A SECOND ORDER MULTIPOINT FLUX MIXED FINITE ELEMENT METHOD ON HYBRID MESHES

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ABSTRACT. We consider the numerical approximation of subsurface flow problems by a mixed finite element method. Following ideas of Wheeler and Yotov, we utilize a mass-lumping strategy that allows us to circumvent the saddle point structure of the underlying variational problem by local elimination of the flux variables leading to a Poisson-type problem for the pressure only. An abstract convergence analysis is given, which allows us to obtain second order approximations on hybrid meshes. We further show that even third order convergence for the pressure can be obtained by local postprocessing. The theoretical results will be illustrated by numerical tests which demonstrate the efficiency of the method.

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