that are suitable for the arbitrary polygonal element geometries permitted by the VEM. The remeshing procedure has been implemented for the case of two-dimensional elastic problems. Additionally, special consideration of the treatment of meso-heterogeneous bodies is presented. The adaptive procedure is motivated by seeking to achieve a user-defined accuracy target while simultaneously generating a quasi-even distribution of error across the elements. Thus, generating a quasi-optimal mesh. The efficacy of the proposed adaptive procedure is demonstrated through a set of numerical investigations.

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