

YONGZAN LIU

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EDUCATION

- Texas A&M University** *2017/09 - 2021/08*
Ph.D. in Petroleum Engineering (specialized in reservoir geomechanics)
Thesis: Hydraulic-Fracture Geometry Characterization Using Low-Frequency Distributed Acoustic Sensing (LF-DAS) Data: Forward Modeling, Inverse Modeling, and Field Applications [link]
- University of Alberta** *2014/09 - 2017/05*
M.S. in Petroleum Engineering
Thesis: Modeling of Recovery and In-Situ Distribution of Fracturing Fluid in Shale Gas Reservoirs Due to Fracture Closure, Proppant Distribution and Gravity Segregation [link]
- China University of Petroleum (East China)** *2010/09 - 2014/06*
B.S. in Petroleum Engineering
- Memorial University of Newfoundland** *2014/01 - 2014/06*
Undergraduate Visiting Student in Memorial University of Newfoundland, Canada

EMPLOYMENT

- Schlumberger-Doll Research, Cambridge, MA** *2022/06 - present*
Research Scientist
Topic: Modeling and Interpretation of Deep Measurements (DAS/DTS/DSS)
- Lawrence Berkeley National Laboratory, Berkeley, CA** *2021/09 - 2022/06*
Postdoc Scholar (supervisor: Dr. Matthew Reagan)
Topic: System Behaviors of Hydrate-Bearing Sediments during Gas Production

RESEARCH INTERESTS

- **Numerical Modeling:** Computational Geomechanics; Multi-Phase Flow in Fractured Porous Media; Coupled Thermal-Hydraulic-Mechanical Modeling
- **Subsurface Monitoring and Diagnostics:** Distributed Fiber-Optic Sensing (DAS, DTS, DSS); Borehole Seismic
- **Fractured Reservoir Simulation and Characterization:** Hydrocarbon Reservoirs; Enhanced Geothermal Systems (EGS); Geological Carbon Storage

RESEARCH PROJECTS

- Automated Real-Time Seismic Event Detection and Location from DAS Data** *2022/07 - present*
· Developed a general workflow for automating real-time event detection and location process for downhole DAS measurements
· The workflow can be used for real-time monitoring of fluid injection (carbon storage; fracturing; waste disposal) and production (oil and gas; geothermal) operations in the field
- System Behaviors of Hydrate-Bearing Sediments** *2021/09 - 2022/06*
· Applied coupled numerical models for hydrate-bearing sediments simulation
· Analyzed system behaviors during long-term gas production from hydrate accumulations
- Inference of Hydraulic Fracture Characteristics from In-Well DSS Data** *2021/01 - present*
· Conducted coupled simulation to interpret DSS data for near-wellbore fracture characterization
· Identified the dominant mechanisms for different pressure/strain patterns
· The first study that provides theoretical support for DSS data interpretation
- Hydraulic-Fracture Geometry Characterization Using LF-DAS Data** *2019/09 - present*

- Developed an efficient 3D geomechanical model to simulate LF-DAS strain/strain-rate response
- Proposed a guideline for fracture-hit detection using LF-DAS data and applied to several field case studies
- Developed an inversion algorithm for quantitative hydraulic-fracture geometry characterization
- Outputs of this project provide critical insights for quantitative hydraulic-fracture geometry characterization
- More advanced inversion algorithms are under development with SLB

Coupled Thermal-Hydraulic-Mechanical (THM) Modeling of Fractured Reservoirs *2017/09 - present*

- A continuous research project on model development for subsurface reservoirs
- Developed efficient coupled thermal flow and geomechanics models for deformable fractured reservoirs
- Fractures modeled explicitly by either Discrete Fracture Model (DFM) with unstructured meshing or Embedded Discrete Fracture Model (EDFM)
- Used Fixed-stress iterative coupling scheme to increase the computational efficiency and application flexibility
- Applications: production-induced stress changes; EOR; flowback; water circulation in EGS, shear dilation of fracture networks, etc.

Fracturing Fluid Flowback and In-Situ Distribution in Unconventional Reservoirs *2015/08 - 2017/06*

- Developed comprehensive numerical models that incorporate essentially all the dominant mechanisms controlling fracturing fluid flowback characteristics
- Investigated the impacts of various physical mechanisms on fracturing fluid flowback and in-situ distribution and their subsequent influences on well performance
- Identified flowback signatures under different fracture geometries that help to better utilize flowback data for hydraulic fracture characterization

PUBLICATIONS

Feature Article – monthly feature in *JPT*

1. Wu, K., **Liu, Y.**, Jin, G., Moridis, G. J. (2021). Fracture Hits and Hydraulic-Fracture Geometry Characterization Using Low-Frequency Distributed Acoustic Sensing Strain Data. *Journal of Petroleum Technology*. **73** (07): 39-42. SPE-0721-0039-JPT. [link]

