XVIII International Conference on Water Resources
CMWR 2010
J. Carrera (Ed)
CIMNE, Barcelona 2010

A NON-CONFORMING MORTAR-LIKE METHOD FOR MODELING FLOW IN 3D MULTI-SCALE FRACTURE NERWORKS

G. Pichot[*], J. Erhel[†] and J-R. de Dreuzy[‡]

[*] Université du Havre (LOMC)
53 rue Prony, BP 540, 76058, Le Havre Cedex, France
e-mail: geraldine.lemarchand@univ-lehavre.fr, web page: http://www.univ-lehavre.fr/recherche/lomc/

[†] INRIA Rennes
Campus de Beaulieu, 35042 Rennes Cedex, France
e-mail: Jocelyne.Erhel@irisa.fr, web page: http://www.irisa.fr/sage/

[‡] Géosciences Rennes
Campus de Beaulieu, 35042 Rennes Cedex, France
e-mail: jean-raynald.de-dreuzy@univ-rennes1.fr, web page: http://www.geosciences.univ-rennes1.fr

Summary. Flow simulations in 3D large-scale fracture networks are constrained by generating a good quality mesh. The constraint is especially strong in intricate configurations where several fracture intersections are close together. Most methods rely on slight modifications of the fracture positions to facilitate the mesh generation and to apply eventually classical discretization schemes. Rather than adapting the mesh and using classical discretization schemes, we propose here to use simpler mesh generation procedures while adapting the numerical methods. We propose to use a Mortar like method at fracture intersections. Each fracture is meshed independently issuing non-corresponding discretizations at fracture intersections. At each intersection, we derive the relation between heads and flows in both intersected fractures from the use of a Mortar method. The Mortar method introduces a dissymmetry by affecting the unknowns in one fracture as principal (master) and the unknowns in the other fracture as secondary (slave). The challenge comes from the large number of intersections and the possible conflicts between master and slave unknowns on close intersections. We present a solution adapted to any kind of 3D fracture networks and tested on a broad range of test cases.