

Computational Fluid Dynamics of geological carbon
storage at the Rio Bonito Formation. REF 23PDR240
University of São Paulo

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Job Title Computational Fluid Dynamics of geological carbon storage at the Rio Bonito Formation. REF 2

Department Physics of Materials and Mechanics

<https://sites.usp.br/rcgi>

Institution University of São Paulo

Sao Paulo, Sao Paulo, Brazil

Date Apr. 5, 2024

Posted

Application Jul. 31, 2023

Deadline

Position August, 2023

Start Date

Job Post-Doc

Categories

Academic Engineering - Other

Field(s)

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Description

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Research theme area:

Materials Science, Fluid Dynamics, Engineering, Physics, Chemistry, Energy, and related areas.

Abstract:

The researcher will work with a multidisciplinary team on projects related to geological carbon storage. The aim is to analyze the impact of coupling pore-scale molecular simulation results to reservoir scale simulations, and to evaluate the potential of this multi-scale approach to reduce uncertainties in predictions on mineral trapping effectiveness and CO₂ plume migration, contributing to improving injectivity and safety assessments of geological carbon storage. Additionally, the proposed approach will be applied to identify strategies to maximize the CO₂ mineralization in conciliation with the maximization of cumulative injected CO₂, considering the geological context of Rio Bonito Formation sandstones located in the Paraná basin.

The candidate will collaborate with researchers from project 58 - Applied Assessment for the potential of BECCS in the Paraná sedimentary basin in Brazil of the FAPESP-Shell Research Centre for Gas Innovation of POLI-USP at the University of São Paulo. A summary of the program and projects can be found on the RCGI website (<http://www.rcgi.poli.usp.br/>).

Description:

The postdoctoral activities are projected for two years, and will follow a list of tasks (scientific reports and paper writing will be performed concomitantly):

1. Literature review;
2. Data Collection and Model Development: Gather relevant geological data, including reservoir characteristics, such as permeability, porosity, and rock properties. Obtain information on the fluid properties, such as CO₂ density and viscosity. Acquire boundary conditions, initial conditions, and any available field data for validation purposes. Develop a computational model that represents the subsurface geological formation and fluid flow processes;
3. Numerical Simulation and Analysis: Run the CFD simulation using the defined model and setup. Solve the governing equations numerically to simulate the fluid flow, CO₂ migration, and other relevant phenomena within the geological formation. Monitor and record the key variables of interest throughout the simulation. Analyze the simulation results to gain insights into the behavior of CO₂ within the reservoir. Evaluate factors such as CO₂ migration patterns, capillary trapping efficiency, or potential leakage pathways;
4. Validation of CFD simulations, considering literature's benchmarks laboratorial tests performed by other researchers at the RCGI;
5. Sensitivity and Uncertainty Analysis: Perform sensitivity analysis to identify the parameters or inputs that significantly influence the simulation results. Assess the uncertainty associated with the model inputs and evaluate its impact on the outcomes. Consider alternative scenarios and perform additional

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simulations to account for uncertainty;

6. Assessment of pore-scale properties for feeding reservoir-scale simulations.

Requirements to fill the position:

This project is suitable for a highly motivated candidate with:

- Strong background in Computational Fluid Dynamics (CFD), Numerical and Analytical Modeling, Optimization, and Material Processing.
- Excellent communication skills, and the ability to work collaboratively;
- The candidate must have a Ph.D. in Engineering, Physics, Chemistry, Mathematics, or Computing.
- The candidate must have obtained a doctorate degree less than seven years ago, a priority for candidates who have just completed the Doctorate, within the regular duration, with an excellent academic record in postgraduate studies.

Experience in this subject will be considered a plus:

- Strong background in geochemical reactions.
- Some experience with experimental work since validation will be done using experimental tools.

Basic knowledge or experience in one or more of the following codes/methods: OpenFOAM, OpenMDAO, interFOAM, waves2Foam, COMSOL, TOUGH, TOUGHREACT, OpenGeoSys, ANSYS Fluent.

INFORMATION ABOUT FELLOWSHIP:

This Postdoc is funded by FAPESP. The fellowship will cover a standard maintenance stipend of R\$ 9.047,40 per month.

MORE INFORMATION:

<https://sites.usp.br/rcgi/opportunities/>

Position: **Post-Doctoral Fellowship REF: 23PDR240**

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Contact Information

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