EPIC Workshop 2018

Talk titles and short abstracts

Fast Marching Method: A New Paradigm for Modeling Unconventional Reservoirs

In this talk I will discuss a novel approach for rapid field-scale performance assessment of shale gas and oil reservoirs. The proposed approach is based on a high frequency asymptotic solution of the diffusivity equation in heterogeneous reservoirs and serves as a bridge between simplified analytical tools and complex numerical simulation. The high frequency solution leads to the Eikonal equation which is solved for a 'diffusive time of flight (DTOF)' using the Fast Marching Method. The DTOF generalizes the concept of depth of investigation to heterogeneous and fractured reservoirs and provides an efficient semi-analytic method to calculate drainage volume, pressure depletion and well performance in unconventional reservoirs. More importantly, in a manner analogous to streamline simulation, the 'diffusive time of flight' can also be used as a spatial coordinate to reduce the 3-D diffusivity equation into an equivalent 1-D equation which can be solved numerically accounting for the relevant physics related to shale gas and oil reservoirs. The speed and versatility of our proposed method makes it ideally suited for high resolution reservoir characterization through integration of static and dynamic data. The major advantages of the proposed approach are its simplicity, intuitive appeal and computational efficiency. We demonstrate the power and utility of our method using several field examples.

Computer Simulation of Suspended Particles in Complex Fluids: From Fracking Fluids to Swimming Worms

Rigid or flexible particles suspended in viscoelastic fluids are ubiquitous in the food industry (e.g. pastes), industrial molding applications (all composites and 3-D printed parts), the energy industry (e.g. fracking fluids), and biological fluids (i.e. swimming of bacteria in mucous). The mathematics of the description of these suspensions is in its infancy. For example, the foundational work in Newtonian suspensions was accomplished by Einstein in 1905 as a mathematical prediction of the shear viscosity of a dilute suspension of particles in Newtonian fluid. That same calculation in an elastic fluid was just submitted for publication now over 100 years later! However, while the mathematics of this subject is subtle the real breakthrough in this area has been the development of a computational simulation of such viscoelastic suspensions, with particle level resolution, such that predictions can be made and tested at all volume fraction loadings. This simulation capability is unique and overcomes the major hurdle in understanding the physics of these suspensions – which in many cases are simply qualitatively different than that of Newtonian suspensions. The simplest flows of such suspensions are not understood at a fundamental level, primarily because the collective behavior of particles in an elastic liquid has no foundation – this will change dramatically in the next few years. I will describe three foundational problems that have now been analyzed using these new computational methods – including fracking fluid design and swimming in mucous.

Value & challenges of Integrated Operations in Digital Oilfield (demo of a practical implementation)

Opportunities and threats are presented by the convergence of emerging technologies around IIoTs and blockchain

This presentation takes a look at the steps to create an organizational readiness toolkit for both a technology seeking company or an enterprise adopting matured technology. We look at raising awareness and learning within the employees, vendors and customers of the potential of these technologies. It reviews risk mitigation methodologies and blue sky visioning efforts to identify roadmaps to potential future state business models and value chains within the context of the logistics and trade finance of hydrocarbons and chemicals. It addresses changes happening in operations, HR, business models and the learning individual in the employee-employer relationship.

IoT Architecture for a Smart Oil Field

IoT as business problem and it's related issues of security and logic portability are addressed here by looking at an end to end networking architecture for a Smart Oil Field. Through this talk, we will explore the notion of network of networks. We will start at the oil well itself, where there could be a variety of sensors around the oil well. Each sensor needs to be low power and wireless. The oil well needs its own processing and analytics to run efficiently without manual intervention. When an operator does show up, he/she needs to be able to connect quickly and easily to the system to access information, diagnose problems and make appropriate tweaks to the system. We will then talk about networking the oil wells to form an oil field. Each field will have many many outbound network nodes to connect it to the outside world. Many of these fields will form the basis of O&G company's assets, where the company can centrally optimize supply and demand. Where possible, we will dive into the business issues to simplify the deployment, and reduce CAPEX.

Speaker Profiles

Prof. Akhil Datta-Gupta, Texas A&M University

Akhil Datta-Gupta is Regents Professor, University Distinguished Professor and holder of L. F. Peterson '36 Endowed Chair in Petroleum Engineering at Texas A&M U. in College Station, TX (USA). Prior to Texas A&M U., he worked for BP Exploration/Research and the Lawrence Berkeley National Laboratory. He holds a Ph.D degree in Petroleum Engineering from the University of Texas at Austin. Dr. Datta-Gupta is well known for his contributions to the theory and practice of streamline simulation in petroleum reservoir characterization, management and calibration of high resolution geologic models. Dr. Datta-Gupta is an SPE Honorary Member and received two of the top three technical awards (Carll Award, 2009; Uren Award, 2003) given by the Society of Petroleum Engineers (SPE) for his contributions related to reservoir characterization and 3-D streamline simulation.

