The Cuttings Transport Modelling with Couette Flow

Ishak Cumhur
Department of Mathematics, Recep Tayyip Erdogan University, Rize, Turkey

Abstract

In the petroleum production, when an oil well is drilled, rock cuttings are transported up to the surface. As current mathematical models of the flow and transport neglect the effect of drillstring rotation, it is necessary to have a model that includes rotation effects. Predicting effective cuttings transport mechanism requires all of the parameters to be considered simultaneously. To beter understand the cuttings transport mechanism, a mechanistic model is used for cuttings in Couette and Poiseuille flow, as well as the helical flow being the superposition of Couette and Poiseuille flows.

In this paper, we present the approximate solution of cuttings transport model(Couette Flow Model) being only direction of rotation by combining Modified Differential Transform Method and Adomian Decompositon.

Couette flow velocity profile will be used in $\varepsilon\frac{d^2\mathrm{x}}{dt^2}+\frac{d\mathrm{x}}{dt}=\mathrm{V}(\mathrm{x})-\varepsilon g_0\mathrm{j}$ model equation instead of $\mathrm{V}(\mathrm{x})$, where $\mathrm{V}(\mathrm{x})$ is fluid velocity at x location, μ_f is dynamic viscosity, a_p is particle size and $k=6\pi a_p\mu_f$ (Kurzweg, 1995). Nondimensional parameters are $\varepsilon=m\omega/k=O(10^{-1})$ and $g_0=g/\omega^2 r_0=O(10^{-1})$.

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