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The New Science Behind Foamed Cement

Barbara G. Kutchko

Abstract:

Foamed cement is used across a variety of applications for oil and gas well cementing including; deep-water riserless cementing, low fracture gradient cementing, horizontal well cementing, steam injection well cementing, and High Pressure High Temperature (HPHT) cementing. When using foamed cement, laboratory testing is utilized to assess the performance of foamed cement slurries that are designed for applications in wells. It is common knowledge that there are significant differences in the methods used to generate foamed cement in the laboratory and those used to generate foamed cement for field applications. The implications of these differences on foamed slurry characteristics (e.g. bubble size distribution) and performance properties (e.g. stability, permeability, mechanical properties) has not been well analyzed or well understood until this study.

This presentation provides an account of a multiphase research endeavor that was undertaken through a joint effort between the National Energy Technology Laboratory (NETL) and the API Sub-Committee 10 to examine the differences between foamed slurries generated with laboratory equipment and field foamed cementing equipment. Results of laboratory testing indicate a direct correlation between foam quality, bubble size distribution and physical behavior. Results of X-ray Computed Tomography scans of field-generated foamed cement show that collection processes have a dramatic influence on the structure and properties of the cured foamed cement, ultimately highlighting key differences between laboratory and field-generated foamed cements. This research is providing operators and service companies the ability to predict the behavior of foamed cements under *in situ* conditions when compared to laboratory generated foamed cements.

Biography:

Dr. Kutchko is a research scientist with the National Energy Technology Laboratory specializing in wellbore isolation, cement, and subsurface materials characterization. She has a PhD from Carnegie Mellon University's Civil and Environmental Engineering and a MS in Geology from the University of Pittsburgh. She works with oil and gas companies, government agencies, and universities to evaluate practices and research needs to ensure the safe placement of cement. She served as an objective expert in the federal litigation over the Macondo incident. She is the recipient of a 2016 Pittsburgh Women in Energy award, a 2015 Pittsburgh Energy Award in Upstream, and a 2014 Federal Executive Board Excellence in Government Award.

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A Soft Transformation Approach to Career Success

Behrooz Fattahi
The EnerTrain Institute

Abstract:

A discussion of the growth and augmentation of work experience (time effect), the career socio-economic, cultural and regional impact (place effect), relates achieving career success to that of progression in human capabilities (people effect) is presented. Success can be measured in many different ways, and by a variety of criteria such as educational achievement, wealth, private lifestyle, family and marriage, career achievement, etc. But whether there is an absolute, and universal definition or benchmark for success, soft competencies have emerged as universally accepted essential ingredients for achieving success in many aspects of our private and professional lives. The presentation will include clear evidence on how national and international professional societies, government organizations, and universities worldwide are rushing to include soft competencies in their programs to produce a new generation of work force that can achieve rapid career success in the new competitive and demanding workplace environment.

Biography:

Dr. Behrooz Fattahi holds Ph.D. degrees in Aerospace Engineering and in Mechanical Engineering from Iowa State University. After 37 years of working in the industry, he retired from Aera Energy LLC, an affiliate of Royal Dutch Shell and ExxonMobil. In his last position as the Learning Advisor, he taught internal company courses. He served as the first Chair of the SPE Soft Skills Committee, and on the board of the SPE International as the Director of the Western North America, and VP-Finance. He served as the 2010 President of SPE International, and the 2014 President of the American Institute of Mining, Metallurgical and Petroleum Engineers, AIME. He served as the VP of the SPE Foundation, and is currently the President of the EnerTrain Institute, providing petroleum technical training and consulting internationally. He is the recipient of AIME/SPE's DeGolyer Distinguished Service Medal, AIME's Presidential Citation, and recognized by SPE as a Distinguished Member.

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Controlling Scale Deposition: Advances in Using Technology to Preserve Production in the Oil Field

Charles Hinrichsen
Chevron ETC

Abstract:

The formation of scale deposits upon tubing, casing, perforations, and even on the formation face itself, can severely constrict fluid flow and reduce the production rate of oil and gas wells. In addition to lost production, a considerable portion of the workover budget is expended in efforts to remove these deposits and prevent their recurrence. As a consequence, scale prevention has been and continues to be a common exercise and is successfully applied in many areas.

Although the principles behind scale formation and prevention are generally well understood, there are many new forms of scale prevention and new scale inhibitor application technologies. Some people consider scale prevention a mature subject matter area with "nothing new under the sun," but in fact there are many new developments, some of which will be highlighted in this presentation.

This presentation will review the major elements that normally comprise any effort aimed at the successful control of scale deposition, starting with scale identification, followed by scale prediction, inhibition, and removal. Several case histories will illustrate the application of these scale control techniques in oil production facilities. Scale formation can be a show stopper, but if properly managed, scale can be prevented economically.

Biography:

Dr. Hinrichsen earned a B.S. degree in Chemistry from the State University of New York at Stony Brook and an M.S. and Ph.D. in Chemistry from Cornell University. He worked at Texaco and later Chevron for forty years at Chevron's Energy Technology Company as a Chemical Treating Specialist. From 1998 to 2001 he coordinated Texaco’s chemical operations in Angola, West Africa, and from 2001 to 2003 he served as Senior Corrosion and Chemical Treating Engineer in Wafra, Kuwait. He has over 38 years of experience in scale and corrosion control treatment and is a member of the Society of Petroleum Engineers, the American Chemical Society, and the National Association of Corrosion Engineers.

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Stop, Drop And Circulate, An Engineered Approach To Coiled Tubing Intervention in Horizontal Wells

Charles Pope
Devon Energy

Abstract:

In North America, the average cost of a coiled tubing intervention is $250,000. Experience shows that 30% of the wells will have cost overruns of more than $500,000. Additionally, 1 well in 16 has a stuck pipe event and consequently, the costs escalates to an average of $1.7 million per well.

This talk will share how and where coiled tubing is used around the world. Historical practices are reviewed and the issues associated with them.

Also, the need for engineering involvement to improve the coiled tubing intervention will be . This includes a road map for expected drag, detailed time modeling, fluid system planning and data capture. Planned short trips have been eliminated. Low viscosity fluids are used to provide superior hole cleaning. When overpull is observed, operators should stop pulling out of the hole, drop down, and circulate until the debris is removed.

This engineered solution has been performed on over 75 coiled tubing interventons. These procedural improvements reduced time on location by 50%, reduced cost by 50% and prevented any stuck pipe.

One take away: old, historical practices are not your friend in preventing stuck pipe. The solution: stop, drop and circulate.

Biography:

Charles Pope is the Completions Technology Supervisor at Devon Energy, where he leads a team focused on optimizing coiled tubing interventions. Charles has spent more than 35 years working on completions. He completed the first horizontal well in the Austin Chalk in the late 1980's. Charles serves on the SPE ATCE Well Completions Committee and SPE Workshop: Application of Integrated Diagnostics for Unconventional Resource Development Committee. He has authored multiple technical papers. Prior to joining Devon, he held various positions with Sun, XTO Energy and Pinnacle Technology. Charles has a Bachelor of Science in Petroleum Engineering from the University of Oklahoma.

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Resilient Projects are the Best Solution to an Uncertain World

Chris Hopper
Moving Future

Abstract:

Recent industry perfomance on major projects has been poor, with the majority of projects failing to meet their cost or schedule objectives. An alternate approach is proposed, where projects are designed to be resilient and so able to accommodate the inevitable changes that always occur when a project is executed.

Uncertainties and risks can often be identified, but are not easily quantified. A resilient project is designed to deal with these risks, even if their outcome is unknown. This is achieved by stress testing a project to establish its key drivers and by putting as much effort into capturing the upside as mitigating risks. The resulting projects can accommodate a range of outcomes and often solve technical problems with commercial solutions.

Examples are given of four North Sea projects that were brought to sanction using an iterative process that combines the Strategic, Technical and Business aspects of a project into a single holistic solution. This Discovery Driven approach has many similarities to the Agile Project Management processes extensively used in other industries.