Journal Article – * denotes corresponding author

18. Liu, L, Fan, W., Huang, Z., Yao, J., **Liu, Y.** et al. (under review) Gas Condensate Well Productivity in Fractured Vuggy Carbonate Reservoirs: a Numerical Modeling Study. *Geoenergy Science and Engineering*
17. Liu, L, Fan, W., **Liu, Y.*** et al. (under review) Importance of Shear Dilation to Two-Phase Flow in Naturally Fractured Geological Media: A Numerical Study Using Zero-Thickness Interface Elements. *Geoenergy Science and Engineering*
16. Srinivasan, A., **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J. 2023. Geomechanical Modeling of Fracture-Induced Vertical Strain Measured by Distributed Fiber Optic Strain Sensing. *SPE Production & Operations*. (major revision)
15. **Liu, Y.**, Liu, L, Jin, G. et al. 2023 Simulation-Based Evaluation of the Effectiveness of Fiber-Optic Sensing in Monitoring and Optimizing Water Circulation in Next-Generation Enhanced Geothermal Systems. *Geoenergy Science and Engineering*. **221**: 211378. [link]
14. Moridis, G. J., Reagan, M. T., **Liu, Y.** 2022 Numerical simulations in support of a long-term test of gas production from hydrate accumulations on the Alaska North Slope: Reservoir response to interruptions of production (shut-ins). *Energy & Fuels*. **36** (7): 3496-3525. [link]
13. **Liu, Y.**, Jin, G., Wu, K. 2022. New Insights on Characteristics of the Near-Wellbore Fractured Zone from Simulated High-Resolution Distributed Strain Sensing Data. *SPE Reservoir Evaluation & Engineering*. **25** (01): 99-112. SPE-208587-PA. [link]
12. Li, J., **Liu, Y.**, Wu, K. 2022. A New Higher Order Displacement Discontinuity Method Based on the Joint Element for Analysis of Close-Spacing Planar Fractures. *SPE Journal*. **27** (02): 1123-1139. SPE-208614-PA. [link]
11. **Liu, Y.**, Jin, G., Wu, K., Moridis, G. J. 2022. Quantitative Hydraulic-Fracture Geometry Characterization with LF-DAS Strain Data: Fracture-Height Sensitivity and Field Applications. *SPE Production & Operations*. **37** (02): 159-168. SPE-204158-PA. [link]
10. **Liu, Y.**, Jin, G., Wu, K., Moridis, G. J. 2021. Hydraulic-Fracture-Width Inversion Using Low-Frequency Distributed-Acoustic-Sensing Strain Data. Part II: Extension for Multifracture and Field Application. *SPE Journal*. **26** (05): 2703-2715. SPE-205379-PA. [link]

9. **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J., Kerr, E. et al. 2021. Fracture-Hit Detection Using LF-DAS Signals Measured during Multifracture Propagation in Unconventional Reservoirs. *SPE Reservoir Evaluation & Engineering*. **24** (03): 523-535. SPE-204457-PA. [link]
8. **Liu, Y.**, Jin, G., Wu, K., Moridis, G. J. 2021. Hydraulic-Fracture-Width Inversion Using Low-Frequency Distributed-Acoustic-Sensing Strain Data. Part I: Algorithm and Sensitivity Analysis. *SPE Journal*. **26** (01): 359-371. SPE-204225-PA. [link]
7. **Liu, Y.**, Liu, L., Leung, J. Y., Wu, K., Moridis, G. J. 2021. Coupled Flow/Geomechanics Modeling of Interfracture Water Injection To Enhance Oil Recovery in Tight Reservoirs. *SPE Journal*. **26** (01): 1-21. SPE-199983-PA. [link]
6. **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J. 2020. Rock Deformation and Strain-Rate Characterization during Hydraulic Fracturing Treatments: Insights for Interpretation of Low-Frequency Distributed-Acoustic Sensing Signals. *SPE Journal*. **25** (05): 2251-2264. SPE-202482-PA. [link]
5. **Liu, Y.**, Liu, L., Leung, J. Y., Moridis, G. J. 2020. Sequentially Coupled Flow and Geomechanical Simulation with a Discrete Fracture Model for Analyzing Fracturing Fluid Recovery and Distribution in Fractured Ultra-Low Permeability Gas Reservoirs. *Journal of Petroleum Science and Engineering* **189**: 107042. [link]
4. Liu, L., **Liu, Y.***, Yao, J., Huang, Z. 2020. Mechanistic Study of Cyclic Water Injection to Enhance Oil Recovery in Tight Reservoirs with Fracture Deformation Hysteresis. *Fuel* **271**: 117677. [link]
3. Liu, L., **Liu, Y.***, Yao, J., Huang, Z. 2020. Efficient Coupled Multiphase-Flow and Geomechanics Modeling of Well Performance and Stress Evolution in Shale-Gas Reservoirs Considering Dynamic Fracture Properties. *SPE Journal*. **25** (03): 1523-1542. SPE-200496-PA. [link]
2. **Liu, Y.**, Leung, J. Y., Chalaturnyk, R., Virus, C. J. J. 2019. New Insights on Mechanisms Controlling Fracturing-Fluid Distribution and Their Effects on Well Performance in Shale-Gas Reservoirs. *SPE Production & Operations* **34** (03): 564-585. SPE-185043-PA. [link]
1. **Liu, Y.**, Leung, J. Y., Chalaturnyk, R. 2018. Geomechanical Simulation of Partially Propped Fracture Closure and Its Implication for Water Flowback and Gas Production. *SPE Reservoir Evaluation & Engineering* **21** (02): 273-290. SPE-189454-PA. [link]

