

## Zhen Qin

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### RESEARCH INTERESTS

**AI for Science:** Applying physics-guided deep learning to the subsurface system (geothermal & geologic CO<sub>2</sub> storage)

**Reservoir Engineering & Management:** Numerical simulation for subsurface system; optimization and inverse modeling.

### EDUCATION

<b>University of Southern California</b> , Los Angeles, United States Ph.D. in Petroleum Engineering (GPA: 3.81/4.00)	01/01/2020 – 12/31/2024 (Expected)
<b>University of Southern California</b> , Los Angeles, United States M.S. in Computer Science (GPA: 3.60/4.00)	01/01/2022 – 12/31/2023
<b>Tianjin University</b> , Tianjin, China M.S. in Engineering Thermophysics (GPA: 3.50/4.00)	09/18/2015 – 01/08/2018
<b>Tianjin University of Technology</b> , Tianjin, China B.S. in Thermal Energy and Power Engineering	09/10/2010 – 06/30/2014

### ACADEMIC EXPERIENCE

<b>Los Alamos National Laboratory</b> <i>Intern - Machine Learning and Environment Management (EES-16)</i> <ul style="list-style-type: none"><li>Applying Machine Learning to the risk assessment for geologic CO<sub>2</sub> storage.</li></ul>	Los Alamos, United States 09/2024 – 12/2024
<b>University of Southern California</b> <i>Research and Teaching Assistant</i> <ul style="list-style-type: none"><li><b>Proxy-based Optimization:</b> 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 (&gt;7%) and significantly reduced computational cost (~90%).</li><li><b>Physics-guided Deep Learning for Subsurface System:</b> 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<sub>2</sub> storage; 3) Achieved stable long-term prediction of both time-series and spatiotemporal features.</li><li><b>Adaptive Parameterization for Inverse Modeling:</b> Developed multi-resolution parameterization for the inverse modeling workflow in geologic CO<sub>2</sub> storage.</li></ul>	Los Angeles, United States 01/2020 – Present
<b>Tianjin University</b> <i>Research Assistant</i> <ul style="list-style-type: none"><li>Worked on surrogate models for the two-phase high-temperature geothermal reservoir.</li></ul>	Tianjin, China 01/2018 – 12/2019
<b>Graduate Research Assistant</b> <ul style="list-style-type: none"><li>Developed a lumped-parameter model for the prediction and history matching in a two-phase geothermal reservoir.</li><li>Developed optimization framework using Genetic Algorithm (GA) and BFGS Method for history matching.</li></ul>	09/2015 – 12/2017
<b>Reykjavik University</b> <i>Graduate Research Assistant</i> <ul style="list-style-type: none"><li>Developed a lumped-parameter model for the prediction and history matching in a two-phase geothermal reservoir.</li></ul>	Reykjavik, Iceland 06/2016 – 09/2017

### PROJECTS

<b>Department of Energy (DOE EERE): Enabling Efficient Surveillance, Control, and Automation of Geothermal Operations with Advanced Predictive Analytics</b> <i>Research Assistant</i> <ul style="list-style-type: none"><li><b>Duty:</b> 1) simulation model of geothermal reservoir; 2) proxy-based control optimization (GitHub Repository); 3) physics-guided deep learning model (GitHub Repository).</li><li><b>Project Link:</b> <a href="https://doi.org/10.2172/2311787">https://doi.org/10.2172/2311787</a>.</li></ul>	Los Angeles, United States 01/2020 – 07/2022
<b>Aramco Americas: Scientific Machine Learning (SciML) for Dynamic Imaging, Characterization, and Prediction of Geologic CO<sub>2</sub> Storage</b> <i>Research Assistant</i> <ul style="list-style-type: none"><li><b>Duty:</b> 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.</li></ul>	Los Angeles, United States 06/2022 – Present

## PUBLICATIONS

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### Journal paper

1. Liu, Y., **Qin, Z.**, Zheng F., & Jafarpour B. (2024): "Spatio-Temporal Neural Networks for Monitoring and Prediction of CO<sub>2</sub> 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<sub>2</sub> 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

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- **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

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- **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

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

## SELECTED COURSES

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- **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