Zhen Qin

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RESEARCH INTERESTS

AI for Science: Applying physics-guided deep learning to the subsurface system (geothermal & geologic CO_2 storage)
Reservoir Engineering & Management: Numerical simulation for subsurface system; optimization and inverse modeling.

EDUCATION

University of Southern California, Los Angeles, United States   01/01/2020 − 12/31/2024 (Expected)
   Ph.D. in Petroleum Engineering (GPA: 3.81/4.00)

University of Southern California, Los Angeles, United States   01/01/2022 − 12/31/2023
   M.S. in Computer Science (GPA: 3.60/4.00)

Tianjin University, Tianjin, China   09/18/2015 − 01/08/2018
   M.S. in Engineering Thermophysics (GPA: 3.50/4.00)

Tianjin University of Technology, Tianjin, China   09/10/2010 − 06/30/2014
   B.S. in Thermal Energy and Power Engineering

ACADEMIC EXPERIENCE

Los Alamos National Laboratory   Los Alamos, United States
Intern - Machine Learning and Environment Management (EES-16)   09/2024 − 12/2024
- Applying Machine Learning to the risk assessment for geologic CO_2 storage.
- Deep Learning surrogate for Underground Hydrogen Storage (UHS).

University of Southern California   Los Angeles, United States
Research and Teaching Assistant   01/2020 − Present
- **Proxy-based Optimization**: 1) Developed field-scale geothermal reservoir simulation using CMG to evaluate and manage reservoir production; 2) Developed deep learning proxy-based optimization workflow and gained improvement in net power generation (>7%) and significantly reduced computational cost (∼90%).
- **Physics-guided Deep Learning for Subsurface System**: 1) Integrated domain knowledge into DL models to solve extrapolation issues during prediction; 2) Applied developed models to the forecasting in geothermal reservoir and geologic CO_2 storage; 3) Achieved stable long-term prediction of both time-series and spatiotemporal features.
- **Adaptive Parameterization for Inverse Modeling**: Developed multi-resolution parameterization for the inverse modeling workflow in geologic CO_2 storage.

Tianjin University   Tianjin, China
Research Assistant   01/2018 − 12/2019
- Worked on surrogate models for the two-phase high-temperature geothermal reservoir.

Graduate Research Assistant   09/2015 − 12/2017
- Developed a lumped-parameter model for the prediction and history matching in a two-phase geothermal reservoir.
- Developed optimization framework using Genetic Algorithm (GA) and BFGS Method for history matching.

Reykjavik University   Reykjavik, Iceland
Graduate Research Assistant   06/2016 − 09/2017
- Developed a lumped-parameter model for the prediction and history matching in a two-phase geothermal reservoir.

PROJECTS

Department of Energy (DOE EERE): Enabling Efficient Surveillance, Control, and Automation of Geothermal Operations with Advanced Predictive Analytics   Los Angeles, United States
Research Assistant   01/2020 − 07/2022
- **Duty**: 1) simulation model of geothermal reservoir; 2) proxy-based control optimization (GitHub Repository); 3) physics-guided deep learning model (GitHub Repository).
- **Project Link**: https://doi.org/10.2172/2311787 .

Aramco Americas: Scientific Machine Learning (SciML) for Dynamic Imaging, Characterization, and Prediction of Geologic CO_2 Storage   Los Angeles, United States
Research Assistant   06/2022 − Present
- **Duty**: 1) simulation model of the deep saline aquifer for carbon sequestration; 2) physics-guided deep learning model; 3) deep learning model for multi-resolution parameterization.

