A convergent adaptive scheme for hierarchical isogeometric methods

Carlotta Giannelli
INdAM c/o University of Florence, Italy
carlotta.giannelli@unifi.it

Adaptive finite element methods (AFEM) usually rely on an iterative procedure that consists of four fundamental modules. For any iterative step, the adaptive loop starts with the approximation of the solution with respect to the current computational mesh. A posteriori error estimates are then computed in terms of local indicators associated to any single mesh element. Subsequently, a marking strategy selects the elements with higher values of the local error indicator. Finally, a refinement procedure constructs the refined mesh starting from the set of marked elements. In general, the refinement procedure identifies the mesh with an increased level of resolution for the next iteration by refining not only the marked elements, but also a suitable set of elements in their neighbourhood. This may allow to guarantee certain properties of the resulting mesh that preserve the error estimates previously computed. In particular, specific bounds for the number of the non-zero basis functions on any mesh element plays a key role for the development of an adaptivity theory. In order to extend recent results obtained in the AFEM context to the isogeometric setting, we rely on local refinement techniques based on adaptive spline spaces. In particular, by exploiting the truncated basis for hierarchical B-spline spaces together with suitable mesh configurations, we will provide simple residual-type error estimates and prove the convergence of the adaptive procedure.

Joint work with Annalisa Buffa (IMATI "E. Magenes" - CNR, Italy).