

*Luis F. Ayala is the William A. Fustos Family Professorship in the John and Willie Leone Family Department of Energy and Mineral Engineering at The Pennsylvania State University<sup>1</sup>. His research activities focus on the areas of advanced computational fluid dynamics modeling applied to multiphase flow of natural gas in porous media, multiphase well performance, natural gas engineering, and multicomponent multiphase thermodynamics. He holds two summa cum laude degrees in both Chemical and Petroleum Engineering from Universidad de Oriente (Venezuela) and MS and PhD degrees, both in Petroleum and Natural Gas Engineering, from The Pennsylvania State University. He has received the Outstanding Faculty Advising and Wilson Award for Outstanding Teaching, the inaugural Charles Hosler Diversity, Equity, and Inclusion Faculty Award, the Howard B. Palmer Faculty Mentor Award, and Outstanding Faculty Mentor Award from The Pennsylvania State U.; “A Peer Apart” Award, Eastern Regional Reservoir Description and Dynamics Award, and the Outstanding Technical Editor Award from the Society of Petroleum Engineers (SPE), and the Presidential distinction for Academic Excellence from Venezuela. He is currently Executive Editor of SPE Journal, member of several SPE committees, and former Editor-in-Chief of The Way Ahead (SPE Publication). In 2022, he was elected a Distinguished Member by his professional society.*

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## Professional Preparation

Universidad de Oriente (UDO), Venezuela  
*Chemical Engineering Degree, summa cum laude honors.*

Universidad de Oriente (UDO), Venezuela  
*Petroleum Engineering Degree, summa cum laude honors.*

The Pennsylvania State University (PSU), USA  
*Master of Science in Petroleum and Natural Gas Engineering.*

The Pennsylvania State University (PSU), USA  
*Doctor of Philosophy in Petroleum and Natural Gas Engineering.*

## Appointments

- 2023-2024      **Visiting Professor**  
Universidad Carlos III de Madrid (UC3M), Spain
- 2022-2023      **Penn State Administrative Fellow**  
Office of the Senior Vice President for Research, Penn State U.
- 2015- *present*      **William A. Fustos Professor**  
John and Willie Leone Family Department of Energy and Mineral Engineering, Penn State U.
- 2021-2022      **BTAA Fellow**  
Academic Leadership Program, Big Ten Academic Alliance (BTAA)
- 2013-2019      **Associate Department Head and Director of Graduate Studies**  
John and Willie Leone Family Department of Energy and Mineral Engineering, Penn State U.
- 2016-2017      **Visiting Professor**  
Universidad de los Andes (Bogotá) and Universidad Nacional de Colombia (Medellín), Colombia
- 2010-2015      **Associate Professor, Petroleum and Natural Gas Engineering**  
John and Willie Leone Family Department of Energy and Mineral Engineering, Penn State U.
- 2004- 2010      **Assistant Professor, Petroleum and Natural Gas Engineering**  
Department of Energy and Mineral Engineering, Penn State U.

