Cement Stress - Modeling Results

CHALLENGE

Efficiently predict stress level of set cement under various events of temperature and pressure changes.

SOLUTION

Compare simulation results with published SPE results and leading edge finite element analysis (FEA) software.

RESULTS

Closely matching results between CEMLife, SPE paper and ANSYS predictions were found.

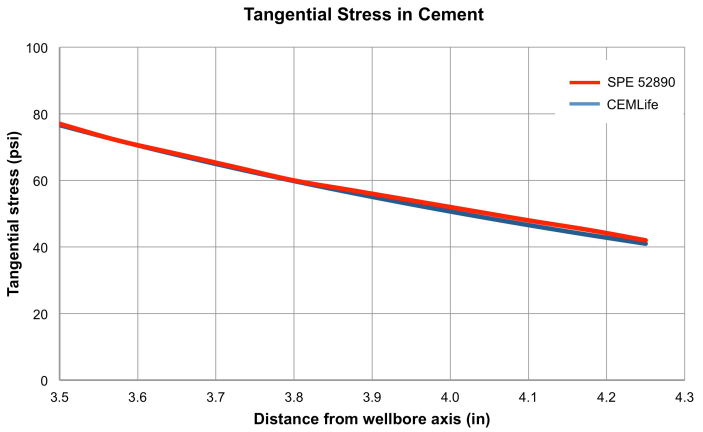
Pegasus Vertex, Inc.'s Cement Stress Model, CEMLife, uses analytical method to analyze 3 types of failure modes (traction, compression, micro-annulus) of cement sheath under various temperature conditions and pressure changes. It balances the accuracy of a full-scale finite element model and the speed of simulation. It performs calculation on the impact of 8 different parameters to quickly achieve the slurry optimization with its sensitivity analysis feature.

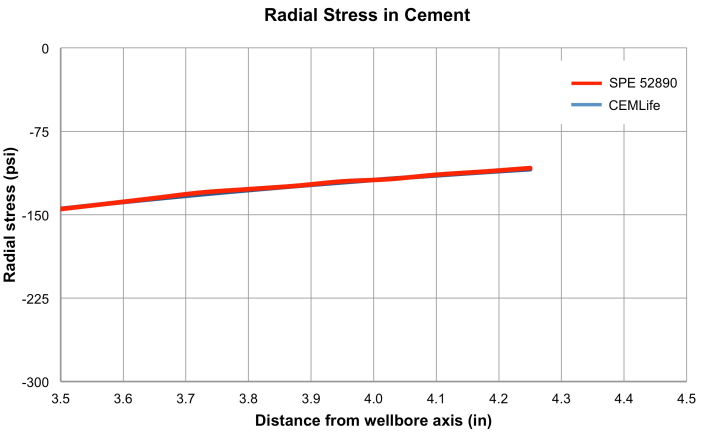
ANSYS FEA software offers comprehensive solid mechanics analysis capabilities and is one of the most accepted and accurate FEA software in the market. Although general purpose software like ANSYS can be applied to many areas, model setup and execution are time consuming. A single analysis may require hours for model creation, pre-processing, calculation and post-processing depending on the model's complexity.

The following case study compares the results of CEMLife, SPE 52890 and ANSYS prediction (Texas A&M University these). The findings show that 3 sources produce similar radial and tangential stresses in the cement.

Case Study: Cement Stress - Modeling Results

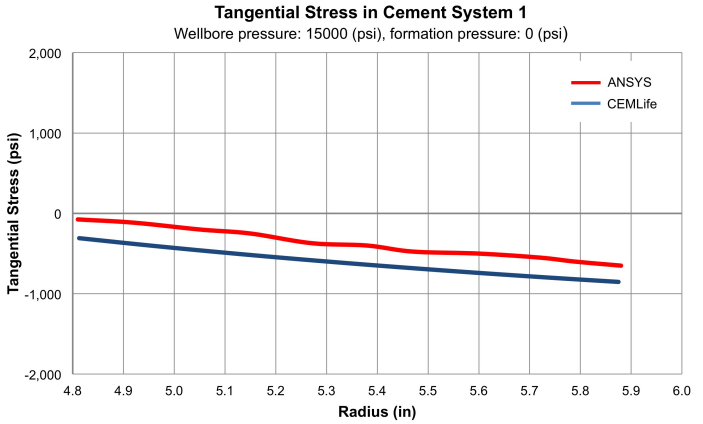
CEMLife and SPE 52890 predict similar tangential and radial stresses in cement.

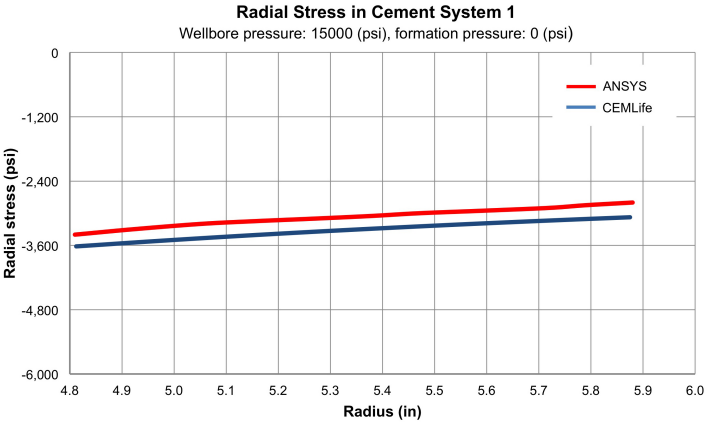




"Cement Design Based on Cement Mechanical Response", M.J. Thiercelin et. al., SPE 52890, SPE Drilling & Completion, December 1998.

The following graphs show that CEMLife and ANSYS FEA predictions of cement stress for high casing pressure and zero formation pressure.





"Cement Fatigue and HPHT Well Integrity with Application to Life of Well Prediction", A MS Thesis by Ignatius Obinna Ugwu, Texas A&M University, December 2008.