CRISMAN INSTITUTE FOR PETROLEUM RESEARCH

PROJECT: 4.08.16

BERG-HUGHES CENTER

i-Unconventional Software for Characterization and Simulation of Unconventional, Naturally Fractured Reservoirs

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OBJECTIVE

1) To generate stochastic complex fracture networks and to evaluate well production performance.

2) To conforms to available data resources regarding the properties of natural and hydraulic fractures.

3) To estimate recovery factor, and make decisions regarding where, how, when to fracture or re-fracture wells, and to perform CO_2 EOR.

APPROACH

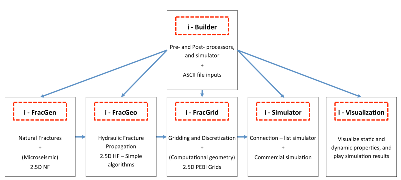

Fig. 1 – Module layout of the ***i-unconventional*** package

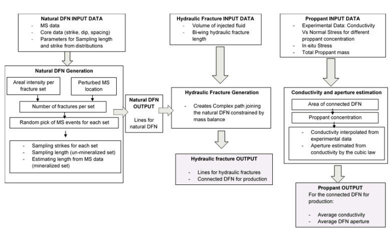

Fig. 2 – Workflow for the ***i-FracGen*** module

APPROACH – cont'd

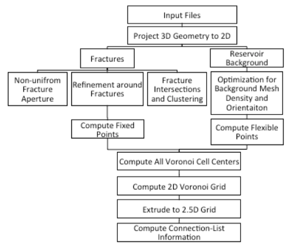

Fig. 3 – Workflow for the ***i-FracGrid*** module

ACHIEVEMENTS

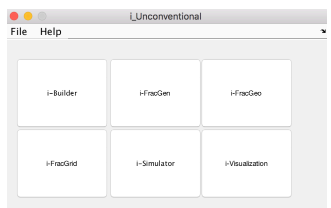

Fig. 4 – Main input menu for the ***i-unconventional*** package

ACHIEVEMENTS – cont'd

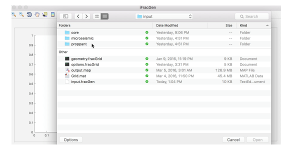

Fig. 5a – Input data in the ***i-FracGen*** module

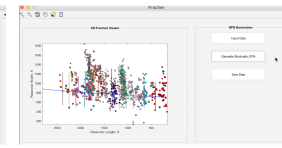

Fig. 5b – Generated DFNs in the ***i-FracGen*** module

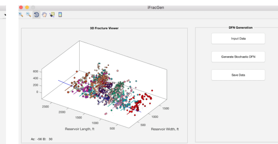

Fig. 5c – 3D view of DFNs in the ***i-FracGen*** module

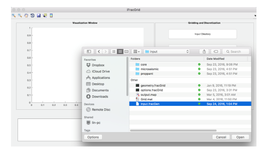

Fig. 6a – Input data in the ***i-FracGrid*** module

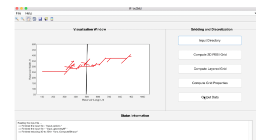

Fig. 6b – a DFN shown in the ***i-FracGrid*** module

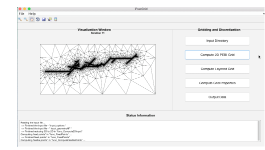

Fig. 6c – Grid optimization process in the ***i-FracGrid*** module

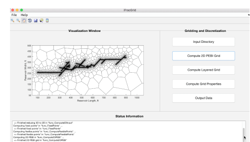

Fig. 6d – 2D PEBI grid in the ***i-FracGrid*** module

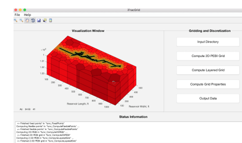

Fig. 6e – 3D Grid in the ***i-FracGrid*** module

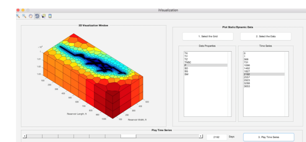

Fig. 7 – Playing 3D pressure changes in the ***i-Visualization*** module

SIGNIFICANCE

1) Unique fracture characterization approaches incooperating fractal theory, core data, microseismic data, and outcrop maps.

2) Efficient proxy model for hydraulic fracture propagation by honoring the volume balance and lab-measured conductivity data.

3) Robust and accurate gridding and discretization algorithms for complex fracture networks with nonuniform fracture apertures.

4) Comprehensive fracture uncertainty analysis to reveal the impact of uncertainties on well production performance.

REFERENCES

1) Sun, J., Schechter, D. S., Huang, C.K. 2016. Grid Sensitivity Analysis and Comparison between Unstructured PEBI and Structured Tartan/LGR Grids for Hydraulically Fractured Horizontal Wells in Eagle Ford Formation with Complicated Natural Fractures. ***SPE Journal***. http://dx.doi.org/10.2118/177480-PA.
2) Sun, J., Schechter, D. S. 2015. Optimization-Based Unstructured Meshing Algorithms for Simulation of Hydraulically and Naturally Fractured Reservoirs with Variable Distribution of Fracture Aperture, Spacing, Length and Strike. ***SPE Reservoir Evaluation & Engineering*** 18 (04):463–480. SPE-170703-PA. http://dx.doi.org/10.2118/170703-PA.
3) Sun, J., Schechter, D. S. 2015. Investigating the Effect of Improved Fracture Conductivity on Production Performance of Hydraulic Fractured Wells through Field Case Studies and Numerical Simulations. ***Journal of Canadian Petroleum Technology*** 54 (06):442–449. http://dx.doi.org/10.2118/169866-PA.
4) Sun, J., Zou, A., Sotelo, E. et al. 2016. Numerical Simulation of CO2 Huff-n-Puff in Complex Fracture Networks of Unconventional Liquid Reservoirs. ***Journal of Natural Gas Science and Engineering*** 31:481–492. http://dx.doi.org/10.1016/j.jngse.2016.03.032.
5) Sun, J., Sotelo, E., Schechter, D. S. 2016. Integrated Workflow to Model Complex Fracture Networks and to Evaluate the Uncertainty of Fracture Characterization on Production Performance Utilizing Microseismic, Outcrop and Horizontal Core Data. ***Journal of Natural Gas Science and Engineering***. http://dx.doi.org/10.1016/j.jngse.2016.08.024.