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## Selected Publications

- Soomro, M., **Ayala, L.F.**, Peng, C., and Ayala, O.M., Fugacity-based lattice Boltzmann method for multicomponent multiphase systems, Phys. Rev. E, 107, 015304, 2023.
- Tran, K., Garcez, J., and **Ayala, L.F.**, A robust density-based approach to production data analysis of oil/water multiphase flow systems, J. Energy Resour. Technol. 2023, 145(11): 112902.
- Zhang, F., Zou, L., Rui, Z., Emami-Meybodi, H., **Ayala, L.F.**, Zhang, Z., A two-phase type-curve method with multiscale fluid transport mechanisms in hydraulically fractured shale reservoirs, Petroleum Sci., <https://doi.org/10.1016/j.petsci.2023.02.004>, 2023.
- Garcez, J. Zhang, M., and **Ayala, L.F.**, Modeling of anomalous gas transport in heterogeneous unconventional reservoirs using a nonlinear generalized diffusivity equation, Fuel, v. 340, 127519, 2023.
- Garcez, J. Zhang, M., and **Ayala, L.F.**, Unified early-to-late time forecasting method for multi-fractured horizontal wells in unconventional gas reservoirs with fracture interference effects, J. of Gas Sci and Eng., v.110, 2023.
- Zhang, M., Garcez, J. and **Ayala, L.F.**, A Similarity-based Solution for Nonlinear Gas Fractional Diffusivity Equation with Application to Rate Transient Analysis of Unconventional Heterogenous Reservoirs, SPE J, Dec. 2022.
- Wang, Z., Soomro, M., Peng, C., Ayala, O.M., and **Ayala, L.F.** Two pressure boundary conditions for multi-component multiphase flow simulations using the pseudo-potential lattice Boltzmann model, Computers and Fluids, v. 248, 15, 105672, 2022.
- Zhang, M., and **Ayala, L.F.**, The Dual-Reciprocity Boundary Element Analysis for Hydraulically Fractured Shale Gas Reservoirs, Transport Porous Media, v. 142, 531-557, <https://doi.org/10.1007/s11242-022-01757-9>, 2022.
- Garcez, J. and **Ayala, L.F.**, Green's function-based type curves for multi-fractured horizontal gas wells in unconventional reservoirs, Fuel, v. 320, 123713, July 2022.
- Peng, C, **Ayala, L.F.**, and Ayala, O.M. Fluid-wall interactions in pseudopotential lattice Boltzmann models, Phys. Review E 104, 03301, Sept. 2021.
- Lou, X., Chakraborty, N., Karpyn, Z., **Ayala, L.F.**, Nagarajan, N., and Wijaya, Z.: Experimental Study of Gas-Liquid Diffusion in Porous Rocks and Bulk Fluids to Investigate the Effect of Rock Matrix Hindrance, SPE J, 26(03): 1174-1188, June 2021.
- Peng, C, **Ayala, L.F.**, and Ayala, O.M. A thermodynamically consistent pseudo-potential lattice Boltzmann model for multi-component, multiphase, partially miscible mixtures, J. Computational Physics, v. 429, 110018, March 2021.
- Zhang, M., Chakraborty, N., Karpyn, Z., Emami, H., and **Ayala, L.F.**: Experimental and Numerical Study of Gas Diffusion and Sorption Kinetics in Ultratight Rocks, Fuel, v. 286, no. 2, Feb. 2021.
- Zhang, M., and **Ayala, L.F.**, The Dual-Reciprocity Boundary Element Method Solution for Gas Recovery from Unconventional Reservoirs with Discrete Fracture Networks, SPE J.I v. 25, 2898-2914, Dec. 2020.
- Garcez, J. Zhang, M., & **Ayala, L.** A robust semi-analytical method based on integral formulations for modeling unconventional gas wells with variable production constraints. Journal of Natural Gas Science and Engineering, v. 83, 103522, Nov. 2020.
- Sun, Q., and **Ayala, L.F.**, Use of a new Thermodynamic-based Saturation-Pressure Relationship in Two-Phase Rate Transient Analysis of Boundary Dominated Gas Condensate Reservoirs, SPE Journal v. 25, 1636-1656, Aug. 2020.
- Chen, Z., Kleit, A., Lei, Z., An, H., **Ayala, L.F.**, and Pruvot, A., The Linear-Analog Method: A More Efficient and Effective Linearization Method for Natural Gas Transportation Optimization, Journal of Natural Gas Science & Engineering, v. 80, 103305, August 2020.
- Peng, C., **Ayala, L. F.** Wang, Z., and Ayala, O.M. Attainment of rigorous thermodynamic consistency and surface tension in single-component pseudo-potential lattice Boltzmann models via a customized equation of state, Physical Review E 101, 063309, June 2020.
- Nguyen, K., Zhang, M., and **Ayala, L.F.**, Transient Pressure Behavior for Unconventional Gas Wells with Finite-conductivity Fractures, Fuels, v. 266, no. 15, p. 117119, April 2020.
- Zhang, M., and **Ayala, L.F.**, A similarity-based semi-analytical solution for recovery performance of unconventional oil and gas reservoirs with IFT-dependent capillary pressure effects, J. Energy Res. & Tech., v.142(4), April 2020.

