PP1.3.5 A Developed Continuum Model for Yield Stress Fluid in a Vibrating Screen (Shale Shaker)

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The shale shaker has been an important operation in the drilling industry for many years for removing sand and coarse particles from drilling fluids. Systematic empirical studies of full scale shakers are difficult and expensive to conduct due to the high volumetric flow rates of drill fluid and coarse materials flowing through the shaker. The drilling mud flows onto the screen and eventually forms a filter cake. The filter cake is the continuum. As the liquid phase flows through the screen the coarse particles in the mud collect on the screen and form a cake. The vibrations of the screen cause the cake to move across the screen while the liquid phase exits the bottom of the screen.

A continuum model of the cake is developed to predict the capacity of the shale shaker and the calculated results are compared to experimental data obtained from a bench scale shale shaker (M-I SWACO, A Schlumberger Company). The model accounts for the non-Newtonian yield stress rheology of the drilling fluid. The continuum theory is used to derive the governing equations of a macro scale system. The governing equations are based on classical balance laws of continuum mechanics and interfacial and boundary conditions.

The process of continuous cake filtration in the bench scale shale shaker is modeled. The model also predicts that the flow rate increases by increasing porosity .The model also predicts that acceleration has much effect on the flow rate and by increasing acceleration, flow rate increases. Comparison of the continuum model results with experimental data showed the model tends to under predict the liquid flow rate.