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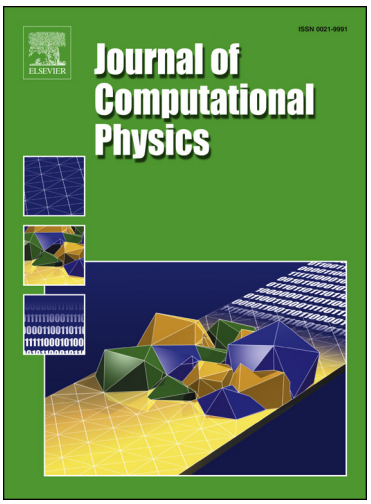

Flow simulations in porous media with immersed intersecting fractures

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Flow simulations in porous media with immersed intersecting fractures

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Abstract

A novel approach for fully 3D flow simulations in porous media with immersed networks of fractures is presented. The method is based on the discrete fracture and matrix model, in which fractures are represented as two-dimensional objects in a three-dimensional porous matrix. The problem, written in primal formulation on both the fractures and the porous matrix, is solved resorting to the constrained minimization of a properly designed cost functional that expresses the matching conditions at fracture-fracture and fracture-matrix interfaces. The method, originally conceived for intricate fracture networks in impervious rock matrices, is here extended to fractures in a porous permeable rock matrix. The purpose of the optimization approach is to allow for an easy meshing process, independent of the geometrical complexity of the domain, and for a robust and efficient resolution tool, relying on a strong parallelism. The present work is devoted to the presentation of the new method and of its applicability to flow simulations in poro-fractured domains.

Keywords: 3D flows, Darcy flows, matrix-fracture coupled flows, optimization methods for elliptic problems, uncoupled large scale simulations, BEM
2010 MSC: 65N30, 65N50, 68U20, 86-08

1. Introduction

The problem of underground flow simulations is an active research field as a consequence of its relevance in many practical activities, ranging from en-

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