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Efficient Solvers based on Hybrid High Order (HHO) methods for flow simulations in fractured rocks

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In many subsurface applications (water resources, geothermal applications, oil/gas extraction, nuclear waste disposal), fractures play a major role as they are preferential flow paths. Fractures appear at all scales, from the centimeter to the kilometer. This wide range of scales spread over large computational domains requires efficient and robust numerical methods, capable of managing networks with millions of fractures. In this presentation, we investigate the computational performance of hybrid high-order methods [1, 2] applied to flow simulations in extremely large discrete fracture networks (over one million of fractures). We study the choice of basis functions, the trade-off between increasing the polynomial order and refining the mesh, and how to take advantage of polygonal cells to reduce the number of degrees of freedom [3].

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