Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXV, págs. 1611-1611 (resumen)
Martín I. Idiart, Ana E. Scarabino y Mario A. Storti (Eds.)
La Plata, 7-10 Noviembre 2017

A COUPLING STRATEGY FOR A CHIMERA METHOD APPLIED TO THERMAL CONDUCTION OPTIMIZATION PROBLEMS

Bruno A. Storti[a], Luciano Garelli[a], Mario A. Storti[a] and Jorge D'Elía[a]

[a]*Centro de Investigaciones de Métodos Computacionales, (CIMEC), (CONICET-UNL)*
Colectora Ruta 168 s/n, Predio Conicet "Dr. Alberto Cassano", 3000 Santa Fe, Argentina,
bstorti@cimec.unl.edu.ar, http://www.cimec.org.ar

Keywords: chimera method, overlapping grids, coupling scheme, domain decomposition, parallel optimization, pyOpt.

Abstract. The main idea of the Chimera method is to generate independent meshes for the objects present in a computational domain and to couple them by a coupling strategy in order to obtain a unique solution of the system. The method has appealing characteristics that are convenient for applications like simplified mesh generation, moving components, local refinement and optimization. The optimization process is a straightforward application where several objects, each one with its respective mesh, can be moved around without the need to remesh the whole computational domain. Then, different optimization techniques can be used to find the optimum configuration of the system in terms of an objective function. In a previous work (B. Storti *et al.*, "A chimera method based on Dirichlet-Dirichlet coupling and pasting penalization operators", Mecánica Computacional, vol. XXXIV, 2016), we have presented and validated a Chimera scheme in the finite element context for structured meshes, and we have proven that it has a good convergence rate solving the system iteratively with BiCGStab (BiConjugate Gradient Stabilized method). In the present work, we improve the Chimera method to solve thermal conduction problems on overlapping unstructured meshes and then we test it in several optimization cases. A Dirichlet-Dirichlet coupling imposes the continuity of the unknown on overlapping subdomains and to transfer these values between the multiples domains, a third order interpolation method is used in conjunction with a "pasting" penalization operator. Several numerical examples are also shown in order to validate the proposed interpolation method. Finally a variety of optimization problems are solved under the pyOpt framework, either using gradient-free or gradient based optimizers, running in the CIMEC cluster Seshat (http://www.cimec.org.ar/c3/seshat/equipos.php), where every evaluation test of the objective function is compute on each core. Seshat is a 69 nodes cluster, which has an Infiniband network and a computing power of almost 7 TFLOPS.