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Multi-fracture network simulation models of hydrocarbon and water reservoirs are clearly over-regularised and simple. There is of course a scaling problem when attempting to incorporate fracture parameters, which influence fluid flows at micro scale into reservoir scale grid blocks. Nevertheless, fracture surface roughness should be taken seriously in single-porosity/permeability systems where fractures provide the main permeable pathways for fluid flow. This is because it causes deviations from parallel plate models assumed in simulators, which predict permeability from the cube of the separation of fracture walls i.e., aperture cubed and the pressure gradient acting across that fracture.

To this end we have made the following advances
- Improved optical imaging of resin replicas of rough fracture surfaces in a variety of rocks.
- Improved prediction of rough-walled hydraulic fracture apertures by relating the mechanical aperture to a dual-mean aperture (i.e., a combination of geometric and arithmetic means).
- Use of improved numerical techniques to match rough fracture surfaces together which more accurately reflect natural fractures.
- Using this data, fluid flow simulations using Ge's equation, which accounts for fracture surface roughness.