Oil and Gas Well Rate Estimation by Choke Formula: Semi-Analytical Approach

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Abstract:

During last decades accurate multi-phase flow meters are introduced to upstream oil and gas industry; however, due to economic and technical issues, the use of choke formula for estimating well production rate is popular, yet. Since introducing first choke formula by Gilbert (1954), a large number of choke formulas introduced: globally or for a special reservoir. All of these Gilbert's type choke formulas assume sonic flow conditions through a well head choke; for this reason, they do not consider the differential pressure across the choke. The other type of choke formulas which are introduced by some pioneer researchers (Fortunati, 1972; Ashford and Pierce, 1974) consider the subsonic velocity condition through the choke at expense of formula complication. Field experience reveals that by flowing the well to a separator but with different separator operating pressure, the well flow rate will change. In this paper, by using basic concepts of fluid mechanics, it is shown that rate of two-phase flow through a choke generally depends on the pressure drop across the choke besides of the other factors by deriving a global choke formula. Based on this finding, a general Gilbert's type choke formula is derived which includes differential pressure across the choke. This new choke formula is validated by a field data bank including 399 data points.

Key Words:

Choke formula, sonic flow, sub sonic flow, well rate, pressure drop across choke, two phase flow