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A 3D IMPLEMENTATION OF A CHIMERA SCHEME APPLIED TO HEAT TRANSFER OPTIMIZATION PROBLEMS

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Abstract. The Chimera method have been studied since the last few decades. The scheme is generally based in a coarse mesh covering the entire computational domain and finer meshes completely overlapped surrounding the objects. The information transmission between meshes is achieved through interpolation. The scheme proved to be convenient for applications like simplified mesh generation, local refinement, problems involving moving objects and optimization. Optimization is a straightforward application where several objects, each one with its respective mesh, can be moved around over the background mesh looking for the best configuration in terms of an objective function. In this way, the need of remeshing the whole computational domain in each function evaluation is avoided. Several implementations can be found in the literature, however the achievement of the solution continuity across the overlapped meshes and a good convergence of the coupled system are not always an easy task. In this work, a Chimera scheme for overlapping three-dimensional grids based on a high-order interpolation algorithm and an automatic interpolation boundary recognition scheme is presented in the FEM context. The L2-norm of the error and convergence of the coupling are assessed and discussed. Furthermore, the method is used in conjunction with optimization solvers in order to optimize the configuration of several objects in heat transfer problems aiming to minimize the average temperature of the domain, for instance.

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