Datta-Gupta earned his master's degree and Ph.D. from the University of Texas at Austin and his B.S. from the Indian School of Mines, Dhanbad (India), all in Petroleum Engineering. He has authored over 100 peer reviewed papers and four books. In 2012, Dr. Datta-Gupta was elected to the U.S. National Academy of Engineering, "for developing the theory and practice of streamline simulation for fluid flow in heterogeneous reservoirs."

Prof. Eric Shaqfeh, Stanford University

Eric Shaqfeh is the Lester Levi Carter Professor and Department Chair of Chemical Engineering at Stanford University. He earned a B.S.E. summa cum laude from Princeton University (1981), and a M.S. (1982) and Ph.D. (1986) from Stanford University all in Chemical Engineering. In 1986, he was a NATO postdoctoral fellow at the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge. From 1987 through 1989 he was employed as a Member of Technical Staff at AT&T Bell Laboratories in Murray Hill, NJ before joining the Stanford Chemical Engineering faculty in early 1990. In 2001 he received a dual appointment and became Professor of Mechanical Engineering. He is most recently (as of 2004) a faculty member in the Institute of Computational and Mathematical Engineering at Stanford.

Shaqfeh's current research interests include non-Newtonian fluid mechanics (especially in the area of elastic instabilities, and turbulent drag reduction), nonequilibrium polymer statistical dynamics (focusing on single molecules studies of DNA), and suspension mechanics (particularly of fiber suspensions and particles/vesicles in microfluidics). He has authored or co-authored over 180 publications and has been an Associate Editor of the Physics of Fluids since 2006. Shaqfeh has received the APS Francois N. Frenkiel Award 1989, the NSF Presidential Young Investigator Award 1990, the David and Lucile Packard Fellowship in Science and Engineering 1991, the Camile and Henry Dreyfus Teacher--Scholar Award 1994, the W.M. Keck Foundation Engineering Teaching Excellence Award 1994, the 1998 ASEE Curtis W. McGraw Award, and the 2011 Bingham Medal from the Society of Rheology. A Fellow of the American Physical Society (2001) and a member of the National Academy of Engineering (2013), he has held a number of professional lectureships, most recently the Merck Distinguished Lectureship, Rutgers (2003), the Corrsin Lectureship, Johns Hopkins (2003) and the Katz Lectureship, CCNY (2004). He was also the Hougen Professor of Chemical Engineering at the University of Wisconsin (2004) and the Probstein Lecturer at MIT (2011).

Rana Basu, Consensys

Rana is a commodities trading risk management and systems expert and a blockchain evangelist for the oil, petrochemicals and chemicals trading and logistics space. He helped orchestrate the first oil and gas consortium based out of Geneva to work on reducing the friction in oil logistics. He is now working on engaging the benefits of emerging technologies such as blockchain and IIoTs in the oilfield logistics sector and an organizational readiness toolkit to enable enterprise adoption of these technologies. Rana shares a vision with many here at this event today, to pragmatically combine the capabilities using gateway methodologies and standards achieved through such forums to improve efficiencies in many use cases and will speak to the logistics and trade finance in cargoes / trucking and for oilfield services use cases among others today.

Andrew Lafleur, Technical Toolboxes

Drew has contributed to successes in his roles in the San Juan Basin, 3 sub-basins within the Permian Basin, Anadarko Basin, Barnett Basins, Texas and Louisiana Gulf Coast, as well as Alaska's North Slope, and Western Canada. This diverse geographic experience is compounded with diversity of experience in dry & wet gas, conventional oil, waterflooding, WAG flooding, and unconventionals such as shale and coal bed methane. While developing a track record of innovation in Reservoir Engineering, Production Engineering, Facilities Engineering, and Integrated Operations/Digital Oilfield, Drew gained valuable insight into various approaches to lowering $/BOE and improving operating efficiency. After working for 10 years for ConocoPhillips, he became Director of Upstream Solutions at TeQnovation, a subsidiary of Technical Toolboxes, whereby additional projects were executed in the Middle East to leverage Drew's expertise in integrated approaches to production optimization in Kuwait, UAE, and Oman. Currently, Drew is Chief Technology Officer at Technical Toolboxes, whose primary focus is midstream engineering, operations, and integrity. Drew has 2 B.S. degrees from LSU, including Petroleum Engineering.

Amar Parmar , Wind River

A strategic pioneer with a 15+ year history of taking innovative IoT systems to market, Amar has helped launch seven different IoT systems, two IoT platforms, and consulted on various others. He has a deep understanding of the full end-to-end system stack, from silicon chips to the cloud. Currently, he heads up the IoT Design Center for Wind River. His group provides IoT consulting services, which include product strategy, technology strategy, security assessments, system integration, UI/UX solutions (cloud, mobile, AR, VR) and program management, all of which enable customers to create a big impact in the world of IoT. Amar's previous roles include leading Samsung's Enterprise IoT initiative; and running the Adura and LC&D divisions for Acuity Brands, Inc. While not working, he enjoys running, food tasting & wine tasting. He is also in a constant search for the perfect pizza