



UNCONVENTIONAL RESERVOIR ENGINEERING PROJECT  
COLORADO SCHOOL OF MINES



## An Analytical Investigation of Boundaries in Naturally Fractured Unconventional Reservoirs

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UNCONVENTIONAL RESERVOIR ENGINEERING PROJECT

### Problem Statement

Modeling hydraulically fractured horizontal wells is difficult, especially to determine drainage area and well to well interference.

The wells exhibits a stimulated inner region within the fracture tips, and virgin reservoir outside of this region.

This behavior needs to be modeled correctly, so that the full effects of the boundaries of this stimulated region can be examined



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## Scope of Research

Develop a rigorous analytical model that allows for examining the key parameters that affect drainage area.



## Approach

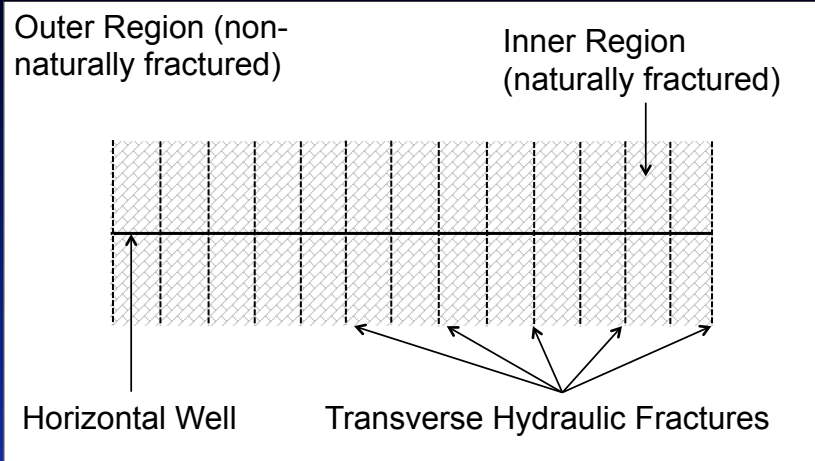
Model built by using semi-analytical method developed by Cinco-Let, et al. (1978) modified by Chen and Raghavan (1997).

This model uses multiple finite-conductivity fractures superimposed with a naturally fractured stimulated rock volume.

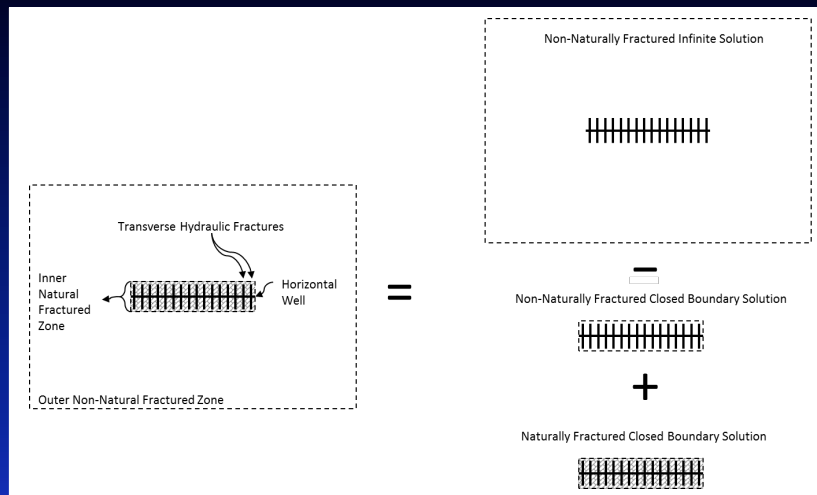
Using this model, we can emulate a tri-linear model, but it can experience pseudo-radial flow.



## Approach



## Approach



## Approach

Using this rigorous approach, we can examine:

- Fracture tip effects
- Drainage area
- Key variables that effect flow regimes
- Comparisons to tri-linear model
- Interference effects