- Wang, Y. and Ayala, L.F., Explicit Determination of Reserves for Variable-Bottomhole-Pressure Conditions in Gas Rate-Transient Analysis, SPE Paper 195691, *SPE Journal* 25(01), p. 369-390, Feb. 2020.
- Zhang, M., and Ayala, L.F., Application of Superposition Principle to Variable Rate/Pressure Analysis of Multi-Fractured Horizontal Wells in Unconventional Gas Reservoirs, *J. Nat. Gas Sc. & Eng.*, v.72, p. 103011, Dec. 2019.
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- Sun, Q., and Ayala, L.F., Analysis of Multiphase Reservoir Production From Oil/Water Systems Using Rescaled Exponential Decline Models, *J. Energy Res. & Tech.*, 141(8):082903, Aug. 2019.
- Wang, Y., Cheng, S., Zhang, K., and Ayala, L.F., Investigation on the Transient Pressure Response of Water Injector Coupling the Dynamic Flow Behaviors in the Wellbore, Waterflood-Induced Fracture and Reservoir: Semi-Analytical Modeling and A Field Case, *Int. J. Heat & Mass Tran.*, v. 130, p. 668-679, March 2019.
- Zhang, M., and Ayala, L.F., Variable Rate and Pressure Integral Solutions to the Nonlinear Gas Diffusivity Equation in Unconventional Systems, *Fuels*, v. 235, p. 1100-1113, Jan. 2019.
- Will, R., Sun, Q., and Ayala, L.F., A Compositional Rescaled-Exponential Model for Multiphase Production Performance Analysis of Boundary-Dominated Gas Condensate Reservoirs, *SPE Journal*, v. 23, no. 6, doi:10.2118/192178-PA, SPE 192178-PA, Dec. 2018.
- Zhang, Z. and Ayala, L. F., Analytical Dual-Porosity Gas Model for Reserve Evaluation of Naturally Fractured Gas Reservoirs Using a Density-Based Approach, *J. Nat. Gas Sc. & Eng.*, v. 59, p. 224-236, Nov. 2018.
- Li, X., Ventura, J., and Ayala, L. F., Carbon Dioxide Source Selection and Supply Planning for Fracking Operations in Shale Gas and Oil Wells, *J. Nat. Gas Sc. & Eng.*, v. 55, p. 74-88, July 2018.
- Zhang, M., and Ayala, L.F., A General Boundary Integral Solution for Fluid Flow Analysis in Reservoirs with Complex Fracture Geometries, *J. Energy Res. & Tech.* 140(5), 052907, Jan. 2018.
- Zhang, M., and Ayala, L.F., A Semi-Analytical Solution to Compositional Flow in Liquid-Rich Gas Plays, *Fuels*, v. 212, p. 274-292, Jan. 2018.
- Singh, M., Zhang, M., Emami-Meybodi, H. and Ayala, L.F., Use of Rescaled Exponential Models for Boundary-Dominated Liquid-Rich Gas Flow Analysis Under Variable Bottomhole Pressure Conditions, *J. Nat. Gas Sc. & Eng.*, v. 46, p. 793-816, Oct. 2017.
- Zhang, Z. and Ayala, L. F., Production Data Analysis for Dual-Porosity Gas/Liquid Systems: A Density-Based Approach, *J. Nat. Gas Sc. & Eng.*, v. 46, p. 143-159, Oct. 2017.
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- Sun, Q. and Ayala, L. F., A linear-rate analog approach for the analysis of natural gas transportation networks, *J. Nat. Gas Sc. & Eng.*, v. 43, pp. 230-241, July 2017.
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- Al-Ghamdi, B. and Ayala, L. F., Evaluation of Transport Properties Effect on the Performance of Gas-Condensate Reservoirs Using Compositional Simulation, *J. Energy Resour. Technol.*, v. 139, n. 3, p. 032910, May 2017.
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- Al-Ghamdi, B. and Ayala, L. F., Examination of unconventional phenomena in naturally fractured liquid-rich gas reservoirs: Single-block compositional model, *J. Pet. Exp. and Prod. Tech.*, v. 7, no. 1, pp 265-279, March 2017.
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- Becker, M.D., Zhang, M., and Ayala, L.F., On the pressure-saturation path in infinite-acting unconventional liquid-rich gas reservoirs, *J. Nat. Gas Sc. & Eng.*, v. 35, pp. 97-113, Sept. 2016.
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- Dong, T. and Ayala, L.F., Two-Phase Flow Models for Thermal Behavior Interpretation in Horizontal Wellbores, *J. Pet. Exp. and Prod. Tech.*, v. 6, no. 1, pp. 45-61, March 2016.
- Zhang, M., Becker, M., and Ayala, L.F., A Similarity Method for Early-Transient Multiphase Flow Analysis of Liquid-Rich Unconventional Gas Reservoirs, *J. Nat. Gas Sc. & Eng.*, 28, 572-586, Jan. 2016.
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- Zhang, M. and Ayala, L. F., Gas-Rate Forecasting in Boundary-Dominated Flow: Constant-Bottomhole-Pressure Decline Analysis by Use of Rescaled Exponential Models. *SPE J.*, v. 19, n. 3, p. 410-417, SPE-168217-PA, 2014.
- Dutta, R., Lee, C.-H., Odumabo, S., Ye, P., Walker, S.C., Karpyn, Z.T., and Ayala, L. F., Experimental Investigation of Fracturing Fluid Migration due to Spontaneous Imbibition in Fractured Low Permeability Sands, *SPE Res. Ev. and Eng. J.*, v. 17, no. 1, 2014.

