

Adaptive local enrichment for the finite cell method

Meysam Joulaian and Alexander Düster

Numerical Structural Analysis with Application in Ship Technology (M-10), Hamburg
University of Technology, Schwarzenbergstr. 95c, 21073, Hamburg, Germany,
meysam.joulaian@tu-harburg.de

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ABSTRACT

The capability of using local enrichments is added to the standard Finite Cell Method (FCM) by means of the the *hp-d* method [1]. Following the general idea of the adaptivity, we also enrich the FCM approximation space by an appropriate enrichment space. The enrichment space can be provided either by choosing the pre-known functions that can describe the special phenomenon in the domain [2] or by a local *h*-, *p*- or *hp*-extension [3,4]. Here, irrespective of the definition of the enrichment space, additional shape functions are introduced on a superimposed mesh utilizing the *hp-d* method. This rises the possibility of using different mesh resolutions for the FCM space and enrichment space. The suggested method can be of special interest for the simulation of singularities, multi-scale problems, or in the case of heterogeneous materials where the solution exhibits weak discontinuities. Furthermore, this method enables us to take advantage of different solvers and software for each part of the approximation space. For the purpose of our discussion, difficulties in the standard FCM for the case of heterogeneous materials simulation are addressed in detail. The *hp-d* method and its implementation in the framework of the FCM are also described. Moreover, the performance of the method is investigated by several numerical examples.

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