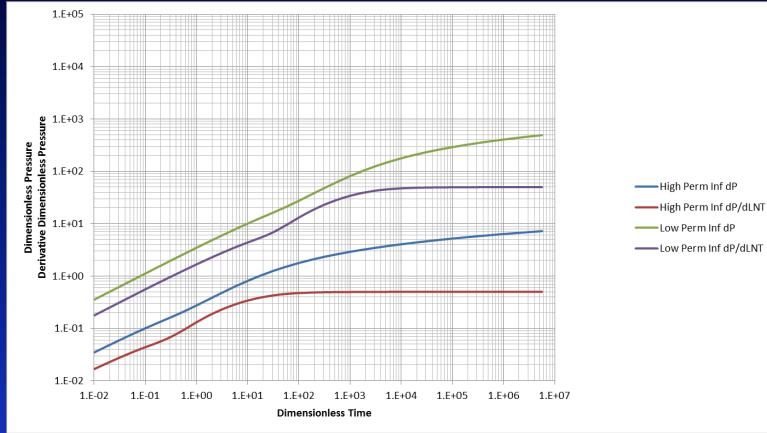
## Early Analysis

Pressure Transient Example

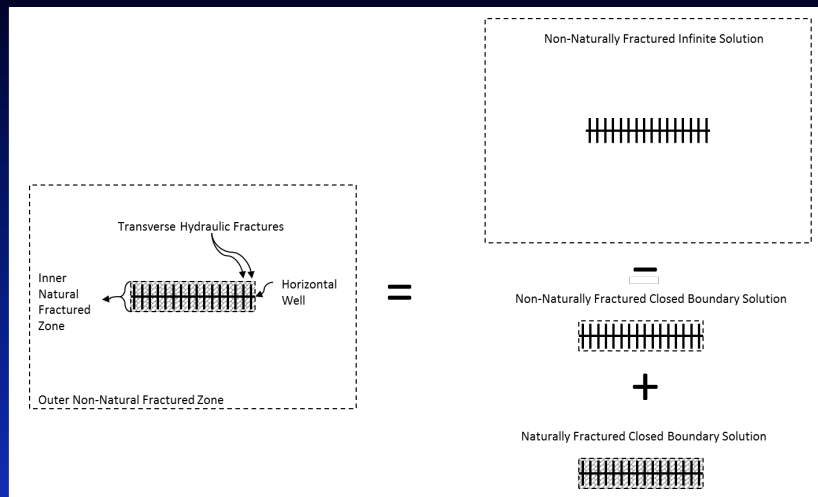
- 5 Fracture Well
- 100x permeability contrast



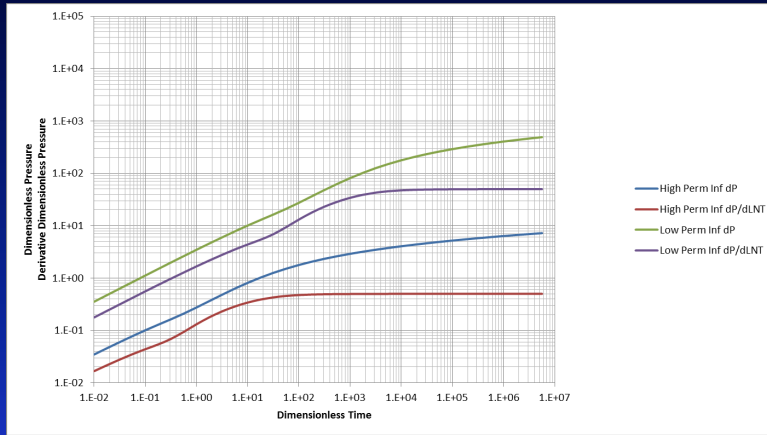
# Early Analysis



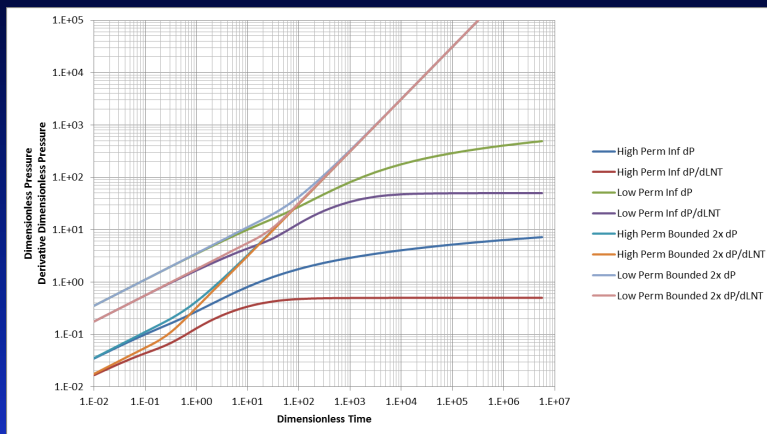
# Early Analysis



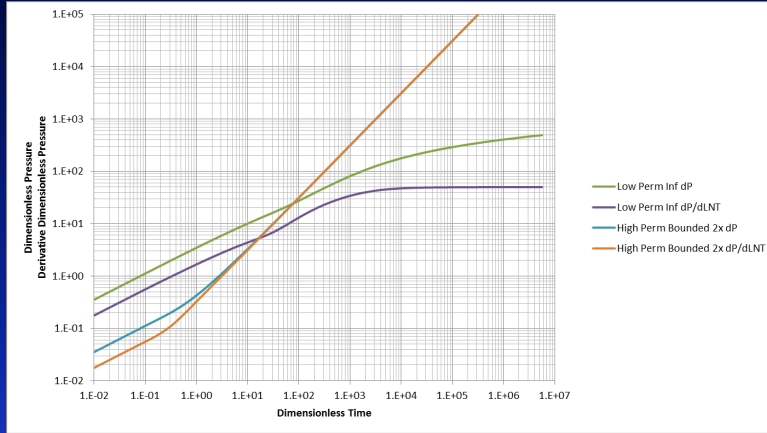
# Early Analysis



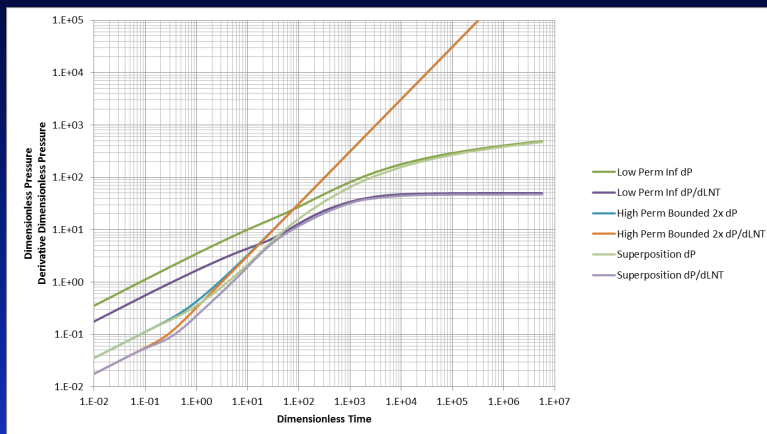
# Early Analysis



## Early Analysis



## Early Analysis



## Early Conclusions

- Method of superimposing a stimulated region onto the virgin reservoir conditions is applicable, and responds as expected

