Hot Articles

“January|2017”

Science & Technology

Title: Fluid flow and heat transfer modeling in the event of lost circulation and its application in locating loss zones

Author: Yuanhang Chen, Mengjiao Yu, Stefan Miska, Evren Ozbayoglu, Shaohua Zhou, Nasser Al-Khanferi

Journal: Journal of Petroleum Science and Engineering

Volume: 148 **Issue:** - **Page:** 1-9

Doi: 10.1016/j.petrol.2016.08.030

Abstract

Lost circulation is one of the most persistent and costly drilling problems that drilling engineers have been struggling with for decades. The pinpointing of the zones of loss allows the treatments to be applied directly to the points of loss rather than to the entire open hole.

This paper presents an approach to predict the location of single loss zone in a vertical well by interpreting the transient mud circulating temperature profiles altered by mud loss. The fluid flow and heat transfer numerical model in estimating the transient mud circulating temperature profiles during a lost circulation event was developed. The temperature profile in both the flow conduits (drillpipe and annulus) were modeled using mass and energy balances. The flow rate of drilling mud decreases in the annulus above the loss zone as part of the fluids lost into the fractures, which in turn alters the heat transmission status between the drillpipe, annulus, and near-wellbore formation. The wellbore is divided into two sections, which accounts for single loss zone. Case studies were performed and numerical solution results were presented and analyzed. According to the results, alterations induced by mud loss include: 1) Declines in both annular mud temperature and drillpipe mud temperature over time, and 2) Discontinuity in the first order derivative of annular mud temperature with respect to depth at the location of loss. By matching the simulated results with the distributed temperature measurements at different time stamps, the depth of the loss zone can be identified.

Database

ScienceDirect

Title: Estimation of vitrinite reflectance from well log data

Author: Ali Kadkhodaie, Reza Rezaee

Journal: Journal of Petroleum Science and Engineering

Volume: 148 **Issue:** - **Page:** 94–102

Doi: 10.1016/j.petrol.2016.10.015

Abstract

Vitrinite reflectance (VR) data provide important information for thermal maturity assessment and source rock evaluation. The current study introduces a practical method for vitrinite reflectance determination from sonic and resistivity logs. The main determinant factor of the method is ΔRRS which is defined as the separation between cumulative frequency values of resistivity ratio (RR) and sonic log data. The values of ΔRRS range from −1 at ground level to +1 at bottom hole. The crossing point depth of the DT and RR cumulative frequency curves, where ΔRRS=0, indicates the onset of oil generation window. From the surface (ground level) to the crossing point depth ΔRRS takes negative values indicating organic material diagenesis window. Below the crossing point depth ΔRRS turns into positive values showing thermally-mature organic matter within the catagenesis window. Vitrinite reflectance measurements revealed strong exponential relationships with the calculated ΔRRS data. Accordingly, a new calibration chart was proposed for VR estimation based on ΔRRS data. Finally, an equation is derived for vitrinite reflectance estimation from ΔRRS and geothermal gradient. The proposed equation works well in the event of having limited VR calibration data.

Database

ScienceDirect

Title: Structural optimization of downhole oil-water separator

Author: Chuanwei Zhao, Haoyu Sun, Zengliang Li

Journal: Journal of Petroleum Science and Engineering

Volume: 148 **Issue:** - **Page:** 115–126

Doi: 10.1016/j.petrol.2016.09.033

Abstract

Downhole oil-water separator is the most important component of downhole oil-water separation system. Its structure has great effects on oil concentration of underflow (OCU) thus requiring further optimization. This work aims to propose an optimization method for the structural optimization of downhole oil-water separator that consists of two series de-oiling hydrocyclones. Firstly, the significant factors influencing OCU are identified by two-level Plackett-Burman Design (PBD) with twelve factors. Then the central levels of the five significant factors identified from PBD are determined by steepest ascent design. Secondly, response surface methodology (RSM) is used to establish the second order model between the OCU and five significant factors for the implementation of particle swarm optimization (PSO). Finally, the optimal structural parameters are obtained by PSO algorithm. Computational fluid dynamics (CFD) is employed to calculate the OCU for each particular case and analyze the separation performance variations before and after optimization. The simulation results show that compared with the original geometry and the best geometry in CCF design, the OCU of the optimized decreases. And the separation performance of the optimized geometry is remarkably improved for the oil droplets whose particle sizes are smaller than 35.78 μm. Furthermore, laboratory experiments have been conducted to validate the proposed optimization method. The experimental results confirm that the OCU also reduces following the proposed optimization method. It can be summarized that PSO algorithm combined with PBD, steepest ascent design and RSM can be an effective method for the structural optimization of the downhole oil-water separator.

