WATER HAMMER

Fracture Diagnosis by Analysis of Water Hammer Signatures in Multi-Stage Fracture Treatments

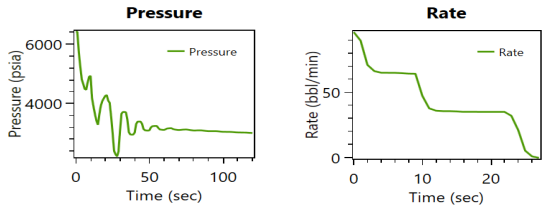
What is WaterHammer?

WaterHammer is a fracture diagnostic tool for multi-stage hydraulic fracture treatments. WaterHammer provides an estimate of fracture dimensions by analyzing water hammer signature data that is readily available for any fracture treatment.

Take Advantage of Data Already Available

Water Hammer Signature Exists in Every Treatment

Water hammer refers to the pressure fluctuations which occur immediately after shut-in (stoppage of pumps). It is essentially free data as surface pressure and flowrate are always recorded during fracture treatments.



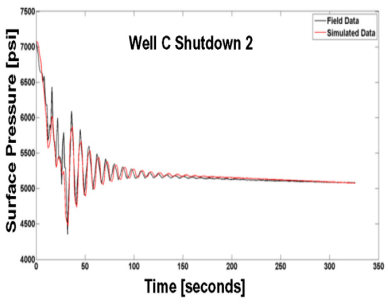
Unique Capabilities of WaterHammer

WaterHammer solves a transient flow problem in a Wellhead-Wellbore-Fracture system, which allows a user to address questions such as:

- What are the induced fracture dimensions including length, height, and width?
- What are the fracture dimensions when multiple fractures are growing in a stage?
- How does the stimulated reservoir volume change in each stage from toe to heel?
- How do other fracture diagnostic data compare with water hammer analysis? (Microseismic, long-term production, DTS/DAS, and so on)
- How does fracture treatment design impact water hammer signature and predicted fracture dimensions?
- How do ISIP, net pressure and near-well pressure drop change over stages?

End Results

WHP before shut-in	=	6415.0 [psi]
WB Friction loss	=	1860.3 [psi]
WB delP	=	639.9 [psi]
BHP before shut-in	=	7054.9 [psi]
NearWB Friction Pnwf	=	1368.9 [psi]
Net Pressure in Frac	=	346.0 [psi]
Shmin	=	5340.0 [psi]
---Single(Effective) Fracture Dimensions:----		
Frac Length	=	254.1 [ft]
Frac Height	=	169.5 [ft]
Frac Width	=	0.368 [in]
Frac Area	=	43074.6 [ft2]
Frac Volume	=	1320.8 [ft3]
--------Multiple Fracture Dimensions:-------		
No. of fracs in a stage	=	5
MultiFrac Frac Length	=	113.6 [ft]
MultiFrac Frac Height	=	169.5 [ft]
MultiFrac Frac Width	=	0.165 [in]
MultiFrac Frac Area	=	19263.5 [ft2]
MultiFrac Frac Volume	=	1320.8 [ft3]



WaterHammer can serve as a critical component for your multi-stage treatment data analysis workflow!

Simulation Results

The simulation results from WaterHammer consist of graphs, charts, and tables including:

- Simulated and field-observed surface pressures for each stage (water hammer signature).
- Pressure drops caused by near-well and wellbore friction, net fracturing pressures, ISIP
- Fracture dimensions for single "effective" fracture and multiple fractures in a stage
- Sensitivity study results for the optimization of pressure match

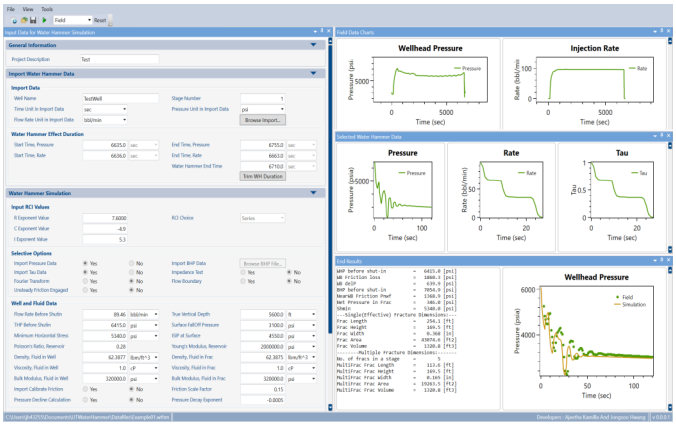
All output data can be saved in an Excel format for your own workflow for fracture treatment data management.

Simple, Intuitive User Experience

A Standardized, Easy-to-use and Flexible Interface

The user interface for WaterHammer is designed to offer the simplest user experience.

1. **INPUTS** – Entering various inputs will be simplified and user can switch between various systems of units.
2. **RESULTS** – A standout feature with the WaterHammer interface is its emphasis on results – both their interpretation and visualization. Our interface offers an integrative comparative analysis.



Consulting Services

Infuse Your Project With Our Customized Solutions

At any stage of your project, we can furnish customized solutions for your hydraulic fracture diagnostic analysis workflow and treatment design problems.

About Us

WaterHammer is a key piece of software in an operators fracture simulation toolbox. Our goal is to lead the advancements in technologies by providing insights using numerical simulations for unconventional and conventional petroleum productions. Dr. Jongsoo Hwang and Dr. Mukul Sharma can support your data analysis using WaterHammer For information/enquiries, please contact us at:
msharma@mail.utexas.edu