DK Seminar

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The hp version of the Virtual Element Method

The Virtual Element Method (VEM) is a recent generalization of the Finite Element Method (FEM). The main features of VEM are the employment of polygonal/polyhedral meshes (thus including non conforming meshes) and the possibility of building in an easy fashion global spaces of arbitrary regularity.
Tipically, the local discrete spaces contain polynomials and, differently from the Finite Element framework, also other functions which are not known explicitly (hence the name virtual) and that are needed for obtaining a H1 conforming method.
In the standard framework of FEM, one can prove that the solution of the method converges to the exact solution of the PDE either by refining an underlying triangular/quadrilateral mesh and keeping fixed the polynomial degree (h-FEM) or by keeping fixed the mesh and increasing the polynomial degree (p-FEM). A combination of the two strategies, i.e. a FEM where both mesh refinement and increasing the polynomial degree are performed, goes under the name of hp-FEM.
It is well known that hp-FEM outclasses h and p-FEM in some particular cases; for instance, when approximating general solutions of elliptic problems on polygonal domains, it is possible to prove exponential convergence, in terms of the number of degrees of freedom, of the energy error.
In the present talk, we give an introduction to the hp version of VEM for the two dimensional Poisson problem in primal formulation, showing (theoretically and numerically) how the geometric flexibility of VEM dovetails with classical hp gospel.