SRIKANTA MISHRA, Ph.D. | Battelle

Education and Training

Ph.D., Petroleum Engineering, Stanford University, 1987
M.S., Petroleum Engineering, The University of Texas, 1983
B.Tech. Petroleum Engineering, Indian School of Mines, 1981

Research and Professional Experience

2020-Present	Technical Director, Geo-energy Modeling and Analytics, Battelle Memorial Institute
2014 – 2020	Institute Fellow (Senior Research Leader) and Chief Scientist, Energy, Battelle
2010 – 2013	Reservoir Engineering Research Leader, Battelle
2009 – 2010	Director, Geologic Waste Isolation Services, Intera
1997 – 2009	Adjunct Professor, Petroleum Engineering The University of Texas at Austin
2006 – 2008	Group Manager, Systems Modeling, Intera
1989 – 2006	Senior Project Manager, Intera
1987 – 1989	Research Scientist, Virginia Tech

Synergistic Activities

- Author of general interest article in March 2021 Journal of Petroleum Technology: "Robust Data-Driven Machine Learning Models for Subsurface Applications: Are We There Yet?"

- Society of Petroleum Engineers (SPE) Global Distinguished Lecturer for 2018-19 on the topic "Big Data Analytics: What Can It Do for Petroleum Engineers and Geoscientists".

- Instructor of industry and academic short courses on (1) data-driven modeling for petroleum geosciences, (2) CO_2 geologic storage and shale gas systems, and (3) uncertainty analysis.

- Program Committee Member, Reservoir Performance / Data Analytics Track, Unconventional Resources Technology Conference (URTeC), SPE/AAPG/SEG, 2016-2021.

- Invited panelist "Data Analytics Update for Unconventionals" at URTeC 2019 in Denver.

- Contributor to National Petroleum Council Report on Carbon Capture & Storage (2018-2019).

Relevant Projects

Big Data Analytics in Fossil Energy – Currently advising DOE-NETL's Computational Science & Engineering Directorate on machine learning and artificial intelligence for fossil energy related applications. Work involves: serving on Technical Advisory Board for the SMART initiative (Science-informed Machine Learning to Accelerate Real-Time Decision Making in Subsurface Applications) involving multiple national labs and universities; and contributing to DOE-NETL high-performance computing and machine learning strategy development.

Data Analytics for Exploration & Production Applications – PI for an industry and Battelle internal R&D co-funded effort applying machine learning techniques in subsurface characterization (constructing synthetic log signatures), optimization of unconventional reservoir performance (using predictive models built with multi-well completion and geologic data) and surrogate modeling of reservoir displacement processes (via experimental design/response surface methods). Developed industry and academic training courses on data analytics.

Reservoir Engineering and Data Analytics, Advanced CO$_2$-EOR in Southern Michigan – Co-PI for DOE-NETL funded project on development of chemically-enhanced CO$_2$-EOR methods for carbonate reservoirs in Southern Michigan. Responsible for the development of practical CO$_2$-EOR performance prediction tools and reservoir engineering analysis with sparse data; data analytics applications for correlating geologic variables with seismic interpretation results; and data-driven predictions of bottom-hole pressure and temperature conditions with wellhead data.

Reservoir Modeling and Analysis, Midwest Regional Carbon Sequestration Partnership – Responsible for the development of numerical and analytical reservoir models of CO$_2$ injection into depleted and active carbonate reef oil reservoirs in Northern Michigan. Activities include geologic and production data integration; material balance analysis of production data to estimate oil-in-place; simulation of injection performance to assess capacity and injectivity; and analysis of rate- and pressure transient data to evaluate reservoir injectivity and connectivity.

Production Decline Modeling in Unconventional Gas Wells – Developed new methods for analyzing production-decline from shale gas wells by aggregation of predictions from multiple plausible models. Applied statistical model averaging techniques to combine forecasts from various models and provide mean estimates with error bars. Performed a comprehensive analysis comparing the efficiency of empirical versus mechanistic models to predict the estimated ultimate recovery from shale gas wells based on limited production data.

Simplified Modeling for CO$_2$ Geological Storage – PI for a DOE-NETL funded project to develop and validate a portfolio of simplified predictive modeling approaches for injection-well pressure buildup and radial plume migration during supercritical CO$_2$ injection into layered saline formations. Methods used included reduced physics and experimental design based statistical learning approaches in conjunction with detailed results from full-physics numerical simulations. The models were validated using an uncertainty and sensitivity analysis approach.

Selected Books and Technical Papers

Mishra, S. (Ed.), 2022. _Machine Learning Applications in Subsurface Energy Resource Management: State of the Art & Future Prognosis_, CRC Press, Boca Raton, FL (in preparation).

De Dios, J.C., **S. Mishra**, F. Poletto and A. Ramos (Eds.), 2020. _CO$_2$ Injection in the Network of Carbonate Fractures_, Springer, London, UK, 243 p.

Mishra, S. and A. Datta-Gupta, 2017. _Applied Statistical Modeling and Data Analytics: A Practical Guide for the Petroleum Geosciences_, Elsevier, New York, NY, 237 p.

