The MHM Method on Non-Conforming Polygonal Meshes

Gabriel Barrenechea[a], Fabrice Jaillet [b], Diego Paredes[c] and Frédéric Valentin[d]

Laboratório Nacional de Computação Científica - LNCC, Av. Getúlio Vargas, 333 - 25651-075 Petrópolis - RJ, Brazil

[a] gabriel.barrenechea@strath.ac.uk

[b] fabrice.jaillet@univ-lyon1.fr

[c] dparedes@udec.cl

[d] valentin@lncc.br

This talk revisits the general form of the Multiscale Hybrid-Mixed (MHM) method for the second-order Laplace (Darcy) equation under the perspective of non-convex non-conforming polyhedral meshes. In this context, we propose new stable multiscale finite elements such that they preserve the well-posedness, super-convergence and local conservation properties of the original MHM method under mild regularity conditions. Precisely, we show that piecewise polynomial of degree $k+1$ and k, $k \geq 0$, for the Lagrange multipliers (flux) along with continuous piecewise polynomial interpolations of degree $k+1$ posed on second-level sub-meshes are stable if the latter is refined enough. Such one- and two-level discretization impact the error in a way that the discrete primal (pressure) and dual (velocity) variables achieve super-convergence in the natural norms under extra local regularity only. Numerical tests assess theoretical results.