Optimization of the gas-lift process

The gaslift method is of special importance at the initial period after the flowing of the oil fields [1,2, 3]. The motion in the gaslift process is known to obey the hyperbolic nonlinear partial differential equations. Therefore, at gaslift operation of the borehole cavity the problem of optimization with boundary control is of special interest. However, with the original formulation of the problem of optimal control one encounters certain difficulties. The averagings of the hyperbolic equation describing the time profile of motion by the gaslift method are given here [1, 3]. It rearranges a partial derivative equation in the nonlinear ordinary differential equations. The strategy of constructing the objective quadratic functional with the use of the weight coefficients lies in minimizing the volume of the gas injected in the annular space and maximizing the desired volume of the gas-liquid mixture (GLM) at the end of the lifter. In this case, the aim lies in solving the corresponding optimization problem where the volume of the injected gas which is used as the initial data and plays the role of the control action.

The impossibility of using the standard methods to construct the corresponding controllers is a disadvantage of this approach. Yet, since at certain time intervals the boundary control is constant, the numerical data obtained can be readily compared with the production data.

Using the method of time averaging, the partial derivative equations of motion of gas and GLM motion proposed in [1] are rearranged in the ordinary differential equations. The problem of optimal boundary control with the quadratic functional is formulated on the basis of the above considerations. The results obtained can be used to control the gaslift borehole cavity at oil extraction. For solution of the considered problem of boundary controls, the gradient method [3] is modified by describing the corresponding Euler–Lagrange equations [4].

References

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