**Effect of Fluid Leaks on Fracture Geometry Evolution during Fracpack Treatments**

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**Abstract**

In recent years, the use of fracpack treatments has gained attention and is becoming increasingly popular because of their dual benefits of stimulation and sand control. A fracpack is a hydraulic fracturing treatment using a very high proppant concentration to pack-off the mouth of the fracture. Fracpacking is widely used in high-permeability, poorly consolidated sandstone formations. Accurate estimation of fracture width is important for both fracpacking and hydraulic fracturing to help ensure successful treatment. With the development of low-leakoff fluid systems, it has become possible to force the fluid through the proppant pack and out through the tip of the fracture without losing all the fluid through the fracture faces in a high-permeability, soft formation as a result of low-non-Newtonian fluid through the proppant pack has been discussed in the literature. In this paper, the work has been further extended to include the effect of fluid leakoff through fracture faces for radial fractures.

The fracture face leakoff phenomenon is modeled using a generalization of Carter equation, with different leakoff rates being incorporated in the form of fracture face leakoff coefficient values. The effect of fracture face leak-off on the final width, profile, net pressure, fracture volume, and peak radius was investigated. It was observed that the width profile is significantly affected when fluid leakoff through the entire fracture face is considered. Controlling fluid leakoff through the fracture faces can result in much wider fractures because of large net pressure developed inside the fracture from fluid squeezing through the proppant pack.

**Introduction**

Fracpack methodology consists of combined fracturing and gravel packing and is popular for completing low- to medium-permeability unconsolidated sandstone reservoirs (Dusterhoft et al. 1995, Sanchez and Tibbles 2001, Ellis 1998, Weirich et al. 2000). Fracpack has been applied to high-permeability reservoirs (Neumam et al. 2000). The essential features of a fracpack include increased proppant loading into the reservoir at rates and pressures exceeding conductive fracture initiation, without proppant loss, and increasing conductive fracture closure during production, as well as creating a proppant screen necessary during the fracpack design (Peebles et al. 1998). In addition, key 3D fracture simulation treatment design (Waltman et al. 2009, Todd et al. 2011, Oseini and Olayan 2007), packers insertion and servicing tools (Ross 1995, Cox et al. 2002), proppant sizing, and fracturing fluids (Todd et al. 2009), techniques can result in multiple benefits, such as reduced skin, accelerated recovery of hydrocarbons, and lower drawdown pressure (Peebles et al. 1998).

Fracpack width profile as a function of the pressure distribution is an important component of any fracturing model, and rectangular (England and Green 1963) fracture have been known for a long time. However, until recently, these equations were only solved for the case of constant pressure at a distance (Sneddon 1946). A nonlinear pressure profile is important for the flow of a Newtonian fluid. In reality, a nonlinear pressure profile can be expected as a result of flow of fluid through the proppant pack.