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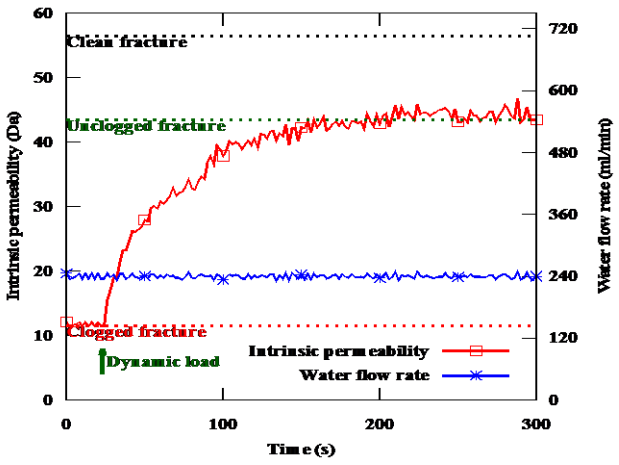
Wave stimulation of reservoir formation

Abstract:

Fines migration in fractured formations has been found as a key cause of oil and gas production loss. These fines adhere to the porous matrix of the fractures and clog the hydraulic drains, reducing locally the permeability of the fractures as well as the well's global production. It has been discovered that dynamic stimulation of the formation, which causes pressure oscillations within the fractures, can increase permeability by breaking up fines clusters. For a better understanding of the process, this PhD dissertation investigates the unclogging process within hydraulically generated fractures during dynamic loading. The study begins with a methodical series of laboratory experiments in which an artificial clogged fracture filled with proppant is created. The results reveal a considerable increase in permeability following the application of synthetic dynamic loads. The influence of proppant density, proppant size, amplitude, frequency, and shape of the dynamic signal are also investigated. The second part of this work is a numerical study that was conducted by utilizing a DEM approach to model the granular bed clogged with fine particles inside the fracture. Following the same experimental procedure, the model demonstrates the capacity to fully reproduce the experimental study.

Results and Discussion:

An example of one of the results is shown in the figure on the right. After applying the dynamic load to a clogged fracture (15% of fines), a significant increase of the permeability is noticed with a high recovery rate reaching 75%. All the fines were flushed out from the fracture. The frequency of the signal plays an essential role in the speed of the unclogging process and thus on the mobilization of the motion of fines through the propped fracture. The numerical model showed the ability to fully reproduce the experimental study and showed also that the increase of fracture conductivity is strongly related to the movement of proppant which help to release and destabilize fines aggregates.



References:

Fawaz, Youssef, et al. "Fracture cleaning: experimental study on the unclogging process within a propped fracture under a dynamic stimulation." *Journal of Petroleum Science and Engineering* (2021): 109028.