Conference Paper – full length

14. **Liu, Y.**, Liang, L., Podgornova, O. et al. 2023. Automated Microseismic Event Detection for Downhole Distributed Acoustic Sensing Data Processing. 57th US Rock Mechanics/Geomechanics Symposium, Atlanta, Georgia, June 25-28.
13. Liu, L., **Liu, Y.**, Wang, X. 2023. A novel MCMC-based hydraulic fracture diagnostics approach using water hammer data. 57th US Rock Mechanics/Geomechanics Symposium, Atlanta, Georgia, June 25-28.
12. Liu, L., **Liu, Y.**, Wang, X. et al. 2022. A Coupled Hydro-Mechanical Model for Simulation of Two-Phase Flow and Geomechanical Deformation in Naturally Fractured Porous Media. 56th US Rock Mechanics/Geomechanics Symposium, Santa Fe, New Mexico, USA. 26-28 June.
11. Srinivasan, A., **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J. 2022. Analysis of Strain Responses in Vertical Monitoring Wells for Low-Frequency Distributed Acoustic Sensing Measurements. 56th US Rock Mechanics/Geomechanics Symposium, Santa Fe, New Mexico, USA. 26-28 June.
10. Srinivasan, A., **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J. 2022. Geomechanical Modeling of Fracture-Induced Vertical Strain Measured by Distributed Fiber Optic Strain Sensing. SPE/SEG/AAPG Unconventional Resources Technology Conference, Houston, Texas, US, 20-23 June.
9. **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J. 2021. Quantification of Thermal Effects on Cross-Well Low-Frequency Distributed Acoustic Sensing Measurements. SPE/SEG/AAPG Unconventional Resources Technology Conference, Houston, Texas, US, 26-28 July.
8. **Liu, Y.**, Jin, G., Wu, K., 2021. New Insights on Near-Wellbore Fracture Characteristics from High-Resolution Distributed Strain Sensing Measurements. SPE/SEG/AAPG Unconventional Resources Technology Conference, Houston, Texas, US, 26-28 July.
7. **Liu, Y.**, Jin, G., Wu, K., Moridis, G. J. 2021. Quantitative Hydraulic-Fracture Geometry Characterization with LF-DAS Strain Data: Numerical Analysis and Field Applications. SPE Hydraulic Fracturing Technology Conference and Exhibition, The Woodlands, Texas, USA. 2-4 February. SPE-204158-MS.
6. **Liu, Y.**, Liu, L., Leung, J. Y., Wu, K., Moridis, G. J. 2020. Coupled Flow and Geomechanics Modeling of Interfracture Water Injection to Enhance Oil Recovery in Tight Reservoirs. SPE Canada Unconventional Resources Conference, Virtual, 15-16, September.
5. **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J., Kerr, E. et al. 2020. Strain and Strain-Rate Responses Measured by LF-DAS and Corresponding Features for Fracture-Hit Detection during Multiple-Fracture Propagation in Unconventional Reservoirs. Unconventional Resources Technology Conference, Virtual, 20-22 July.

4. **Liu, Y.** Liu, L., Leung, J. Y., Wu, K., Moridis, G. J. 2020. Numerical Investigation of Water Flowback Characteristics for Unconventional Reservoirs with Complex Fracture Geometries. Unconventional Resources Technology Conference, Virtual, 20-22 July.
3. **Liu, Y.**, Wu, K., Jin, G., Moridis, G. J. 2020. Hydraulic Fracture Modeling of Fracture-Induced Strain Variation Measured by Low-Frequency Distributed Acoustic Sensing (LF-DAS) along Offset Wells. 54th US Rock Mechanics/Geomechanics Symposium, Golden, Colorado, USA (canceled). 28 June-1 July.
2. Liu, L., Huang, Z., Yao., Yuan, D., Wu, Y. S., **Liu, Y.** 2020. An Efficient Coupled Hydro-Mechanical Modeling of Two-Phase Flow in Fractured Vuggy Porous Media. 54th US Rock Mechanics/Geomechanics Symposium, Golden, Colorado, USA (canceled). 28 June-1 July.
1. **Liu, Y.**, Leung, J. Y., Chalaturnyk, R., Virus, C. J. J. 2017. Fracturing Fluid Distribution in Shale Gas Reservoirs Due to Fracture Closure, Proppant Distribution and Gravity Segregation. SPE Canada Unconventional Resources Conference, Calgary, Alberta, Canada. 15-16, February. SPE-185043-MS.