The one idea that I would like members to take away from this lecture is that the industry needs to improve its success ratio on major projects and that the key to achieving this is to embrace uncertainty rather than fight it. Making these changes will require a change in mind set as much as a change in process, which will not be easy, but is inevitable

Biography:

Chris Hopper has spent the last 30 years creating field development plans around the world and bringing them on stream using highly creative and sometimes unorthodox business strategies. These projects include the Strathspey, Captain, Galley and Kraken fields in the North Sea, the Gorgon LNG project in Australia, Karachaganak in Kazkhastan, Agbami in Nigeria and Angola LNG.

These projects were often difficult to commercialize and so required a different approach. To achieve this, he combined his experience in the design and project management of major projects with an understanding of the inherent commercial and strategic complexities to produce development plans that were subsequently brought to sanction.

He has a BSc and PhD in Civil Engineering and while working for Britoil, was seconded to Conoco to be a member of the team that developed the world first TLP for the Hutton Field. He subsequently worked for Texaco both in the UK and internationally.

Chris Hopper is currently Managing Director of Moving Future Ltd, an independent consultancy providing field development services to the upstream industry.

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Managing Non-Technical Risks Made Practical and Value-driven

Christiaan W.F. Luca

Abstract:

Non-technical or external stakeholder risks have become a dominant factor in the upstream business. Especially capital projects may experience significant schedule delays or cost overruns due a variety of issues of governmental, social, environmental, security or other external nature. Delegating your response to External Affairs or hiding behind a Corporate Social Responsibility program is no longer good enough.

Adequate addressing of non-technical risks, both mitigating downsides and benefiting from upsides, can be done, but needs an advanced level of internal organisation and a culture that accepts external stakeholder perspectives. Technical functions need to take an active role and responsibility in addressing non-technical risks and need to work closely together with commercial and externally facing functions.

Christiaan Luca will give you practical tips on how to organise internally for effective addressing of non-technical risks and how to minimise undesired surprises from external stakeholders. The important role of management and the technical functions will be a key element of this lecture.

A solid external response requires a solid internal organisation.

Biography:

Christiaan Luca graduated with a BSc in mining engineering and a MSc in petroleum engineering, both from Delft University, the Netherlands. The first 14 years of his 32-year career with Shell he spent overseas in a variety of petroleum engineering roles, including drilling, reservoir engineering, project planning and economics developing oil and gas fields in Thailand, Syria, Gabon and Nigeria.

Upon returning to Shells corporate offices in the Netherlands he held various management roles in technology and business strategy and planning. In these positions he was closely involved with externally challenged programs in CCS and Rigs-to-Reefs. Until end 2016, Christiaan was the head of Shells global practice in non-technical risk management. He now is an independent trainer, assessor and coach in this expertise area.

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Reservoir and Fluid Characterization with Formation Testers: Reducing Asset Uncertainties

Cosan Ayan

Abstract:

Formation Testers (FT) have been around for more than 50 years. Early 1990's, have seen the emergence of pumpout wireline formation testers (WFT) which modernized their applications, including better fluid sampling, permeability and anisotropy measurements and basic downhole fluid analysis. Now, the technology is advancing further in both hardware and software as we are entering a new era in formation testing. While the industry is pushed to reduce costs, compromises on reservoir and fluid characterization can have detrimental effects in new projects and emerging FT applications are well poised to provide critical answers to reduce asset uncertainties.

In this lecture, we will briefly focus on existing and emerging hardware/software on formation testing but our focus will be on applications of acquired and interpreted data for reservoir and fluid characterization. We will discuss pressure gradient analysis and implications of gradient errors for reservoir engineers. We will review the effects of OBM contamination on fluid uncertainties and the choice of inlet types on cleanup behavior. Emerging downhole fluid analysis sensors will be discussed and a new deep transient testing method will be introduced. In-situ stress testing with WFT will be outlined with drilling and reservoir engineering applications. We will discuss these points with field examples. Finally, desired features of next generation WFT will be outlined.

Biography:

Dr. Cosan Ayan was a Reservoir Engineering Advisor for Schlumberger Wireline Headquarters based in Paris, France, who has opted for early retirement in June 2017. Cosan had several international assignments covering Houston-USA, Indonesia-Jakarta, United Kingdom-Aberdeen, UAE-Abu Dhabi, and Egypt-Cairo. He holds BS degree from Middle East Technical University, Ankara, MS and Ph.D. degrees from Texas A&M University, College Station all in Petroleum Engineering. He is the author of more than eighty-five technical papers on Well Testing and Reservoir Engineering and was a SPE Distinguished Lecturer during 2005-2006. Cosan served as an Executive Editor for SPE REE Journal from 2007-2010 and edited SPE e-book volumes on "Getting Up-To-Speed: Formation Testing". Cosan received the SPE Formation Evaluation Award, September 2015.

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Using Downhole Fiber Optic Temperature Sensing Technology to Monitor, Control and Improve Well Performance

Ding Zhu
Texas A&M University

Abstract:

Downhole sensing technology today provide engineers continuous measurements for flow condition diagnosis. The measurements include temperature, pressure, acoustic, and strain, with distributed temperature sensors (DTS) and distributed acoustic sensors (DAS) being more commonly used compared with other measurements. Since the optical fiber technology introduced to the industry, it has advanced dramatically. Many field applications have been proven effective and beneficial. From downhole flow condition characterization, we can diagnose flow problems, monitor, control, and optimize producing and injecting well performance, monitor well stimulation, both matrix acidizing and hydraulic fracturing, and optimize treatment designs. There are rich field application examples to show the potential of the technology.

One of the keys of applying downhole sensing technology is to develop models and methodologies to interpret the senor measurements. This is challenging, because from data collection and processing, to model development, to invert the measured parameters to flow profiles, it is extremely mathematical and computationally intensive. In this lecture, we will review current status of downhole sensing technology, explain the available models and approaches for interpretation, and present field application examples including production profiling, horizontal well flow control, matrix acidizing optimization and multi-stage hydraulic fracture diagnosis. The lecture is based on publications by the author and other SPE publications. The lecture illustrates the power of DTS as a tool for production problem diagnosis and well performance optimization.

Biography:

Dr. Ding Zhu is a Professor at Petroleum Engineering Department at Texas A&M University. She Holds a BS degree in mechanical engineering from the University of Science and Technology, Beijing, China, a MS and PhD degree in Petroleum Engineering, both from the University of Texas at Austin. Her research areas are production engineering, well stimulation, intelligent well modeling and complex well-performance optimization. Dr. Zhu is an author of more than 150 technical papers, a co-author of text book, *Petroleum Production Systems* (2nd edition), and a co-author of a SPE book, *Multilateral Wells.* She has been a committee member and chairperson for many conferences and events with Society of Petroleum Engineers, and is currently an associate editor for SPE Production and Operation Journal. She is a Distinguished Member of SPE.

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CO2 in the Subsurface - From EOR to Storage

Gary Teletzke
ExxonMobil Upstream Research

Abstract:

The Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) have issued recent reports suggesting that deployment of carbon dioxide capture and storage (CCS) can significantly reduce the cost of achieving CO2 emission reduction targets. However, several questions remain: Under what circumstances will large-scale deployment take place? Where and when will this occur? How large a role will CCS play in stabilizing atmospheric concentrations of CO2? I will review the current status of CO2-EOR and geologic storage focusing on subsurface lessons learned and their implications for large-scale CCS.

Our industry has a long history with CO2-EOR that provides a strong experience base for CO2 storage. However, CO2-EOR alone will be insufficient to meet emission reduction targets and storage in deep saline aquifers is also being investigated.Experience from operating CCS projects shows that subsurface storage capacity in saline formations can be limited by dynamic injectability factors. Hundreds of years of CO2 storage capacity is potentially available, even after accounting for dynamic limitations, but the areal distribution of potential storage capacity is widely varied. Geologic and reservoir engineering studies will be essential for identifying storage sites having adequate capacity, containment, and injectivity. Petroleum engineers will play a key role in these studies.

