

Curriculum Vitae

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Areas of Expertise

- Fluid flow through porous media
- Geological CO₂ storage
- Hydro simulation
- Machine learning
- Optimization
- Computational Fluid Dynamics

Work Experience

Jul 2020 to Aug
2021

Undergraduate Internship

Subsurface Fluid Flow and Transport Lab (SFTL),
Department of Energy Resources Engineering, Seoul
National University

Seoul, Republic of Korea

Academic Background

Mar 2017 to Aug
2021

B.S., Energy Resources Engineering, Seoul National
University

Sep 2021 to
Present

Integrated MS/Ph.D. course, Energy Systems
Engineering, Seoul National University

Publications

- International Journal Articles

1. Oh, H, Yoon, H., Park, S., Kim, Y., Sun, W., Estimation of CO2 Storage Capacities in Saline Aquifers Using Material Balance, Fuel, *accepted*
2. Kim, J., Yoon, H., Hwang, S., Jeong, D., Ki, S., Liang, B., Jeong, H., Real-time monitoring of CO2 transport pipelines using deep learning, Process Safety and Environmental Protection, Volume 181, 2024, Pages 480-492, ISSN 0957-5820, <https://doi.org/10.1016/j.psep.2023.11.024>.

- Domestic Journal Articles

1. none

- Non-Peer Reviewer Journal Articles

1. none
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Conferences

- International Conferences

1. Yoon, H., Kim, Y., Jeong, H., Sun, A., Ren, B., Robust Optimization of Brine Extraction Well Location for CCS: A Surrogate Model Using FMM and CNN, 84th EAGE Annual Conference & Exhibition, Vienna, Austria, June 5-8, 2023.
2. Yoon, H., Kim, Y., Jeong, H., Sun, A., Ren, B., Deep-learning-based surrogate model for brine extraction well placement for geological carbon storage, International Society for Porous Media, Online, May 31-June 4, 2021.

- Domestic Conferences

1. Yoon, H., Jeong, H., Kim, T., Sensitivity Analysis on the Separation Efficiency of Oil-water In-line Separator Using Computational Fluid Dynamics Modeling, Conference of the Korean Society of Mineral and Energy Resources Engineers, Seoul, South Korea, May 11, 2023.

2. Yoon, H., Kim, Y., Oh, H., Jeong, H., Fast Robust Optimization of a Brine Extraction Well Location for Carbon Storage Using Fast Marching Method and Convolutional Neural Network, Conference of Korean Society of Petroleum Engineers, Busan, South Korea, June 24, 2022.
 3. Yoon, H., Kim, Y., Oh, H., Jeong, H., Optimization of Brine Extraction Well Locations for Safe Geological Carbon Storage Using Fast Marching Method and Deep Learning, Conference of the Korean Society of Mineral and Energy Resources Engineers, Ulsan, South Korea, May 20-21, 2021.
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Awards and Honors

- Yoon, H., Jeong, H., The Excellent prize, KIGAM, Utilization of Geological Data and Artificial Intelligence Contest, Jul 2021.
 - Yoon, H., Paper Award, Conference of the Korean Society of Mineral and Energy Resources Engineers, May 2021.
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Current Research Topics

- **Prediction of Oil and Water Separation Efficiency of an Inline Separator Using Machine Learning**
 - Optimizing experiment settings using CFD simulator is costly.
 - A machine-learning model predicts separation efficiency using input data.
 - Good candidates for optimal conditions can be identified based on predicted efficiency.
 - This approach speeds up optimization and improves separation efficiency.
- **Prediction of CO₂ Corrosion in Pipeline Flow Using Machine Learning**
 - CO₂ flow containing water can cause pipeline corrosion in Carbon Capture and Storage projects, but simulating all scenarios is costly.
 - A machine-learning model predicts CO₂ corrosion rate using input data.
 - The model is improved by comparing predicted results with experimental data.

- This approach reduces simulation costs and improves the accuracy of predicting CO₂-induced pipeline corrosion rates.
 - **Robust Optimization of Brine Extraction Well Using Deep-Learning Based Surrogate Model**
 - Optimizing the location of brine extraction wells is crucial for maximizing the net present value (NPV) of the project.
 - Traditional optimization methods using reservoir simulations are time-consuming, and robust optimization considering geological uncertainty can be even more computationally expensive.
 - A proposed approach combines the fast-marching method (FMM) with a machine learning model based on convolutional neural network (CNN) for faster and more efficient NPV prediction
 - The proposed surrogate model can improve well placement decisions by reducing computational costs, ultimately improving project profitability
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Projects

- **Hydrogeological and Geomechanical Analysis of CO₂ Injection Behavior in Saline Aquifers with POSCO International**
 - Analyzed reservoir conditions and operational parameters using the Sleipner 2019 Benchmark model and CMG software to optimize CO₂ injection behavior.
 - Investigated outcomes such as CO₂ diffusion range, pore pressure changes, trapping mechanisms, anhydrite precipitation, and hydrate formation.
 - Reviewed 4D history matching procedures and latest trends.
- **Collaborative Project with KIGAM for the Optimization of the Operating Conditions of the In-line Separator**
 - Conducted a numerical simulation of a horizontal in-line separator using ANSYS Fluent software
 - Evaluated the impact of various injection parameters on fluid flow and separation efficiency

- Analyzed the sensitivity of the simulation results to different numerical methods and mesh sizes
 - Presented the project findings and results to our research group
 - **Geological Resource Data Utilization and Artificial Intelligence Contest - Robust optimization of a brine extraction well using FMM and CNN**
 - Developed a machine-learning model based on CNN to predict the net present value (NPV) using MATLAB
 - Presented the project result to a panel of judges from KIGAM (Korea institute of Geoscience and mineral resources) and won the excellent prize
 - **Prediction of Production Rate of Shale Gas Reservoirs**
 - Developed an LSTM machine-learning model using MATLAB
 - Predicts a shale gas production rate from short production history
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Certificated Programs

- ANSYS (from TSNE, <https://www.tsne.co.kr/>)
 1. Reactive Flow (2023.04.04~2023.04.05)
 2. Rocky for Particle Behavior Analysis (2023.02.14~2023.02.15)
 3. Rocky-Fluent Coupling (2023.02.16)
 4. Fluent Turbulence Basic (2023.01.05)
 5. Ansys optiSLang Optimization (2022.07.19)
 6. Fluent Multiphase (2022.02.17~2022.02.18)
 7. Basic CFD Analysis Using Fluent (2022.02.08~2022.02.11)
- CMG
 1. Introduction CMG Workflow & Modelling of Natural Fracture Reservoir (2021.08.23~2021.08.27)
 2. Modeling of Shale, Tight Oil and Gas Reservoirs (2020.01.06~2020.01.10)
- Schlumberger
 1. Rock Facies Modeling (2023.01.16 ~ 2023.01.19)

2. MEPO Uncertainty and Optimization Fundamentals (2022.07.04, 2022.07.08)
3. Petrel Property Modeling (2021.11.18~2021.11.19)
4. CCS Simulation (2021.11.02, 2021.11.09)
5. Symmetry Fundamentals (2021.02.02~2021.02.05)
6. PIPESIM Fundamentals (2020.10.28, 2020.10.30)