TECHNICAL SKILLS

- **Numerical Method:** Finite Element Method, Finite Volume Method, Boundary Element Method
- **Programming Language:** fluent in FORTRAN, Python, MATLAB; competent in C++
- **Numerical Modeling/Open Source Package:** CMG, StimPlan, FLAC, deal.II
- **Visualization Software:** Paraview, Tecplot

AWARDS & HONORS

- Texas A&M Petroleum Engineering Department Faculty Award of Excellence in Research 2022/05
- SPE Journal Excellent Technical Reviewer Award 2021/10
- Winner of TAMU ARMA Graduate Research Competition 2021/03
- Third Place Winner of TAMU SPE Student Paper Contest (PhD Division) 2021/01
- Nomination for TAMU College of Engineering Outstanding Graduate Student 2020/10
- University of Alberta Graduate Research Assistant Fellowship 2014/09 - 2017/06
- University of Alberta Travel Award 2017/02
- Excellent Undergraduate Student Award 2014/01
- China University of Petroleum Technology Innovation Awards 2013/09
- China National Inspiration Scholarship 2012/09

RECOGNITION

- **Journal of Petroleum Technology Monthly Feature:** Fracture Hits and Hydraulic-Fracture Geometry Characterization Using Low-Frequency Distributed Acoustic Sensing Strain Data. *Journal of Petroleum Technology*. **73** (07): 39-42. SPE-0721-0039-JPT. [link]
- PhD Research highlighted in Texas A&M Today [link] and College of Engineering News [link]
- **Journal of Petroleum Technology Highlight:** The Sound of One Fracture Flowing [link]

INVITED TALKS

- ARMA Workshop on Fiber-Optic Sensing** 2022/06/26
Title: An Efficient Inversion Algorithm for Quantitative Hydraulic Fracture Characterization Using Low-Frequency Distributed Acoustic Sensing Strain Data
- Schlumberger - Doll Research** 2022/04/25
Title: Quantitative Hydraulic Fracture Characterization Based on Cross-Well Low-Frequency Distributed Acoustic Sensing Data
- Lawrence Livermore National Laboratory** 2021/07/08
Title: Hydraulic Fracture Characterization and Advanced Fractured Reservoir Simulation
- Lawrence Berkeley National Laboratory** 2021/06/10
Title: Sequentially Coupled Multiphase Flow and Geomechanics Modeling of Hydraulically Fractured Unconventional Reservoirs

PROFESSIONAL SERVICES & AFFILIATIONS

Major Professional Activities

Associate Editor, *Geoenergy Science and Engineering*, 2022 - present
Guest Editor, special issue - Distributed Fiber Optic Sensing, *Interpretation*, 2022
Guest Editor, special issue - Integrated Geosciences and Engineering in Unconventional Oil and Gas Resources: Novel Insights and Challenges, *Lithosphere*, 2022
Program Committee, 2023 Annual Technical Conference and Exhibition (ATCE)
Session Developer/Chair, 2023 57th ARMA Rock Mechanics/Geomechanics Symposium
Judge, 2022 SPE ATCE Student Paper Contest (PhD Division)
Judge, 2022 SPE Rocky Mountain Regional Student Paper Contest
Session Developer/Chair, 2022 56th ARMA Rock Mechanics/Geomechanics Symposium
Organizing Committee Member, 2021 55th ARMA Rock Mechanics/Geomechanics Symposium
Judge, 2021 SPE ATCE Student Paper Contest (PhD Division)

Journal Technical Reviewer

Transport in Porous Media, International Journal of Rock Mechanics and Mining Sciences, Rock Mechanics and Rock Engineering, Water Resources Research, Interpretation, International Journal for Numerical and Analytical Methods in Geomechanics, SPE Journal, SPE Reservoir Evaluation & Engineering, SPE Production & Operations, SPE Drilling & Completions, Fuel, Energy & Fuel, Journal of Petroleum Science and Engineering, GEOPHYSICS

Professional Member

Society of Petroleum Engineer (SPE)
America Rock Mechanics Association (ARMA)

Student Organization

Founder & President (2021), ARMA-TAMU Student Chapter