Biography:

Gary Teletzke is Senior Technical Advisor for Enhanced Oil Recovery at ExxonMobil Upstream Research Company. He has led research projects related to gas injection EOR, chemical EOR, and compositional reservoir simulation. He has also led several EOR field studies, integrating laboratory work, reservoir simulation, and pilot testing. For the past ten years, he has provided technical leadership to research efforts on CO2 sequestration. He has published more than 40 technical papers and patents. He has organized numerous SPE conferences over the past two decades and currently serves as Executive Editor of SPEREE. He was named an SPE Distinguished Member in 2013. He received a BS in chemical engineering from Northwestern University and PhD in chemical engineering from University of Minnesota.

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Global Climate Change Wars and Fossil Energy; Current and Future Realities

George Stosur
Consultant, Formerly U.S. Dept. of Energy

Abstract:

Global climate change remains top of the agenda for lively discussion on TV documentaries, frightening newspaper headlines, science magazines and foreign policy journals.

The sudden abundance of relatively clean and inexpensive shale oil and gas is profoundly changing global energy markets. Despite the rapid growth of renewable energy, the fact remains that fossil fuels will continue to dominate world energy consumption for decades to come. Therefore, fossil fuel consumption will continue to produce greenhouse gas emissions that are linked to global warming. Public and political pressure, however, is to curtail the use of oil and gas hydrocarbons or find solution for permanent disposal of heat trapping gases. This is no longer an option for the future; it is a political necessity.

Carbon dioxide sequestration and storage presents a huge challenge for research and development. Massive projects will eventually be required, leading to many opportunities, new businesses and specialized services. Most of these activities will fall on the shoulders of petroleum engineers and geologists.

This presentation provides a view on global climate change issues, starting with causes and effects, the positions of believers and skeptics and the often contradictory arguments of scientists and policy makers, with the likely political consequences for the petroleum industry.

Biography:

George Stosur managed oil and gas R&D programs at the U.S. Department of Energy in Washington, D.C. for 22 years. He was responsible for DOE-sponsored research at universities, National Laboratories and joint R&D projects with several countries. Other experience includes Chevron and Shell Oil R&D in EOR, heavy oil, and the first trial of using nuclear explosive to fracture ultra-low permeability formations. He served as an SPE Section Director, SPE Distinguished Lecturer and guest speaker for several cruise lines. Authored 86 papers and contributed to a five-volume encyclopedia on hydrocarbons. He holds two M.S. degrees and a Ph.D. in petroleum engineering.

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Enhanced Production Through Surface Facilities Sand Management

C. Hank Rawlins
eProcess Technologies

Abstract:

All oil & gas wells produce sand – either a little or a lot! Conventional sand control, which includes production limits or completions, has two downsides:

1. neither method achieves maximum production
2. both methods fail at some point - allowing solids to overwhelm the surface facility

Solids handling then becomes an expensive maintenance problem, HSE incident, or downtime production loss. What if the facility handled sand without interruption or equipment downtime? Even better, what if sand co-production improved recovery or restarted shut-in wells? Facilities Sand Management (FSM) skillfully handles solids to sustain production while minimizing the effects on operations.

FSM methodology uses five discrete steps: Separation, Collection, Cleaning, Dewatering, and Transport. All steps must be followed, with a focus on the approach - not a piece of equipment. Separation removes sand and solids from the flow stream, while Collection gathers the solids into a central location and isolate them from the process. Cleaning, if required, removes associated oil and Dewatering removes associated liquids – both to simplify handling and minimize handling volume. Transport brings the solids to disposal location, which may be discharge, landfill, ship-to-shore, or injection. Each step is integral to simplify operations and extend equipment life, and all steps can be incorporated into new or existing facilities. Solids handling should not be viewed as a waste stream treatment problem – it is a critical flow assurance task. FSM provides a degree of skill to solids handling to sustain flow in surface operations and enhance production.

Biography:

Hank Rawlins is the Technical Director of eProcess Technologies with 25 years' experience in the upstream oil & gas industry. He actively conducts research in Facilities Sand Management, Produced Water Treatment, and Compact Separations Systems - and blogs weekly, teaches courses, and has fifty-six publications on these topics. Hank served as the chair of the SPE Separations Technology Technical Section (2013-2015), was an SME Henry Krumb Lecturer (2011-2012), and co-authored the PEH Chapter on Produced Water Treatment. Dr. Rawlins holds a PhD in Metallurgical Engineering from the University of Missouri-Rolla, is a registered Professional Engineer, and serves as adjunct professor at Montana Tech.

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NMR Logging While Drilling – From Concept to Reality

Holger Thern

Abstract:

The lecture covers a timespan of approximately 20 years, from the early concepts for nuclear magnetic resonance (NMR) logging while drilling (LWD) tools to their current application in the petroleum industry. After briefly introducing the NMR measurement and reviewing the historic evolution of the technology, the presentation focuses on case histories that illustrate the benefits but also limitations of today's NMR LWD technology.

NMR logging measurements capture rock and fluid properties. Best known is the lithology-independent total porosity that complements or replaces porosity data from radioactive logging services. A unique NMR feature is the separation of bound and movable fluids. The NMR T_2 distribution is used for estimating rock properties such as permeability, pore sizes, and shale content. Furthermore, NMR can yield an estimate of the saturation and the viscosity of the hydrocarbon within the sensitive volume of the tool.

A variety of NMR-only and integrated approaches (including core and surface logging data) were developed and introduced over the past years. Reservoir characterization applications while or shortly after drilling are available for various fluid types (e.g., gas and heavy oil reservoirs) as well as for various rock types (e.g., complex mineralogy). Promising fields for extended usage of NMR LWD include full petrophysical evaluation without radioactive sources and field development decisions based on real-time NMR data.

The main goal of the presentation is to communicate the manifold contributions of NMR LWD to reservoir characterization and its capability to support drilling and completion decisions in the early drilling process.

Biography:

Holger Thern is a Technical Lead for NMR research at the Celle Technology Center at Baker Hughes, a GE company, in Germany. In this role, Holger aims to connect research activities to the needs of the petroleum industry for the development of NMR logging services and integrated reservoir solutions.

In 1998 Holger joined Western Atlas' research department in Houston, Texas, focusing on data interpretation and technical support for NMR wireline logging applications. In 2000, he became part of the NMR logging while drilling (LWD) development team for Baker Hughes INTEQ in Celle, Germany. During the past 18 years he held different positions in NMR product development and geoscience research teams. In addition, he was active in numerous NMR LWD job support activities, many with direct customer collaboration around the world.

Holger earned a B.Sc. in Physics from the University of Constance and a M.Sc. in Geophysics from the University of Cologne. He has authored and co-authored more than one dozen patents and two dozen technical publications.

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Autonomous Inflow Control Device: Principle, Prediction & Reality

Ismarullizam Mohd Ismail
Tendeka

Abstract:

In the current oil and gas environment, operators have focused on production optimisation, effectively squeezing every last drop of oil out of their wells. Autonomous Inflow Control Device (AICD) technology has been deployed as part of the completion in old and new wells resulting in increased oil production by reducing water and gas production. For many years, inflow control devices (ICD), which restrict flow by creating additional pressure, have been used to mitigate this problem. They are however, passive in nature and after the onset of water or gas breakthrough, the choke effect cannot be adjusted without intervention.

The AICD is an active inflow control device with a self-adjustable design to self-regulate and provide greater choke when unfavorable fluid such as gas and water ingress. This prevents the well from being flooded when unwanted fluids break through, therefore providing the advantage of being able to even out the inflow into well. In addition, it will also choke the unfavorable breakthrough sections of the well and producing from remaining sections leading to greater recovery, lower water and gas production.

This technology has helped improve recovery in horizontal well across the globe by reducing gas-oil ratio or water cut of the well, thus increasing ultimate oil recovery. The key factor to successful application is a systematic approach in prediction modelling and well design workflow to select a well candidate between Passive and Autonomous inflow control device.