Database

ScienceDirect

Title: Effects of pH on rheological characteristics and stability of petroleum coke water slurry

Author: Fu-Yan Gao, Eric-J. Hu

Journal: Petroleum Science

Volume: 13 **Issue:** 4 **Page:** 782–787

Doi: 10.1007/s12182-016-0118-1

Abstract

In this study, the effects of pH on slurrying properties of petroleum coke water slurry (PCWS) were investigated. The slurrying concentration, rheological characteristics and stability of PCWS were studied with four different types of additives at pH varying from 5 to 11. The results showed that the slurrying concentration, rheological characteristics and stability of PCWS all increased at first and then decreased with increasing pH from 5 to 11, and a pH of around 9 was found to be the most favorable acid–alkali environment to all these three slurrying properties. It was also indicated that only in a moderate alkaline environment can the additives be active enough to react with particle surfaces sufficiently to obtain good slurrying concentration and form a stable three-dimensional network structure, which can support strong pseudoplastic characteristics and good stability. An acid environment was a very unfavorable factor to the slurrying properties of PCWS.

Database

SpringerLink

Title: Interactions between the fluid and an isolation tool in a pipe: laboratory experiments and numerical simulation

Author: Hong Zhao, Yi-Xin Zhao, Zhi-Hui Ye

Journal: Petroleum Science

Volume: 13 **Issue:** 4 **Page:** 746–759

Doi: 10.1007/s12182-016-0123-4

Abstract

A remote-control tether-less isolation tool is a mechanical device that is normally used in pipelines to block the flow at a given position by transforming a blocking module. In this study, the interactions between the fluid and the plug module of the isolation tool were investigated. Simulations of the plug process and particle image velocimetry measurements were performed to study the flow characteristics. Numerical solutions for the continuity, momentum, and energy equations were obtained by using commercial software based on finite-volume techniques. Box–Behnken design was applied, and response surface methodology (RSM)-based CFD simulation analysis was conducted. The dynamic model in the plug process was built by RSM and used to evaluate the influences of the main mechanical parameters on the pressure during the plug process. The diameter of the isolation tool and the diameter of the plug module have strong influences on the process, and the length of the isolation tool has only a little influence on the plug process.

Database

SpringerLink

Title: Performance improvement of ionic surfactant flooding in carbonate rock samples by use of nanoparticles

Author: Mohammad Ali Ahmadi, James Sheng

Journal: Petroleum Science

Volume: 13 **Issue:** 4 **Page:** 725–736

Doi: 10.1007/s12182-016-0109-2

Abstract

Various surfactants have been used in upstream petroleum processes like chemical flooding. Ultimately, the performance of these surfactants depends on their ability to reduce the interfacial tension between oil and water. The surfactant concentration in the aqueous solution decreases owing to the loss of the surfactant on the rock surface in the injection process. The main objective of this paper is to inhibit the surfactant loss by means of adding nanoparticles. Sodium dodecyl sulfate and silica nanoparticles were used as ionic surfactant and nanoparticles in our experiments, respectively. AEROSIL® 816 and AEROSIL® 200 are hydrophobic and hydrophilic nanoparticles. To determine the adsorption loss of the surfactant onto rock samples, a conductivity approach was used. Real carbonate rock samples were used as the solid phase in adsorption experiments. It should be noted that the rock samples were water wet. This paper describes how equilibrium adsorption was investigated by examining adsorption behavior in a system of carbonate sample (solid phase) and surfactant solution (aqueous phase). The initial surfactant and nanoparticle concentrations were 500–5000 and 500–2000 ppm, respectively. The rate of surfactant losses was extremely dependent on the concentration of the surfactant in the system, and the adsorption of the surfactant decreased with an increase in the nanoparticle concentration. Also, the hydrophilic nanoparticles are more effective than the hydrophobic nanoparticles.

