Executive Summary

For those of you interested, some journal performance statistics are shared below, covering the period from July 2016 to June 2017 (period 2015/16 in brackets).

- 171 (137) manuscripts submitted for review. 56 (43)% were direct-to-peer and 44 (57)% from SPE conferences.
- 21 (23)% acceptance rate.
- 155 (170) Technical Editors participated.
- 257 (358) reviews performed.
- 59 (91) days average time to initial decision.
- 188 (107) final decisions.
- 1,605 (2,418) subscribers.
- >38,000 articles downloaded from OnePetro (January to September 2017).
- Impact Factor: 0.56 (0.31).

As before, a short overview about the industry experts comprising the Committee will follow in the next (March) issue of *SPEDC*, when we will also honor the crucial input of all our Technical Editors.

Regular readers will notice that the article layout is gradually changing, with the traditional two columns being replaced by a single-column continuous text to better support the format of our digital journals.

Because I like to hear/read from you, please kindly note a change of my e-mail address at the very end of this summary.

And now on to our articles, hoped to provide some useful ideas for your areas of responsibility.

Completion. If you plan the installation of a (horizontal) completion with orifice-type inflow-control devices (ICDs), our first article is for you, because it investigates what could be done to improve the nozzles' erosion resistance to support desired performance over the lifetime of the well.

In **Characterization and Erosion Modeling of a Nozzle-Based Inflow-Control Device**, the authors start with a description of their computational-fluid-dynamics model to reflect incompressible fluid flow, particle motion, erosion and nozzle geometry (discharge coefficient, Reynolds number). The simulated erosion patterns are presented, and their dependence on sand particle size, pressure drop, material (carbon steel, tungsten carbide), fillet radius, and the used turbulence model is discussed.

It is concluded that for the investigated situations, the use of tungsten carbide material and a fillet radius of > 0.5 mm (0.02 in.) on the nozzle edge should improve the erosion resistance for predictable ICD performance over 20 years. In my view, another good example where computation can assist in solving equipment design challenges.

Drilling. In case traditional (rotary or sidewall) coring is not an option, but cuttings are too small for a meaningful characterization of the drilled formations, an alternative is presented in the next paper. And although the idea of cutting "minicores" is not new, the results shared can help to decide for which type of rock this approach could be useful.

In the article **Research and Application of a New Polycrystalline-Diamond-Compact Bit With Suction-Type Minicore Drills**, an overview of available (PDC) bit types for minicoring is provided together with a description of the new design with an internal discharge channel for the minicores cut. Optimization of the jet nozzle diameter to support discharge by sucking action from a slip stream of the drilling mud, and laboratory experiments on a horizontal lathe and an actual field test in a vertical well onshore China are presented.

The field results suggest that minicores of cylindrical shape can be obtained from hard (Mohs' hardness > 3.5), competent formations, but could be more of a challenge in soft (clay content) or brittle rock. Having been involved in a minicore trial myself, I appreciate the sharing, which can support the selection of suitable targets for this technology, as well as respective discussions with the geologists.

When drilling high-pressure/high-temperature (HP/HT) wells with oil-based mud (OBM), kick detection can be a challenge because fluid properties used are often only extrapolated from moderate pressures and temperatures. The experimental results in our next article reduce this "knowledge gap" by providing some actual data about how OBM properties change after an influx of gas.

An **Experimental Study of Gas Influx in Oil-Based Drilling Fluids for Improved Modeling of High-Pressure, High-Temperature Wells** begins with an overview of previous research in the area before moving on to describe the experimental setup and base oils (refined mineral oil, linear paraffin) used. The results (gas absorption capacity, rheological properties) are shared with a focus on density measurement and prediction.

The authors conclude that the conducted experiments are suitable for the HP/HT region and that gas absorption capacity and shear response seem to be governed by base oil composition. Predicting OBM density by use of pressure/volume/temperature models based on equations of state (i.e., Peng-Robinson, Soave-Redlich-Kwong) "shows promising potential." Perhaps an approach worth considering for improved well control?

The next paper is highly recommended for all colleagues concerned with directional drilling and wellbore collision risk because it presents new ways of quantifying respective probabilities analytically. A topic certainly relevant, not only for offshore platforms, but also pad drilling and (re-)development of mature fields onshore.