Biography:

Dr Ismarullizam Mohd Ismail is the Subsurface Engineering Manager for Tendeka based in Aberdeen, United Kingdom. He received a MSc. and PhD in Mechanical Engineering from University of Leeds, United Kingdom. He has been working in sand control and inflow control technology for over 15 years in multiple roles, mainly in offshore operation, project engineering and product development. His current work involves developing new inflow control technology, subsurface modelling and managing an inflow control product line. He has designed and modelled AICD/ICD nozzle completions for more than 100 wells across the globe and he also holds various patents for inflow control design. Prior to joining Tendeka, Dr Mohd Ismail worked for various major service companies and carried out university research.

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Geochemical Logging: A Valuable Tool for Exploring Complex Reservoirs

Jim Galford
Halliburton

Abstract:

The foundation of modern geochemical logging for concentrations of elements in earth formations emerged in the 1990s. The additional information provided by geochemical logs makes it possible to account for complex and variable mineral mixtures during the formation evaluation process. This added value wasn't fully recognized until the early 2000s when the petroleum industry began increasing its focus on unconventional reservoirs. Today, geochemical logs have become a valuable exploration tool to enable accurate formation volumetric analyses in both conventional and unconventional reservoirs.

The presentation briefly discusses neutron-induced gamma ray spectroscopy measurement theory, which is the cornerstone of modern geochemical logging instruments, and the flow of data from the raw measurement to elemental concentrations. Log examples show how geochemical logs can be used to identify the presence of common minerals in sandstone, carbonate, and organic shale reservoirs. The example logs also show how geochemical and traditional logs can be used in combination to carry out a complex reservoir volumetric analysis. When working in unconventional reservoirs, a well-defined workflow can be used to obtain formation evaluation results that compare favorably with core porosity, grain density, and matrix mineralogy from X-ray diffraction measurements. A new development makes it possible to use geochemical logs to assess the reliability of lithodensity photoelectric (PE) logs in wells drilled with moderate-to-heavy mud weights. In deepwater exploration where heavy muds are used and PE logs may not be available, a substitute PE log can be derived from geochemical logs.

Biography:

Jim Galford is a Chief Scientific Advisor for the nuclear physics group in Halliburton's Sensor Physics team. He holds a BS degree in physics from West Virginia University. His career began in 1975 as a Schlumberger field engineer. He joined Halliburton via their acquisition of NUMAR in 1997. He has written 29 technical papers on magnetic resonance imaging and nuclear logging applications. He holds 15 patents and he has 14 additional patents pending. He received a Distinguished Technical Achievement Award from the Society of Petrophysicists and Well Log Analysts (SPWLA) in 2017. He has been a member of the SPWLA for 35 years and the Society of Petroleum Engineers for 37 years.

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Enhancing production with Electric Submersible Pumps (ESP) – Challenges and Solutions

JJ Xiao
Saudi Aramco

Abstract:

ESP is a mature artificial lift technology having been in existence for at least 80 years. Yet its applications are still engineering intensive, and numerous challenges still remain. Two significant ones topping the list are run life and intervention cost. The run life of ESPs is still far from desirable. This is particularly true for fields with high H2S concentration. Most ESPs today are installed and replaced with workover rigs with jointed pipes. To replace a failed ESP, the waiting time for a workover rig can be long and the workover time and cost can be high, especially for offshore fields. This presentation first provides insights on the leading causes of ESP failures revealed through Dismantle Inspection Failure Analysis (DIFA) of hundreds failed ESPs. It then leads the audience through the research, development, trial tests of new technologies targeting 10-years of ESP run life and 1-day ESP replacement. It shows how subsea technology can be adopted to re-engineer the ESP power delivery system to bring about a whole new level of reliability. To move away from workover rig utilization, a novel rigless cable-deployed ESP system was developed. The presentation also highlights new techniques being developed to address other challenges such as slim well completion. Experience and technologies discussed in this presentation are applicable for operators worldwide. It is evident that when it comes to ESP challenges, operators cannot be passive. It is critical to actively engage and collaborate with service providers to turn challenges into opportunities.

Biography:

Dr. JJ Xiao is a Petroleum Engineering Consultant working in Saudi Aramco's Advanced Research Center. He is the focus area champion for artificial lift, leading a team of multi-discipline researchers to catalyze the industry, innovate, develop, trial test and commercialize cutting edge artificial lift technologies to improve system reliability, operational efficiency, and to expand system capabilities into ever challenging field applications. Prior to joining Saudi Aramco in 2003, JJ spent 10 years with Amoco and later BP-Amoco, working on multiphase flow, flow assurance and deepwater production engineering. He received both his M.S. and Ph.D. degrees in Petroleum Engineering from the University of Tulsa, Tulsa, OK. JJ has authored 40 technical publications including journal and conference papers. He holds 9 patents and has additional 27 patent applications under processing.

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Drilling Automation and Downhole Monitoring with Physics-based Models

John D. Hedengren
Brigham Young University

Abstract:

The drilling industry faces challenging market conditions that motivate the use of automation to reduce costs and decrease well manufacturing variability. The objective of this presentation is to motivate automation initiatives that utilize physics-based models for predictive monitoring and control. This presentation explores current progress, challenges, and opportunities to control critical drilling conditions such as downhole pressure in Managed Pressure Drilling (MPD). The 3 essential elements of automation are explored with a perspective on recent advancements in automation due to downhole measurement availability through wired drillpipe. However, only a small fraction of drilling systems currently utilize wired drillpipe. In automated rig systems, there is additional potential to unlock the predictive capabilities of physics-based models to "see" into the near future to optimize and coordinate control actions.

A convergence of several key technologies creates an opportunity to use sophisticated mathematical models within automation. A significant challenge is the size of the physics-based models that have too many adjustable parameters or are too slow in simulation to extract actionable information. This presentation shows how fit-for-purpose models can be used directly in the automation solutions. These fit-for-purpose models have unlocked new ways to think about automation in drilling. For example, rate optimization and pressure control have traditionally been separate applications in MPD. Simulation studies suggest significant potential improvement when combining the two applications.

Biography:

John Hedengren is an Assistant Professor in the Department of Chemical Engineering at Brigham Young University. He received a PhD degree in Chemical Engineering from the University of Texas at Austin. Previously, he developed the APMonitor Optimization Suite and worked with ExxonMobil on Advanced Process Control. His primary research focuses on accelerating automation technology in drilling. Other research interests include fiber optic monitoring, Intelli-fields, reservoir optimization, and unmanned aerial systems. In addition to drilling automation, he is a leader of the Center for Unmanned Aircraft Systems (C-UAS), applying UAV automation and optimization technology to energy infrastructure.

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Freshwater Neutral: Managing Water Use and Giving Back to the Environment

Karen E. Olson

Abstract:

Managing water use and giving back to the environment including highlighting challenges, lessons, and best practices encountered when companies implement efforts to become better stewards of freshwater resources. Specific case studies related to Southwestern Energy's "Freshwater Neutral" initiative, achieved in 2016 within all operating divisions will be reviewed.

A small multi-discipline team evaluated all elements within the operational water life cycle, identifying cost-competitive ways to optimize the company's freshwater usage. Key components were:

1) commitment from company leadership and support across all operations;
2) setting achievable, operational goals;
3) accounting for all water used;
4) applying new completion designs and technologies;
5) increasing the use of alternative, non-fresh water, and
6) supporting research in groundwater protection and water treatment technologies.

This reduced freshwater requirements by up to 30% in some operating areas and saved the operator over $20 million US dollars. Another component was required in order for companies to completely offset the need for their remaining freshwater use, the importance of investing in conservation projects to improve freshwater resources within basins where operations are occurring.

Achieving a freshwater neutral status requires improvements in everyday work practices and a change in the mindset of water management. The practices implemented will allow for the use of alternative water sources whenever economically and operationally feasible, and the conservation projects have added value to local communities.

Biography:

Karen Olson, Director of Technologies for Southwestern Energy Company (SWN), served as Director of the Strategic Solutions Team which was accountable for leading SWN's Freshwater Neutral initiative. Other positions at SWN include Corporate Completion Engineering Chief. Olson has been a Completion/Reservoir Engineer over 30 years with expertise in the design/modeling and operational execution of hydraulic fracturing. At BP, a Completion Team Leader in GOM Deep Water, and as the Stimulation Team Leader in the North Sea, and worked onshore US, offshore US and in the North Sea for Mobil.

