# Determination of fracture network parameters using multi-rate well test data

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## *Abstract*

The objective of this paper is to investigate the fracture parameters for oil fracture reservoirs by using multi-rate well test data. This work is based on the steady state flow of homogenous liquid through fracture network toward wells using *Kazemi* and *Warren-Root* models. Multi-rate well testing is powerful tools that could describe quantitatively the fracture networks. For constant oil production rate, if the fracture density (i.e. number of fracture) increases, then the drawdown of oil well decreases. On the other hands, by decreasing the fracture density, the drawdown increases. Therefore, the drawdown of the well could be related to the fracture network and could provide the data about the fracture reservoir characterization. This study based multi-rate well testing and two main prevailing of fracture model (i.e. Kazemi and Warren-Root) tried to obtain the fracture reservoir characterization that includes permeability of fracture and matrix, porosity of fracture, Arial fracture density, block size and fracture opening. Also, these data could be assisted to calculate the water and gas coining. Finally, the modeling was carried out for two Iranian fracture reservoirs in South. The results show very good agreement between Warren-Root model and fracture image log.

**Key words**: fracture parameters, fracture network, well testing, gas coning, water coning

## Introduction

Naturally fractured reservoirs have recently attracted intensive research attention, because the world market is increasingly under pressure to exploit energy from unconventional sources such as naturally fractured oil and gas rock reservoirs. From field experience very high rates are obtained from fracture wells under a very limited pressure drop. The magnitude of rates or productivity index is directly associated to the presence or absence of fractures. In order to simplify the complexity of fracture networks, models based on their regular geometry have been proposed. There are several models for fracture networks. In this study the *Kazemi* and *Warren-Root* models were used. As determination of fracture parameters is very essential to analyze the fracture networks, there are several methods to obtain them. One of these methods that can be used easily is multi rate data. In some cases that enough data are not provided or to compare the results of the other methods the multi rate method can be used. If the data are obtained from well testing, the permeability $K_f$ can be determined from the test results. Since Areal fracture density (AfD) is often determined by logging or core analysis, the porosity of fracture $\Phi_f$ and fracture width b may be determined by use the equations given in the table 1.

Table 1.Basic parameters of simplified models

| Model Type | Velocity | $A_{fD}$ | $\phi_f$ | $\phi_f$ | a | b |
|---|---|---|---|---|---|---|
| 1.Slides | $V_x = 0$ | $1/a$ | $b/a$ | $(12 K_f A^2_{fD})^{0.33}$ | $1/A_{fD}$ | $(12 K_f/\phi_f)^{0.5}$ |