The working group activities on Fracture in Porous Media and Fluid Flow in a Fractured Media will be held in the framework of Women in Mathematics and Materials workshop. The first team meeting will be at the Michigan Center for Applied and Interdisciplinary Mathematics (MCAIM), University of Michigan, May 14-18, 2018.

1. Project description. Modeling fluid flow through fractured porous media is an important and challenging question in many disciplines such as geosciences, environmental and petroleum engineering, and material sciences, to name a few areas. In these applications, often, the domain of interest (bulk) has anisotropic inclusions and discontinuous material properties/coefficients which can span over several orders of magnitude. If the size of these heterogeneities is small in normal direction comparing to the tangential direction, they are referred to as fractures. These fractures can act as conduits and/or barriers affecting the flow within the porous media. Therefore, mathematical and computational modeling are essential for the understanding, predicting and controlling the behavior of the fluid flow and the fractured system, as well as their two-way interaction. Despite, the increasing attention to the subject and recent progress, there are many research questions that remain open, like the study of sharp interface models versus phase-field models for fracture; investigation of physically consistent interface/coupling conditions to account for the exchange of the fluid between the fracture and the porous media; consideration of the single phase and two-phase fluid flow models, efficient and accurate numerical methods, etc.

The main goal of the project is to develop a more accurate mathematical model and computational methods that will help to improve our understanding of the interaction between the fluid flow and the fractured system in porous media. This goal will be accomplished through some of the following steps: (1) review of existing mathematical models and numerical methods in the current literature; (2) development of a theoretical framework for coupling fluid flow and fracture in porous media; (3) design of robust numerical methods and integration of the theory into computational model that will be able to address some of the existing open issues; (4) validation.

2. Background required from the team members. Partial Differential Equations, Mathematical Modeling, graduate level knowledge of Numerical Analysis and Scientific Computing. Some familiarity with Mechanics of Porous Media and Fracture Mechanics is a plus (but not required). The team members should review suggested literature below [2, 3, 4, 8, 5, 1, 7, 6] before the workshop and will be expected to deliver a short presentation on a topic related to the project. The members should contact the project leaders to discuss their background.
References


