Study of coarsening algorithms for adaptive methods with hierarchical B-splines

Eduardo M. Garau*, and **Rafael Vázquez**†

* Universidad Nacional del Litoral, Consejo Nacional de Investigaciones Científicas y Técnicas, FIQ, Santiago del Estero 2829, Santa Fe (3000), Argentina.
e-mail: egarau@santafe-conicet.gov.ar

† Istituto di Matematica Applicata e Tecnologie Informatiche E. Magenes (CNR), Pavia, Italy.
Institute of Mathematics, École Polytechnique Fédérale de Lausanne, Station 8, 1015 Lausanne, Switzerland.
e-mail: rafael.vazquez@epfl.ch

ABSTRACT

The use of adaptive methods for the solution of partial differential equations requires the use of refinement algorithms, to control the accuracy of the discrete space in localized regions. Coarsening algorithms are extremely important to save computational time, for instance in time dependent problems where the region to refine locally moves along the time.

Refinement algorithms appear many times in the IGA literature, and are more or less well understood. Instead, the study of coarsening is still in a very preliminary phase, and very few papers deal with coarsening in IGA [1, 2, 3].

We have introduced in [4] a rigorous definition of coarsening that can be proved to be the inverse of refinement, in the sense that a coarsening (respectively refinement) operation can be reversed by refining (resp. coarsening) a set of active elements of the mesh. This coarsening algorithm requires as the input a set of entities, either elements or basis functions, to be reactivated. That is, the input entities are *inactive*.

The coarsening algorithm in [4] lacks one last step: the decision on which entities to reactivate, depending on the results of the a posteriori error estimator. Since the estimator works on active entities, it is necessary to pass the information from these active entities to their parents. The robustness of the coarsening algorithm depends on this decision, specially when coarsening is performed using an estimator based on functions.

In this work we present and compare different strategies to perform coarsening, both for element-based and function-based a posteriori error estimators.

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