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- **Ayala, L.F.**, and Zhang, M., Rescaled Exponential and Density-Based Decline Models: Extension to Variable-Rate/Pressure-Drawdown Conditions. *J. Can. Pet. Tech.* **52** (6): 433-440. SPE-168223-PA., 2013.
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- Ye, P. and **Ayala, L.F.**, Straight-Line Analysis of Flow Rate vs. Cumulative Production Data for the Explicit Determination of Gas Reserves, *J. of Can. Pet. Tech.*, v. 52, n. 4, pp. 296-305, July 2013.
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## Synergistic Activities

**Graduate Student and PostDoc Ombusperson** (2022-present); **Executive Editor**, SPE Journal (2019-2022); **Associate Department Head and Director of Graduate Studies**, John and Willie Leone Family Department of Energy and Mineral Engineering, (2013-2019); **Member**, SPE Book Development Committee (2017 - 2020); **Member**, SPE Reservoir Description and Dynamics (RDD) Advisory Committee (2016-2018); **Member**, Reservoir Engineering Program Subcommittee: 2019 SPE Annual Technical Conference and Exhibition, Calgary, Canada and 2018 SPE Annual Technical Conference and Exhibition, Dallas, TX; **Member**, SPE Reservoir Description and Dynamics Program Subcommittee, 2017 SPE Annual Technical Conference and Exhibition, San Antonio, TX.;

**Specialty Coordinator and Chair**, Reservoir Description and Dynamics, 2016 SPE Annual Technical Conference and Exhibition, Dubai, U.A.E.; **Chair**, Reservoir Engineering Program Subcommittee 2014 SPE Annual Technical Conference and Exhibition, Amsterdam, The Netherlands; **Member**, Reservoir Engineering Program Subcommittee: 2015 SPE Annual Technical Conference and Exhibition, Houston, 2013 SPE Annual Technical Conference and Exhibition, New Orleans, USA, 2012 SPE Annual Technical Conference and Exhibition in San Antonio, Texas, 2011 SPE Annual Technical Conference and Exhibition in Denver, Colorado, USA, and 2010 SPE Annual Technical Conference and Exhibition in Florence, Tuscany, Italy; **2010-2011 Advisor**, *The Way Ahead*, SPE; **2009-2010 Editor-in-Chief**, *The Way Ahead*, Society of Petroleum Engineers (SPE) Magazine; **Member**, SPE Reservoir Description and Dynamics Advisory Committee, Society of Petroleum Engineers (2009-2012); **Associate Editor**, Journal of Natural Gas Science and Engineering (JNGSE); Member of Editorial Review Board of the Society of Petroleum Engineering Journals (SPE J., and SPEREE J.); Member of Editorial Board of Petroleum Science and Technology J. (PST); **Member**, Society of Petroleum Engineers (SPE) and National Association of Engineers of Venezuela; **College Representative**, Graduate School's Graduate Subcommittee for New and Revised Programs (2014-2016); **Chair**, Graduate Council Committee on Research, The Graduate School (PSU) (2010-2011); **Member**, Penn State's University Graduate Council (2009-2011).

## Honors and Awards

2023 E. Williard & Ruby S. Miller Faculty Fellowship, PSU; 2022 Distinguished Membership, Society of Petroleum Engineers (SPE); 2022 Howard B. Palmer Faculty Mentor Award, PSU; 2021 Charles Hosler Diversity, Equity, and Inclusion Faculty Award, College of Earth and Mineral Sciences, PSU; 2021 Outstanding Faculty Mentor Award in the College of Earth and Mineral Sciences, PSU; 2020 "A Peer Apart" Honoree, Society of Petroleum Engineers (SPE). 2020 Eastern Regional Reservoir Description and Dynamics Award Recipient, Society of Petroleum Engineers (SPE); 2018 Outstanding Faculty Advising Award, College of Earth and Mineral Sciences, PSU; 2016-2017 Fulbright Scholar recipient, Fulbright-Colciencias Innovation and Technology Award; William A. Fustos Family Professor in Energy and Mineral Engineering (2016-present); Energi Simulation Chair in Fluid Behavior and Rock Interactions (2014-2020); 2010 Wilson Award for Outstanding Teaching; SPE Outstanding Technical Editor Awards (2007, 2017, and 2018); PNGE Graduate Merit Award (PSU); Presidential Distinction for Academic Excellence "*José Félix Ribas*" awarded by the President of the Republic of Venezuela, *Summa Cum Laude* distinction in Petroleum Engineering; Diploma of Recognition for Outstanding Academic Accomplishment granted by the Board of Trustees of Universidad de Oriente (UDO, Venezuela) for obtaining the highest academic distinction (*summa cum laude*) in two engineering majors studied simultaneously; *Summa Cum Laude* distinction in Chemical Engineering; Merit Medal "21<sup>st</sup> of November" granted by the Board of Trustees of Universidad de Oriente for outstanding academic achievement.

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