LOW-FREQUENCY ATTENUATION MEASUREMENTS OF FLUIDS

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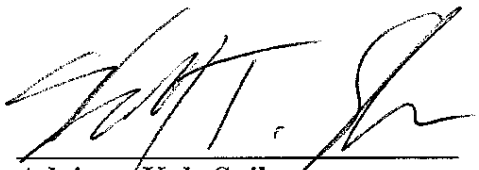
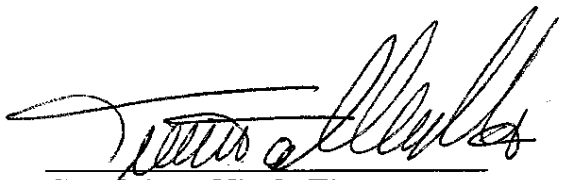
ABSTRACT

Pore fluids significantly affect the elastic responses of rocks. Rock-physics models can be used to predict how pore fluids affect the elastic responses of rocks when rocks are fully or partially saturated. Thus, to identify fluids in the subsurface, knowing the elastic properties of such fluids is useful. In addition, new technologies to assess and monitor hydrocarbon exploration rely on the precise determination of the elastic properties of hydraulic fracturing fluids. Moreover, the elastic properties of rocks depend on the frequency of the wave propagating through the rock. Methodologies to measure high-frequency elastic properties of fluids have been widely reported. What have not been established are methodologies to measure the low-frequency elastic properties of fluids in a laboratory setting. Using the low-frequency properties, rather than the already known high-frequency properties of pore fluids, will provide more accurate values when calculating the low-frequency elastic properties of rocks saturated with pore fluids from rock physics models and seismic data. To address this situation, a laboratory machine has been designed and built to measure the low-frequency attenuation and bulk modulus of fluids at frequencies from 0.1 to 5 Hz. Deionized water and aqueous guar gum solutions have been tested. Results for measurements of attenuation and bulk modulus of water are in agreeance with reported values for water. Measurements of guar gum solutions show attenuation is greater than 0.01 with higher concentration samples having higher attenuation. This is explained by energy being lost during the breakup of weak and strong bonds in the guar gum chains. A higher concentration provides more bonds to break up which leads to more energy being lost which increases attenuation. The machine used for these experiments is most reliable at frequencies less than 5 Hz.



Advisor: Kyle Spikes



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