Active with SPE for more than 30 years, she was a Guest Editor for the Deepwater and Hydraulic Fracturing section of the *JPT (Journal of Petroleum Technology),* authored 15 papers, and provided presentations at SPE events. In 2009, she was awarded the SPE Gulf Coast Section Region Production and Operations Award. She was the 2014-16 Chair for the SPE Hydraulic Fracturing Conference, served on the executive committee for the 2015 ATCE and was honored as a Distinguished Member of SPE.

Olson holds a BS degree in Petroleum Engineering from LSU and a MS degree in Petroleum Engineering from Texas A&M. She currently serves on the Industry Board for the Petroleum Engineering Department at Texas A&M.

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The Unfulfilled Expectation of Horizontal Wells with Multistage Fracture Completions in Conventional Reservoirs: A Solution

Krešo Kurt Butula
Schlumberger

Abstract:
This lecture presents approaches for increasing production from horizontal wells with multistage fracture (HWMSF) completions in conventional reservoirs. HWMSF completions are now regularly being drilled and completed in low-to-mid-permeability oil-bearing conventional reservoirs (k<10 md) where the oilfield is under waterflooding. Although the industry has closed the HWMSF technology gap of drilling and completing these wells, the productivity has been below the expected level. The production is characterized by either an early-time relatively high production rate followed by a steep production decline and water breakthrough or low initial production and even lower late-time production. What went wrong and what can be done? The lessons learned in unconventional reservoirs are not pertinent to conventional formations. Hence, the problem was examined from the reservoir standpoint, focusing on achieving adequate pressure support to maximize drainage, revising the waterflood process through drilling patterns, and evaluating the specific completion techniques. Equally, the question warrants answers on current HWMSF restimulation, addressing methodology applied to specific completion design, the horizontal wellbore azimuthal orientation within the stress field, and, finally, the operating condition of the injector and producer wells. The lecture discusses novel designs for refracturing and for future reservoir development, and, at the same time, is a plea to the drilling, completion, and reservoir engineering teams to integrate their competencies to optimize these complex production systems.

Biography:
Krešo Kurt holds the position of Reservoir Management Advisor to the Schlumberger President for Russia and Central Asia. He has a Masters degree in petroleum engineering, University of Zagreb, Croatia, and has been based in Moscow, Russia, for the last 15 years. He has more than 27 years of worldwide onshore and offshore exposure and experience in multiple oilfield service domains.
Currently, he is responsible for the assessments and integration process for complex subsurface projects and for defining the company business model and technological solutions, including new directions in Schlumberger R&E centers in Russia.
Krešo Kurt was a Director of Reservoir Physics of Schlumberger Moscow Research Center, where leading scientists in physics and petrophysics developed new methodologies, simulators, tools, and apparatuses for the oilfield industry, including the development of the digital core approach and the core thermal scanner. Previously the Business Development Manager for unconventional reservoirs and other various technical management and an advisory position, including an external consulting role as a Senior Technical Advisor to VP Production in OAO Lukoil. He continues to be actively involved in Schlumberger's new technology development, with specific emphasis on horizontal well multistage refracturing in low- to mid-permeability conventional reservoirs under waterflood.
Krešo Kurt has published a series of several technical papers for SPE and Russian journals, received the Schlumberger Well Services R&D Input Award, and holds several patents related to hydraulic fracturing stimulation and IOR/EOR.
He is a member of SPE and EAGE and a member of the Society of Core Analysts. He has been on program committees of international and Russian technical conferences. He served as the Program Director for the Moscow SPE Section and was awarded the Regional Service Award in 2014. Since 2014, he has been the SPE Moscow Section Chairperson.
He is a fluent speaker of Russian, English, German, Italian, and Croatian.

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Solving the Mystery of Low Rate of Penetration in Deep Wells

L.W. (Roy) Ledgerwood III
BHGE

Abstract:

Rocks deep in the earth have unique and enigmatic material properties due to the confining pressures in the earth. Confining pressure increases rock strength and changes rock from a brittle to a ductile material. Humans tend to think of rock as brittle, since all of our direct experience with rock is at atmospheric pressure. But as wells were drilled deeper into the earth, it became apparent that the rock drilled in oilfield wells yielded much lower penetration rates than rocks of the same composition near the surface. About seventy years ago, researchers in drilling mechanics began to study this by building high-pressure test facilities in which rock could be confined and drilled. Even with these new test machines, researchers had to hypothesize what was happening to the rock at the bottom of the borehole because they could not observe the drilling process first-hand. Though they understood that rocks under confining pressure become ductile, they continued to form hypotheses based on brittle failure mechanics. This presentation reviews the detective-story history of model development to explain low rate of penetration in deep boreholes. It then describes our current industry understanding of rock failure in a borehole, which includes a significant role played by crushed rock detritus. Current challenges facing the drilling mechanics community are identified. This presentation constitutes a plea for continued research in this area.

Biography:

Roy Ledgerwood earned a BS in Mechanical Engineering from Texas Tech University in 1975 and began working for Hughes Tool Company Research. Bob Cunningham, one of the pioneers in oil-field drilling mechanics, mentored him. In 1987, Ledgerwood earned an MS in Mechanical Engineering from Rice University where he studied drilling mechanics with Dr. John Cheatham, another pioneer in the field. When Hughes Tool Company built its Full-scale High Pressure Drilling Simulator—a test facility in which may stress rock rock up to 15,000 psi and test bits as large as 12 ¼"—Ledgerwood was the first supervisor of the facility. He designed and performed unique tests to show that crushed rock detritus in a borehole has a strength on the same order of magnitude as the original rock at the instant it is created. Ledgerwood has collaborated with other similar laboratories in Salt Lake City, Tulsa, and Pau, France in joint-industry and proprietary tests. In addition to testing, Ledgerwood has modeled the drilling process with both Finite Element Analysis and Discrete Element Analysis. These mathematical models show that most of the energy expended while drilling a deep well is dissipated not in failing the rock, but in extruding crushed rock detritus. He holds 14 patents and is the author of 23 techincal papers.

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Soft Skills for Hard Times:
How To Succeed In the Industry Downturn

Lori Dalrymple
AOC, LLC

Abstract:

The Oil & Gas Industry is in a downturn. In the last two years, over 300,000 jobs have been lost or eliminated through attrition or termination. Profitability is limited. Some of the smaller companies have closed or face bankruptcy. Projects are being delayed or canceled.

These are difficult times for the industry. Even though the price of oil is slowly rising, and the industry seems to be rebounding, the stability is fragile. Recent studies show that 85% of job success comes from having well-developed soft skills, and only 15% of job success comes from technical skills and knowledge.

Soft skills are Interpersonal Relationship Skills. In the Oil & Gas industry today, these skills are more critical than ever. Organizations (and workers) are struggling to find meaningful ways to remain competitive and be productive. Teamwork, leadership and communication are underpinned by soft skills development. Since each is an essential element for organizational and personal success, developing these skills is crucial.

Soft Skills and Technical Skills work together synergistically. Many major organizations such as SPE, AIME, & AAES have developed soft skills committees. Major companies, such as OMV, Halliburton, Schlumberger, Exxon, Nalco Champion, and many others have incorporated soft skills into their employees training.

Take Home Message: Soft Skills Help You Succeed

Biography:

Lori Dalrymple is the CEO of Architecture of Communication, (AOC, LLC). She developed a Global Soft Skills Training Program for the Oil & Gas Industry. Her expertise in Soft Skills training helps Professionals and University Students to achieve higher levels of interpersonal communication, both internal and external. She has been working as a subject matter expert in Soft Skills training since 2005, and is a member of SPE and a standing member of the Soft Skills Committee.

Lori holds a Bachelor's degree in Corporate Communications and Performance, an Associate's degree in Sales & Marketing, and is currently pursuing her Master's degree in Multicultural Psychology, along with University studies in geology, and the sciences to increase her technical understanding. She holds multiple certifications in motivational training as well as Praxis Global and SPE Workshops on Oil & Gas. Lori volunteers as an SPE representative to teach Soft Skills to Petroleum Engineering Departments at Universities around the globe.