Quantification of Wellbore-Collision Probability by Novel Analytic Methods explains the reasons to develop new analytic ways for "direct hit" (DH) and "unintentional crossing" (UC) scenarios and discusses the existing solutions. Subsequently, the author presents his approach (with mathematical details in the appendices), the underlying assumptions, examples for how to calculate DH and UC probabilities for different trajectories, and then discusses advantages and limitations.

It is shown that it is insufficient to consider only one point in each well (points with a higher probability could be ignored), that DH and UC events and probabilities are in general incompatible, that the approach makes no assumptions about wellbore shapes or their directions, that test case results agree well with Monte Carlo probability simulations, and that the algorithms are suitable for integration into existing anticollision software.

Next, we cover another important aspect of well construction—hole cleaning—that can be a challenge, especially in extended-reach drilling (ERD) wells. Cuttings transport simulators help to support planning and execution, and here the focus is on the effects a tortuous well path could have on cuttings removal.

Simulation Study on Influences of Wellbore Tortuosity on Hole Cleaning in Extended-Reach Drilling briefly describes the transient cuttings transport model published earlier, the (synthetic) horizontal ERD well trajectory (8 ½ in. openhole), and the simulation conditions. The influence of rate of penetration (ROP) (cuttings generation), cuttings size, bottoms-up circulation period before connections, and the effect of well tortuosity are simulated and discussed.

For the ERD well model, the authors recommend a minimum pump rate of 1900 lpm (12 BPM), limiting ROP to 15.2 m/h (50 ft/hr), a minimum of one bottoms-up volume after each stand drilled (or larger if the desired pump rate cannot be achieved), and to drill the horizontal section as smooth as possible to minimize cuttings accumulations in the troughs of a tortuous wellbore. In my opinion, a welcome reminder to "get the (hydraulic) basics right."

Obtaining a good seal from cementing is the objective of most jobs pumped, also in water-injection wells. To improve understanding of the potential cement sheath failure mechanisms (inner and outer microannuli, tensile, shear, disking), our next paper presents one operating company's development of a cement-integrity simulator (CIS) and its validation by a large-scale test under water-injection conditions.

Large-Scale Testing and Modeling for Cement Zonal Isolation in Water-Injection Wells shares the motivation for the CIS development, how it incorporates the initial stress state after cement hydration, the model's validation with published experimental and field data, and output visualization. It then presents the large-scale (7 ¾ in. casing) test details (cement curing, pressure testing, temperature, and pressure cycling), test results, and how these correlate with the CIS predictions.

It is concluded that the CIS was able to predict all failure modes observed during the large-scale test and can be used to design new (injection) wells with high-pressure and -temperature fluctuations expected over their life, as well as for the assessment of cement sheath conditions in wells already in operation. Probably the CIS itself is proprietary, but I very much appreciate that the authors share the thoughts behind its development and validation.

Are you planning or executing underbalanced drilling (UBD) operations and interested in nonproductive time (NPT) reduction, safety improvements, and operating closer to the constraints of the process? Then please read on, because our next article presents how UBD control functions could be automated using a new multivariable controller.

In **Linear Multivariable Control of Underbalanced-Drilling Operations**, the authors start with a description of the UBD process (pressures, flow of phases), explain why a model predictive control (MPC) approach was selected, and explain how the controller is designed (controlled and manipulated variables, priorities). Then, MPC performance is investigated for an example well (including separator on surface) using commercial software (OLGA ™ and Matlab ™) to understand if the specified objectives (both downhole and at surface) are actually met.

It is shown that the control performance (bottomhole pressure, pressures at previous casing shoe, choke, in stand pipe and separator, separator levels, hole cleaning ability, mud pump rate, and choke opening) for the evaluated example is well within the specified limits with only low pressure fluctuations during connections and that maximum run time for one optimization step is < 1 second. Perhaps something to consider for your UBD wells to minimize the potential impact of "human error"?

That's it for our last issue in 2017. On behalf of the entire Editorial Review Committee, I thank you for your continued support of *SPE Drilling & Completion*.

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2017 Outstanding Technical Editor Awards

Every year, SPE recognizes members who have made an exceptional effort to ensure the technical excellence of the Society's peer-reviewed journals. For their contributions, the following individuals are recipients of the 2017 Outstanding Technical Editor Award for *SPE Drilling & Completion:*

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Oscar Contreras, Chevron

John M. Cook, Schlumberger

David A. Curry, Baker Hughes

Matthew Goodine, BP

Oliver Han, Titan/Hunting

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