Database

SpringerLink

Title: Hydrodynamic response for flexible connectors of mobile offshore base at rough sea states

Author: Linjian WU, Yuanzhan WANG, Zhong XIAO, Yi LI

Journal: Petroleum Exploration and Development

Volume: 43 **Issue:** 6 **Page:** 1089–1096

Doi: 10.1016/S1876-3804(16)30127-6

Abstract

Mobile offshore base (MOB) was treated as a research object, and a simplified algorithm was developed for determining the dynamic constraint forces on flexible connectors of MOB at rough sea states. The algorithm was adopted to calculate and analyze the fluctuation laws between dynamic constraint forces and different parameters. The wave loads on MOB structures were evaluated based on the revised Morison equation instead of potential flow theory, and the conventional computational methods were simplified. The numerical results of the simplified algorithm were compared to those of the algorithm based on potential flow theory for validating the correctness and reasonability of the simplified algorithm. The simplified algorithm was used to estimate the dynamic constraint forces on flexible connectors of MOB under different sea states, wave incident directions, and connector stiffness values. The results show as the wave angle increases, the dynamic constraint force decreases in the x direction, while increases first and then decreases in the y and z directions; the dynamic constraint force increases as the sea state increases, and shows a trend of linear increasing with the connector stiffness increasing; the dynamic forces on different connectors are well even in the same conditions.

Database

ScienceDirect

Title: Numerical simulation of chemical potential dominated fracturing fluid flowback in hydraulically fractured shale gas reservoirs

Author: Fei WANG, Ziqing PAN

Journal: Petroleum Exploration and Development

Volume: 43 **Issue:** 6 **Page:** 1060–1066

Doi: 10.1016/S1876-3804(16)30123-9

Abstract

To find out the impact of chemical potential difference between the low salinity fracturing fluid and the high salinity formation water on fracturing fluid flowback, a chemical potential difference expression of fracturing fluid and formation water was deduced, on this basis, a mathematical model which considers viscous force, capillary force and osmosis pressure driven gas-water flow in matrix-fracture system was built, the flow back performance of fracturing fluid driven by chemical potential difference was simulated, and the formation water saturation and salt concentration profile with flow back time were analyzed. The results show that in the process of flow back, the water molecules in the matrix driven by the chemical potential difference continually migrated to the deeper reservoirs, while salt ions in the matrix constantly spread to the fractures. After 168 h of fracturing-fluid flow back, the migration distance of water was up to 40 cm, and the salt concentration near the fracture surface increased by 0.841%, and the cumulative flowback ratio of the gas well was only 22.1%. The cumulative flowback ratio would be 23.5%, 32.4% and 41.1% respectively, without taking into account the effect of gas absorption, chemical osmosis or capillary imbibition. The capillary imbibition and chemical osmosis seriously hindered the fracturing-fluid flow back, therefore, the two factors should be fully considered in the post-fracturing evaluation of shale gas wells.

Database

ScienceDirect

Title: Mathematical modeling of unsteady-state gasification of petroleum residue

Author: Wei Gao, Mohammad Reza Farahani, Mehdi Rezaei, Rajesh Kanna & Alireza Rezaee-Manesh

Journal: Petroleum Science and Technology

Volume: 34 **Issue:** 24 **Page:** 1946-1951

Doi: 10.1080/10916466.2016.1235048

Abstract

Gasification is a thermochemical process which converts organic fuels into a high caloric value syngas and other chemicals in the presence of a gasification agent. Tar generation represents the strongest barrier for the use of fixed-bed reactors for liquid fuel gasification, whereas sufficing is only possible with catalytic activities and expensive physical processing. In this work, a kinetic model of waste oil gasification was proposed which can be used a flexible model to provide a quantitative prediction of product yield of other fuels. Results were validated against the experimental measurements and showed a good agreement. In accordance with the modeling results, it was found that the greenhouse gas emission (GGE) of waste oil is higher than that of biomass materials, but the caloric value of the syngas generated is higher. The residence time was also recognized as an important design parameter to improve the syngas volume fraction.

Database

Taylor & Francis Journals

Title: Detailed modeling study of low-velocity combustion of crude oil at different moisture content

Author: Yong Cao, Mohammad Javad Esfahani, Hasan Akbari & Amin Foroughi

Journal: Petroleum Science and Technology

Volume: 34 **Issue:** 24 **Page:** 1978-1983

Doi: 10.1080/10916466.2016.1238935

Abstract

The authors developed a kinetic model of crude oil combustion in different moisture contents and operating conditions by considering the reaction rates and fuel properties. To model the diffusion of gaseous products under high-temperature conditions, the authors used a binary diffusion equation that depends on the physical properties of fuel used and the reaction temperature. Results showed that the combustion of crude oil at higher moisture is not more favorable because of a considerable increase in greenhouse gas emissions, although an optimum condition for output temperature is obvious. It also found that the char conversion is higher for the high residence times. Model validated against the experimental data available in the literature, which showed fully good agreement.

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