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Developing the Next Generation of Completion Engineers

Mark L. Van Domelen

Abstract:

As the development of oil and gas reservoirs continues around the world, the need for innovative solutions to economically produce these reservoirs remains as strong as ever. Building a talent base within an organization is paramount for this task. The successful exploitation of these often- challenging plays will require completion engineers who can implement new technologies and function within a multidisciplinary work environment. This presentation will describe technical training options and available resources for developing high performing completion engineers within an organization. A case study of an advanced engineering training program implemented within a major service company will be presented, along with recommendations for external training and development programs.

Our industry faces several challenges related to advanced engineering training and technology application including generation gaps brought about from industry downturns, global expansion of unconventional reservoir plays, cost constraints, and the complex nature of the reservoirs we work in today. Companies that recognize this changing landscape and focus their efforts on engineering development will be rewarded with a more productive workforce, higher retention of their technical employees, and a more seamless transition through the years ahead.

Biography:

Mark Van Domelen is an industry-recognized expert in hydraulic fracturing and well completion methods. He is currently the Vice President of Technology for Downhole Chemical Solutions, and worked for Halliburton for 31 years in a variety of roles including engineering, technology, operations management, supply chain, and training positions. Nearly half of Mark's career has been spent in international positions in The Netherlands, Angola, Egypt and Denmark. Mark has a degree in Mining Engineering from the University of Wisconsin-Madison and has been a member of SPE since joining the industry in 1984. He has authored or co-authored 17 industry papers and has served on several committees for the Society of Petroleum Engineers.

A few of Mark's major accomplishments include his involvement on several startup hydraulic fracturing projects in frontier areas such as Kuwait, Oman, Thailand, Poland and West Africa, startup of a new technology center in the Netherlands, becoming the first category manager in Halliburton for global sourcing of proppants, and advancing well stimulation operations in Africa as the Regional Manager.

Mark is passionate about training young professionals and spent the past several years developing and implementing an advanced engineering training program called the College of Completions Engineering for Halliburton engineers in the area of unconventional reservoirs. He has also recently published two SPE papers on the topic of multidisciplinary

training, and participates as a mentor for young engineers through the SPE Trailblazer and E-Mentoring programs.

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The "Fracts" of Life
(Common Failure Mechanisms Associated with Fracturing)

Martin Rylance
BP Exploration

Abstract:

Hydraulic fracturing is the single most commonly applied completion and intervention approach across the globe, from high-permeability reservoirs at one end of the scale to unconventional formations at the other. Constantly, changing, adapting and challenging established thinking, it is one of the most widely and successfully applied techniques that is used within the oil and gas industry.

However, while we are all taught the fracturing theory and fundamentals, there is no true replacement for extensive operational exposure and experience, in planning, executing and working with hydraulic fracturing operations in a variety of situations. The purpose of this presentation is to outline, impart and share, those issues that consistently recur and combine, to reduce or completely eliminate the success of hydraulic fracturing operations, particularly in new and start-up basins and regions. This insight is based on more than 30 years of performing Exploration, Appraisal and Development fracturing operations; in diverse, frontier and challenging environments across some 35 Countries and many different basin types and depositions. The themes, advice, best practice and lessons learned will be shared by means of actual case histories.

Attendees will leave with refreshed insight and renewed awareness of some of the most frequent issues that can negatively affect a fracturing operation. The lessons learned are multi-disciplinary in nature and this renewed level of awareness will generate fresh perspective from the attendees, and encourage open discussion with their colleagues from other disciplines, on fracturing understanding, interpretation and impacts. This is particularly important as large scale fracturing developments extend into new unknown formations and challenging new International basins, where skillsets and experience will sometimes be less well established.

Biography:

Martin Rylance is the VP Wells for BP Russia as well as their Global Sr. Advisor for Hydraulic Fracturing and Stimulation. He has worked with BP for 33 Years, since graduating with a BSc in Pure Mathematics. He has numerous publications to his name, is a previous SPE DL, he received the SPE GCS Completions Optimisation Award in 2015, is an SPE Distinguished Member and is also a Fellow of the Institute of Mathematics.

Technically, he has been involved in all aspects of pumping, well interventions and pressure control service. More recently he has specialised in unconventional resources and fracturing in tectonic and HPHT environments. During his career he has been responsible for the implementation of numerous intervention campaigns, pilots and exploration programmes. Having lived in more than 12 Countries and pumped in more than 35, he has created and managed Teams that have delivered 10s of 1,000's of treatments around the globe.

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Conventional & Unconventional Reservoirs; What is In & Out in Today's Pressure and Rate Transient Analysis

Medhat (Med) Kamal

Abstract:

Transient data is rich in information about the dynamic characteristics of the well/reservoir system. It has been used extensively by petroleum engineers since the 1920's. Sustained development in this area is necessitated by three factors: (1) changes in the types of reservoirs we produce (e.g. conventional, unconventional) and their stages of recovery (e.g., primary, secondary), (2) new tools (e.g. formation testers, permanent downhole gauges), and (3) advances in solution techniques (e.g., use of computers, deconvolution). Today, the value and use of transient data are at an all-time high.

Several crucial technology advancements were achieved during the last 10-15 years. The aim of this lecture is to update the audience about the increased capabilities of Pressure and Rate Transient analyses (PTA and RTA respectively) and how to use them to optimize reservoir management.

After a brief review of existing methods in PTA / RTA, new developments will be discussed with special emphasis on integration and the role of the engineer to obtain a sensible and consistent reservoir model. Practical applications will be discussed including: characterizing unconventional reservoirs by combining multiple measurements, determining permeability and fluid saturations under multi-phase flow conditions, integrating the analytical and numerical solutions, combining single and multi-well tests to characterize the reservoir anisotropy, calculating the average reservoir pressure under non-uniform production and boundary conditions, and using continuous measurements of well pressures to integrate PTA and RTA to characterize reservoirs. For each case, best practices and their limitations will be presented.

Biography:

Medhat (Med) Kamal is a Chevron Emeritus Fellow and SPE Honorary member with over 40 years of industry experience in well testing, reservoir description and production and reservoir engineering. He is the editor and lead author of SPE Monograph 23 "*Transient Well Testing*", and has published 35+ technical papers in SPE journals. He holds BSc (Hons.) from Cairo University, and MS and PhD from Stanford University in petroleum engineering. Kamal was an SPE board member and served as the Executive Editor of SPEREE. He received several regional and international awards including the Cedric Ferguson Medal and SPE Formation Evaluation Award.

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4D Seismic History Matching

Paul Mitchell
TAQA Bratani Ltd.

Abstract:

This presentation will show how time-lapse or 4D seismic data can be used as an additional constraint to history match reservoir models in a 4D Seismic History Matching (4D SHM) workflow. 4D seismic provides an independently measured and spatially extensive dataset that complements the field's production data.

It is sensitive to fluid saturation and pressure changes and provides information on the dynamic behavior of the reservoirs. It is also sensitive to the geological properties and informs the geological model too. 4D SHM is the process of developing reservoir models that are consistent with both the observed production data and the 4D seismic data. When 4D seismic data are available the reservoir model can be used to generate synthetic 4D data. Discrepancies between those two datasets are used to update the models and to attain a seismic history matched simulation model. A case study will be presented where 4D SHM was applied to the Harding and Gryphon fields in the North Sea. It was used to develop regional geological and simulation models for a major gas development project. The combination of geological knowledge, reservoir simulation and 4D SHM led to greater confidence in the final models. 4D SHM is an evolving technology, so the presentation will conclude with a discussion on the current status of the technology and some of its research and development directions.