Lin, L, J. Schuetter and **S. Mishra**, 2021. Evaluating variable importance in black-box models for subsurface applications: a comparison of strategies, Computational Geosciences (in review).

Sen, D., H. Chen, A. Datta-Gupta, J. Kwon and **S. Mishra**, 2021. Data-driven rate optimization under geologic uncertainty using machine learning in injection-production systems, Journal of Petroleum Science & Engineering. (in review).

Mishra, S., M. Kelley, S. Raziperchikolaee et al., 2021. A Comprehensive Analysis of Transient Pressure / Rate Data from CO$_2$ Storage Projects in a Depleted Pinnacle Reef Oil Field Complex, Michigan, USA, Intl. Journal of Greenhouse Gas Control, DOI:10.1016/j.ijggc.2021.103294

Mishra, S., and P. Ravi Ganesh, 2021. A screening model for predicting injection well pressure buildup and plume extent in CO$_2$ geologic storage projects, Intl. Journal of Greenhouse Gas Control, DOI:10.1016/j.ijggc.2021.103261.

Raziperchikolaee, S., and **S. Mishra**, 2020. Statistical based hydromechanical model to estimate poroelastic effects of CO_2 injection into closed reservoir. Greenhouse Gasses: Science & Technology, DOI: 10.1002/ghg/1956.

Mishra, S., A. Haagsma, M. Valluri and N. Gupta, 2020. Assessment of CO_2 EOR and associated geologic storage potential in the Michigan Northern Pinnacle Reef Trend, Greenhouse Gasses: Science & Technology, 1-18.

Mishra, S., L. Keister and S. Mawalkar, 2020. Interpretation of bottom-hole temperature data in CO_2 injection projects, Intl. Journal of Greenhouse Gas Control, 10.1016/j.ijggc.2020.10313.

Schuetter, J., **S. Mishra**, L. Lin, and D. Chandramohan, 2019. Ensemble learning: a robust paradigm for data-driven modeling in unconventional reservoirs. Proc., SPE/AAPG/SEG Unconventional Resources Technology Conference, Denver, CO, July 22-24.

Raziperchikolaee, S., and **S. Mishra**, 2019. Statistical learning-based predictive models to assess stress changes and reservoir deformation due to CO_2 sequestration in saline aquifers, Intl. Journal of Greenhouse Gas Control, Vol. 88, pp. 416-429.

Bhattacharya, S., and **S. Mishra**, 2018. Application of machine learning for facies and fracture prediction using Bayesian network Theory and random Forest: cast studies from the Appalachian basin, USA, Journal of Petroleum Science & Engineering, Vol. 170, pp. 1005-1017.

Schuetter, J., **S. Mishra**, M. Zhong and R. LaFollette, 2017. A data analytics tutorial: building predictive models for oil production in an unconventional shale reservoir, SPE Journal, pp. 1-15.

Vyas, A., A. Datta-Gupta and **S. Mishra**, 2017. Modeling early-time rate decline in unconventional reservoirs using machine learning techniques. Proc. SPE Abu Dhabi International Petroleum Exhibition and Conference, 13-16 November, Abu Dhabi, UAE.

Mishra, S., and L. Lin, 2017. Application of data analytics for production optimization in unconventional reservoirs: a critical review. Proc., SPE/AAPG/SEG Unconventional Resources Technology Conference, Austin, TX, July 24-26.

Valluri, M., **S. Mishra** and J. Schuetter, 2017. An improved correlation to estimate the minimum miscibility pressure of CO_2 in crude oils for CCUS projects, J. Pet. Sci. Eng., Vol. 158: 408-415.

Mishra, S., 2016. Hydraulic fracturing – hydrologic impacts, In Handbook of Applied Hydrology, Chapter 57, V.P. Singh (Ed.), McGraw Hill, New York.

Fukai, I., **S. Mishra**, M. Moody, 2016. Economic analysis of CO_2-enhanced oil recovery in Ohio: Implications for carbon capture, utilization, and storage in the Appalachian Basin region, International Journal of Greenhouse Gas Control, 10.1016/j.ijggc.2016.07.015

Mishra, S., P. Ravi Ganesh, J. Schuetter, J. He, Z. Lin and L. Durlofsky, 2015. Developing and validating simplified predictive models for CO_2 geologic sequestration. Proc., SPE Annual Technical Conference and Exhibition, Houston, TX, 28-30 September.

Schuetter, J. and **S. Mishra**, 2015. Experimental Design or Monte Carlo Simulation? Strategies for Building Robust Surrogate Models. Proc., SPE Annual Technical Conference and Exhibition, Houston, TX, 28-30 September.

Mishra, S., Y. Oruganti, N. Gupta, P. Ravi Ganesh, I. Bhattacharya and G. Spitznogle, 2014. Modeling CO_2 plume migration based on calibration of injection and post-injection pressure response at AEP Mountaineer. Greenhouse Gasses: Science & Technology, Vol. 4, pp. 331-356.

Mishra, S., 2012. A new approach to reserves estimation in shale gas reservoirs using multiple decline curve analysis models. Proc., SPE Eastern Regional Meeting, Lexington, KY, Oct. 3-5.