Numerical aspects of box-spline isogeometric methods

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An efficient handling of local refinements and an easy modeling of complex geometries are two main issues in the numerical treatment of PDEs and in particular in Isogeometric Analysis (IgA), see [1].
Splines on regular triangulations equipped with suitable bases, are the natural bivariate generalization of univariate B-splines and can be seen as an intermediate step between tensor product structures and general triangulations. They can be easily extended to higher dimensions, and therefore they turn out to be a powerful geometric tool in IgA ([4]). Moreover local refinement can be achieved by considering hierarchically nested sequences of box spline spaces and the boundary conditions can be enforced in a weak form by using weak boundary immerse approaches ([3]).
On the other hand, in order to fully profit of such tool, proper numerical methods to solve the linear system associated to the PDE discretisation, are strongly required. When performing refinements of the mesh we get a sequence of linear systems with increasing size. Usually the corresponding sequence of discretization matrices enjoys an asymptotic spectral distribution (see [2]) which is a key tool to build efficient numerical solvers.

In this talk we aim to report our ongoing research on the use of box-splines on regular three-directional meshes in IgA, with particular attention to the spectral properties of the arising discretization matrices.

Joint work with: Carla Manni and Hendrik Speleers (University of Rome "Tor Vergata").

References

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