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Particle laden fluids in hydraulic fracturing

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The aim of hydraulic fracturing is to create a highly conductive pathway in the reservoir formation of interest. This is typically achieved by "propping" the created fracture with solid particles (i.e. proppant) in order to prevent complete closure of the created fracture due to in-situ stresses when pumping stops. The placement of proppant is therefore the main goal of any fracturing treatment. It involves a number of interesting fluid dynamics problem (suspensions flow with settling, complex rheologies of the base fluid, effect of the fracture roughness etc.). In this talk, we will review the different class of fluids used to achieve proppant placement in fracture particularly focusing on their widely varied rheological properties. We will also discuss the different flow regimes that are typically encountered during a hydraulic fracturing job. In particular, we will notably present in details how recent advances in our understanding of dense suspensions flow [1,2] can improve predictions of proppant placement in the Stokesian regime.

[1] Boyer, F.; Guazzelli, É. & Pouliquen, O. Unifying suspension and granular rheology Phys. Rev. Lett., APS, 2011, 107, 188301

[2] Lecampion, B. & Garagash, D. Confined flow of suspensions modeled by a frictional rheology J. Fluid Mech., 2014, 759, 197-235

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