Biography:

Paul Mitchell is the Discipline Lead for Geophysics at TAQA in the UK. He has broad ranging responsibilities and is a technical authority for geophysics within the company. Paul has thirty years of experience in exploration, development and production geophysics from around the world. He spent a number of years working in ExxonMobil's Upstream Research Center in Houston specializing in seismic depth imaging, 3D volume interpretation and 4D seismic. He is currently working within a multi-disciplinary team developing subsurface models for a large gas development project in the North Sea. His current interests are in 4D seismic and its application to 4D Seismic History Matching and he has presented his work at numerous international conferences. He holds a B.Sc. in Physics from the University of Southampton and a M.Sc. in Exploration Geophysics from Imperial College in London. He is the Founding President of the EAGE Local Chapter in Aberdeen and is Chair of the SPE Seismic2018 conference.

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Real-Time Data Acquisition & Analysis for Enhanced Production

Rajan Chokshi
Accutant Solutions LLC

Abstract:

In a lower-for-longer environment, demand for higher efficiencies with reduced staff levels has accelerated moves towards real-time monitoring and related production optimization technologies that fall under the umbrella of digital oilfield. While dynamic production management is a must in frontier areas like subsea, HP/HT and unconventional fields, significant benefits can be realized for conventional and mature fields. As our data sensing and acquisition capabilities continue to expand, a related challenge is managing the data streams and converting them into actionable information. Dashboard-tools have been successfully used in operations to simplify data interpretation; however, there is a need for analysis tools that help enhance production by reducing downtime, improving workflows and identifying hidden inefficiencies. These tools need to incorporate intuitive visualization and right-time analysis capabilities. This presentation covers several field-cases on real-time data acquisition and the approaches used to convert data into information. One key takeaway is that although real-time technologies have matured, much more needs to be done to develop and utilize real-time analysis tools. While expectations for marginal fiscal gains are prudent, intangibles such as reduced downtime, improved workflow and improved QHSE are the biggest prizes.

Biography:

Dr. Rajan Chokshi works as an artificial lift and production 'Optimizer' for Accutant Solutions. He has over 34 years of experience working with a national oil company, research consortia, consulting and software firms, and a service company in various roles from engineer, software developer, project manager, trainer, consultant, and a senior business leader.

Dr. Chokshi has worked on projects globally in the areas of multi-phase flow, artificial lift, production optimization, and real-time production monitoring. He has co-authored over fifteen SPE papers and has four patents pending. Besides delivering several SPE webinars, Dr. Chokshi continues to conduct workshops for practicing professionals globally in SPE and private forums. He has taught at Texas Tech, Missouri S&T, and continues to teach at the U of Houston, and U of Southern California. He has served on the SPE training and global production award committees. He was co-chair of an SPE artificial lift workshop, and is co-chair of SPE forum on production issues in unconventional. He was an SPE Distinguished Lecturer for the 2015-2016 year. Dr. Chokshi holds a Bachelors and Masters in Chemical Engineering from the Gujarat University and IIT-Kanpur, India; and a Ph.D. in Petroleum Engineering from the University of Tulsa, USA.

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Fluid Imbibition - Hydraulic Fracture Flowback Dynamics

R.V. Hawkes

Abstract:

Multi-stage unconventional hydraulic fracturing treatments require pumping large volumes of water based fluids. As the industry continues to develop extremely low permeability reservoirs increasingly larger water based fluid treatments are being pumped. These large treatments also lead to varying flowback issues ranging from high to low load fluid recoveries. In many cases, either by design or controlled by operational restrictions, wells can undergo weeks or months of shut-in following these very large treatments. In most cases, these shut-in wells have demonstrated significant upticks in production resulting in some operators reporting an enhancement to hydrocarbon recovery. The reasons for the low and inefficient water recovery after fracturing are only now being understood. Some researchers believe that low water recovery is due to water retention in secondary fractures or unstable displacement and gravity segregation in fractures. Others believe the retained water in the reservoir can leak-off into the rock matrix due to water imbibition. Yet, in many cases, there are no negligible effects on long term productivity. The dynamics of shut-in time permits the imbibition process to evolve; allowing water to move deeper into the water-wet/clay-rich formation. This results in lower water saturation and a corresponding higher gas/oil relative permeability near the fracture surface. In contrast, if the well is not shut-in, capillary forces are balanced by viscous forces, thereby trapping water at much higher saturations around the fractures and reducing hydrocarbon flow potential.

Biography:

Robert graduated from the Southern Alberta Institute of Technology in Calgary, Alberta, Canada with a diploma in Petroleum Engineering Technology in 1979. Robert has authored and co-authored over 20 papers and was co-Author, Chapter 3 “Gas Well Testing and Evaluation” of the 2007 Modern Fracturing - Enhancing Natural Gas Production, engineering text book. Robert’s role at Trican Well Service in Calgary is Reservoir Engineering Advisor for their Geological and Reservoir Engineering Service group. Robert has been the recipient of numerous awards and was a Distinguished Lecturer with SPE in 2008. In 2011, Hawkes was the recipient of the SPE Canadian “Reservoir Description and Dynamics” award and recently was recognized for his achievement as the recipient of the 2016 Canadian “Completions Optimization and Technology” award. Robert has served on a multitude of SPE workshops and conferences and was the Program Committee Chairman for the 2013 Hydraulic Fracture Flowback Workshop.

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The Exceptional Price Performance of Oil – Explanations and Prospects

Roberto F. Aguilera
Curtin University

Abstract:

Oil price developments over the past 45 years have been truly spectacular. In constant money, prices rose by 759% between 1970-72 and 2012-14. This can be compared with a price index for metals and minerals, which increased by a mere 38%. Analysis shows that the exceptionality of oil's upward price push over the past decades cannot be adequately explained by cost-raising depletion or by OPEC interventions. The better explanation is an inadequate development of production capacity, caused by above-ground hurdles; e.g. onerous fiscal regimes and conflicts over resource rents. Despite past experience, a turning point has been reached where scarcity, uncertain supply and high prices will be replaced by abundance, undisturbed availability and suppressed price levels. Technical advances in drilling and hydraulic fracturing, which led to fast rising oil and natural gas production in the US but is also applicable to unconventional and conventional formations worldwide, will assure ample and diversified future supply. Although short-run price spikes may occur, oil prices are unlikely to prevail above the total production costs of new supplies, which are estimated to settle at $40-60/barrel in the coming two decades. Expanding global gas output and trade will likely depress gas prices as well. It is concluded that oil and gas will continue to play an important role in satisfying energy demand, from Asia to the Americas, with innovation that will allow for economic production in spite of low prices.

Biography:

Roberto F. Aguilera is a Research Fellow with Curtin University, Australia. From 2013-2017, he was an analyst with the OPEC Secretariat, Vienna, and a co-author of their annual World Oil Outlook. Previous affiliations include IIASA, University of Vienna, Catholic University of Chile and Servipetrol. He has participated in numerous energy studies, including with the World Petroleum Council and US National Petroleum Council. He holds PhD and Master degrees from Colorado School of Mines and a Bachelor's from Haskayne School of Business, University of Calgary. His publication record comprises The Price of Oil, a book published by Cambridge University Press (2015).

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Coiled Tubing Telemetry – State of the Technology

Silviu Livescu
Baker Hughes, a GE Company

Abstract:

For more than 50 years, coiled tubing has been an intervention technology primarily used to maintain or increase production, fulfilling the vital requirements for intervening on live wells. However, the downhole parameters during a conventional coiled tubing operation are only inferred through surface-measured parameters, such as coiled tubing weight and length and pumping pressure, leading to uncertainties regarding the operation's actual progress and outcome. In order to increase certainty in unknown downhole conditions, enhance safety and efficiency, and reduce the operational time and cost, coiled tubing telemetry technologies have been developed in the last 10 years and used for a wide range of coiled tubing applications. These systems, consisting of downhole tools with sensors and electronics, data transmission media through the coiled tubing such as optical fiber, wire, or both, and surface hardware and software, provide real-time monitoring of single-point data such as pressure, temperature, depth correlation, tool force and torque, inclination and acceleration, etc., and distributed temperature and acoustic data along the coiled tubing. This lecture will provide a brief introduction of coiled tubing history and current status, before describing the coiled tubing telemetry technologies and their game-changing advantages comparing to conventional coiled tubing. Several case histories will exemplify how the real-time coiled tubing telemetry information improves well intervention operations by making decisions based on dynamic downhole events and eliminating missed or wasted runs. The lecture will conclude discussing how coiled tubing telemetry is transforming the coiled tubing operations and its growing significance within the current industry trends leading to a severe shortage of experienced coiled tubing personnel.