PUBLICATIONS

Journal paper

1. Liu, Y., **Qin, Z.**, Zheng F., & Jafarpour B. (2024): "Spatio-Temporal Neural Networks for Monitoring and Prediction of CO2 Plume Migration from Measurable Field Data". (*Under review*)
2. **Qin, Z.**, Liu, Y., Zheng F., & Jafarpour B. (2024): "Encoding Physics into Deep Learning Model for Long-Term Spatial-Temporal Prediction in Geological CO_2 Storage". (*Under review*)
3. **Qin, Z.**, Jiang, A., Faulder D., Cladouhos T.T., & Jafarpour B. (2024): "Physics-Guided Deep Learning for Prediction of Energy Production from Geothermal Reservoirs". *Geothermics*
4. Jiang, A., **Qin, Z.**, Faulder D., Cladouhos T.T., & Jafarpour B. (2023): "A multiscale recurrent neural network model for predicting energy production from geothermal reservoirs". *Geothermics*
5. **Qin, Z.**, Jiang, A., Faulder D., Cladouhos T.T., & Jafarpour B. (2023): "Efficient Optimization of Energy Recovery from Geothermal Reservoirs with Recurrent Neural Network Predictive Models". *Water Resources Research*
6. Jiang, A., **Qin, Z.**, Faulder D., Cladouhos T.T., & Jafarpour B. (2021): "Recurrent neural networks for short-term and long-term prediction of energy production from geothermal reservoirs". *Geothermics*
7. **Qin, Z.**, Valfells, Á., & Guðjónsdóttir, M.S. (2017): "The Lumped-parameter Model on Two-phase and Superheated Geothermal Reservoir". *Energy Procedia*

Conference paper

1. **Qin, Z.**, Jiang, A., Faulder D., Cladouhos T.T., & Jafarpour B. (2022): "Physics-Guided Deep Learning for Prediction of Energy Production from Geothermal Reservoirs". *GRC Transactions*, Vol. 46, 2022
2. **Qin, Z.**, Jiang, A., Faulder D., Cladouhos T.T., & Jafarpour B. (2022): "Physics-Guided Deep Learning for Prediction of Geothermal Reservoir Performance". *Stanford Geothermal Workshop*, SGP-TR-223
3. **Qin, Z.**, Jiang, A., Faulder D., Cladouhos T.T., & Jafarpour B. (2021): "Optimization of Energy Production from Geothermal Reservoirs Using Physics-Based and Data-Driven Models". *GRC Transactions*, Vol. 45, 2021

AWARDS

- **Ph.D. Program Fellowship** — Los Angeles, CA, United States
  Graduate School Fellowship awarded by University of Southern California — 2019
- **Erasmus Scholarship** — Reykjavik, Iceland
  Erasmus Scholarship awarded for international exchange students in Reykjavik University — 2016
- **Third Place in SPE Western Region Paper Contest** — Stanford, CA, United States
  Society of Petroleum Engineers (SPE) — 2024

ACTIVITIES

- **Energi Simulation Summit 2023** — The Hague, Netherlands
  Presented Academic Posters — 2023
- **Energi Simulation Summit 2022** — Calgary, Canada
  Presented Academic Posters — 2022
- **UNU Geothermal Training Programme Alumni Dinner** — Beijing, China
  Attended the alumni dinner organized at the Icelandic Embassy in Beijing — 2018
- **Attended Student Symposium at the Chinese Embassy in Iceland** — Reykjavik, Iceland
  Links for the symposium — 2017
- **Dual-Degree Exchange Program at Reykjavik University** — Reykjavik, Iceland
  Participated in the program at Reykjavik University - Iceland School of Energy — 2016-2017
- **Volunteer at 2016 Arctic Circle Assembly** — Reykjavik, Iceland
  The Arctic Circle Assembly is the largest annual international gathering on the Arctic — 2016

SKILLS

- **Programming:** Python; C#
- **Software:** MATLAB; Unity; CMG; SGEMS
- **Soft Skills:** PyTorch; TensorFlow; Deep Learning; Machine Learning; Numerical Simulation; Optimization; Inverse Modeling

SELECTED COURSES

- **Computer Science**: Machine Learning, Deep Learning, Data Science, Applied Natural Language Processing, Advanced Mobile Game Design, Data Structure and Algorithms, Robotics
- **Petroleum Engineering**: Numerical Simulation, Geostatistics, Optimization, Well Testing and Damage Control, Enhanced Oil Recovery, Inverse Modeling