Biography:

Dr. Silviu Livescu is the chief scientist in the global Coiled Tubing Research and Engineering center of Baker Hughes, a GE Company, in Calgary, Canada, with fundamental and applied research, industrial research and development, innovation, commercialization, and intellectual property experience mainly related to Production and Operations. Silviu is an executive editor for the Journal of Petroleum Science and Engineering and an associate editor for the SPE Journal, and serves on the SPE Production and Facilities advisory committee and the SPE Journal of Petroleum Technology editorial committee. Silviu received the SPE Canada Region Production and Operations award in 2017 and the SPE 'A Peer Apart' award in 2015.

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How to Develop a Management System to Avoid Inorganic Scale Problems

Snezana Sevic
PM Lucas Enterprises

Abstract:

Because of inorganic scale buildup, equipment often must be repaired or replaced due to premature failure, production goals are not met due to downtime or reduced well productivity, and costly workovers and treatments must be carried out. Thus, scale can negatively impact the technical and economic success of a project. To avoid scale problems, companies must develop an effective scale-control management system that consistently predicts the potential for scale deposition and reliably addresses its impact on the entire production system. An effective management system starts with a risk assessment to identify potential scale locations, probabilities, and magnitudes over the life of the asset. The next step is to develop a strategy for proactive scale control and establish a well-organized monitoring program to provide full insight into treatment performance. Validation of the applied mitigation methods, or re-assessment if results don't meet expectations, will lead to permanent optimization of the process and big savings in operating costs. Two case studies describing the development of such scale management system will be presented: one using chemical injection with results showing a marked increase in the run life of installed ESPs in oil producing wells, and the other which provided successful $CaSO_4$ scale control in source water wells and reduced PCPs failures.

Biography:

Snezana Sevic is a process chemistry specialist at PM Lucas Enterprises. She holds BSc, MS, and PhD degrees in chemical engineering from Technological Faculty, University of Novi Sad. Sevic has 36 years` experience in the oil and gas industry. Her main responsibilities include diagnosis of problems resulting from fluid properties; conducting risk analyses, and recommending management and monitoring programs to handle flow assurance issues. Before joining PML, she worked at NIS-GaspromNeft, Quimica Apollo, and was involved in more than 50 projects in Serbia, Mexico, Kazakhstan and Russia. She has authored more than 50 papers and supervised several graduate, master and doctoral theses. She has been involved in SPE E-Mentoring program.

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Big Data Analytics: What Can It Do For Petroleum Engineers And Geoscientists?

Srikanta Mishra

Abstract:

Big data analytics has become quite the buzzword in recent years, and its growing application in E&P operations promises to be an exciting new development. It involves: (1) acquiring and managing data in large volumes, of different varieties, and at high velocities, and (2) using statistical techniques to "mine" the data and discover hidden patterns of association and relationships in large, complex, multivariate datasets. The ultimate goal is to extract as much intelligence from our ever-expanding trove of data to improve operational efficiencies and make better decisions for optimizing the performance of petroleum reservoirs. However, the subject remains a mystery to most petroleum engineers and geoscientists because of the statistics-heavy jargon and the use of complex algorithms.

In this talk, I will provide a "gentle" introduction to big data analytics by focusing on: (a) easy-to-understand descriptions of the commonly-used concepts and techniques, (b) broad categories of E&P problems that can be solved with big data analytics, and (c) case studies demonstrating the value-added proposition for big data.

The one key idea I would like to offer as a takeaway is this*: There is significant potential for data analytics to provide insights that can be translated into actionable information in E&P projects, but petroleum engineers and geoscientists need to have a fundamental understanding of data-driven modeling concepts, their applicability and limitations.*

Biography:

Dr. Srikanta Mishra is Institute Fellow and Chief Scientist (Energy) at Battelle Memorial Institute, the world's largest independent contract R&D organization, where he manages a geoscience-oriented technology portfolio related to computational modeling and data analytics for geological carbon storage, shale gas development and improved oil recovery projects. Dr. Mishra is the author of "Applied Statistical Modeling and Data Analytics for the Petroleum Geosciences" recently published by Elsevier, and has also taught multiple short courses on uncertainty quantification, statistical modeling and data analytics. He holds a PhD degree in Petroleum Engineering from Stanford University.

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Well Collision Avoidance, The Way Forward

Steve Sawaryn
Consultant

Abstract:

The consequences of an unplanned intersection with an existing well can range from financial loss to a catastrophic blow-out and loss of life. The process of well collision avoidance involves rules that determine the allowable well separation, the management of the associated directional planning and surveying activities and assurance and verification. The adoption of a particular minimum allowable separation rule, no matter how conservative, does not ensure an acceptably low probability of collision. Many other factors contribute, such as the level of compliance by office and rig personnel with collision avoidance procedures, and the completeness and correctness of the directional database. All these factors are connected.

This is not a new subject, but current guidance is disparate, company specific and occasionally contradictory. As a result, the guidance can be difficult to understand and implement. Standardisation is required. This standardisation has been the goal of the SPE Wellbore Positioning Technical Section (WPTS). The resulting recommendations are a culmination of the work and consensus of industry experts from both operators and service companies.The effects of a standardised separation rule and attendant practices are far reaching. They influence slot separations, trajectories, drilling practices, surveying programme and well shut-in, with commercial as well as HSE implications.

Although collisions are rare, investigation of 19 anonymous collision events suggests they occur more frequently than formal accounts would lead us to believe. Common themes across these events can be identified and these lead to a conclusion that all such collisions are avoidable.

Biography:

Steve Sawaryn is an independent drilling engineering consultant specialising in drilling systems. During the previous 35 years he held a variety of national and international posts in BP's Drilling Engineering Division in drilling operations, consultancy and projects. He is also a chartered engineer and fellow of the British Computer Soc. Sawaryn holds PhD and M.A. degrees from Cambridge U. He has authored more than 35 SPE papers and has served on a number of SPE committees. He received the 2010 SPE North-Sea Region Technical Award for Drilling Engineering and now chairs the SPE Wellbore Positioning Technical Section Collision Avoidance sub-committee.

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EOR from Micro-Scale to Field Implementation - Example of Polymer Injection

Torsten Clemens
OMV Upstream

Abstract:

Various Enhanced Oil Recovery (EOR) methods have been used to increase oil production and reserves. However, implementing such projects is challenging owing to the higher complexity and larger uncertainty of EOR projects compared with conventional water flooding.

To implement EOR technologies, first, the portfolio of the company should be screened for applicability of the various EOR methods. Next, an appropriate field needs to be chosen for pilot testing of the selected technology. Laboratory experiments are required to determine ranges for the injected EOR fluid properties and fluid-rock-interaction. Pilot testing leads to reducing the subsurface uncertainties but also improves the operating capabilities of the company and economic understanding of EOR projects.

At the example of a polymer EOR project, it is shown that within the last years, significant improvements in predicting polymer EOR performance have been achieved. Injectivity can be assessed using coupled geomechanical-fluid flow models and polymer injection incremental oil recovery can be simulated and optimized taking uncertainty into account. Also, pilot interpretation was advanced by applying the latest tracer technology for reservoir characterisation and monitoring.

In addition to the subsurface assessment, a more holistic view on EOR pilot projects including surface challenges is required to ensure conclusive pilot test results to either implement or drop EOR full-field implementation. A long-term commitment is needed for EOR implementation as well as seamless cooperation between staff operating pilot tests and staff involved in pilot test interpretation.

Biography:

Dr. Torsten Clemens is a Senior Reservoir Engineering Adviser with OMV Upstream. He used to work in Shell on EOR projects and fractured reservoirs and joined OMV in 2005. In OMV, he is covering EOR/IOR as well as fractured reservoirs and uncertainty management. Torsten published more than 70 technical papers, is a member of various conference committees (SPE, EAGE, WPC), technical editor of several journals and is chairing the IEA EOR Technology Cooperation Program.