UNIVERSITY OF CALIFORNIA, IRVINE

THE HENRY SAMUELI SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

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Department of Civil and Environmental Engineering
Position: Postdoctoral Scholar and Ph.D. Research Assistantships with Professors MJ Qomi and Russ Detwiler
Salary: Commensurate with Experience and According to UCI Salary Scale.
Start Date: November 2023
Application Deadline: Open until filled

The Department of Civil and Environmental Engineering at the University of California, Irvine (UCI), invites applications to fill positions for 2 postdoctoral associates and 3 Ph.D. students to join the recently funded Center for Understanding Subsurface Signals and Permeability (CUSSP). CUSSP is a Department of Energy-funded center led by the Pacific Northwest National Laboratory (PNNL) to advance enhanced geothermal systems to make them a widely accessible and reliable renewable energy source. (https://www.pnnl.gov/news-media/enhanced-geothermal-offshore-wind-energy-gain-earthshot-support-pnnl)

The vision of CUSSP is to develop the ability to predict and control flow through fracture networks for enhanced geothermal systems (EGS) by advancing a basic understanding of the coupled chemo-mechanical interactions governing permeability evolution and by demonstrating novel methods to remotely sense and accurately simulate these interactions from the microscale to the field scale. Our principal goal is to demonstrate, for an intermediate-scale EGS testbed, the ability to reconstruct the spatiotemporal distribution of reactive flow properties that give rise to multiple time-lapse geophysical observables. To achieve this goal, CUSSP complements distributed seismic, strain, and temperature sensing with time-lapse electrical resistivity tomography to provide novel "orthogonal" information on the relationship between porosity, stress, and fluid chemistry. Enabled by advances in leadership class computing, joint inverse estimations of governing fracture network properties from these complementary data streams will be guided to physically meaningful solutions using novel physics-informed machine learning algorithms trained on chemo-mechanical process understanding from micro- to core-scale studies and discrete fracture network and multi-continuum forward simulations. Chemically controlled field-scale experiments will provide comprehensive time-lapse data sets for inversion and verification of system predictability.

The successful candidates will participate in this exciting multi-disciplinary project and collaborate with scientists from participating national laboratories (PNNL, ANL, and LBNL) and universities to bridge the gaps between understanding fundamental processes and successful field implementation of EGS at a well-instrumented test site. The work at UCI requires a combination of some of the skillsets described below:

- Computational modeling expertise, including code development experience related to one or more of the following: 1) Molecular dynamics (MD) simulations with reactive, non-reactive, and machine-learned force fields; 2) Kinetic Monte Carlo simulations; 3) Enhanced sampling techniques such as Metadynamics and umbrella sampling; 4) Classical Density Functional Theory (cDFT) of confined ionic fluid; 5) Flow and reactive transport in fractured porous media. As for programming, we prefer familiarity with Matlab, Python, and C++. Prior experience with high-performance computing (HPC) clusters is an advantage.
- Experimental design and implementation, including the following: 1) Pore-scale or microscale experiments in porous or fractured media; 2) Imaging of flow and transport processes in micromodels; 3) Core-scale experiments in fractured rock under reservoir conditions (high pressure and temperature); 4) Measurement of electrical resistivity in porous or fractured media. Expertise with data analysis, including image processing, using tools such as Matlab or Python is desirable.

We welcome applicants from various backgrounds, including civil and environmental engineering, earth sciences and geophysics, geochemistry, geomechanics, applied physics, computational and experimental materials science, and chemistry. For postdoctoral applicants, we expect a proven track record of peer-reviewed publications in relevant scientific journals. Because this project involves collaborators from multiple institutions, enthusiasm for scientific collaboration is necessary, and strong written and oral communication and presentation skills are critical.

The postdoctoral scholars and Ph.D. students will work in Professors MJ Qomi's and Russ Detwiler's research groups to conduct their interdisciplinary research projects toward a better understanding of enhanced geothermal systems.

- For postdocs, the initial appointment will be for 24 months, renewable, subject to performance and continuation of project funding. Postdoc salary will be commensurate with qualifications and experience and includes health insurance and benefits. Minimum postdoc qualifications include a Ph.D. in one of the aforementioned areas or a closely related field from an accredited university.
- For Ph.D. research assistantship applicants, the initial appointments will be for five years, subject to good academic standing, per UCI policies. These appointments cover tuition, a generous stipend, health insurance, and benefits.

The University of California, Irvine is located in the heart of beautiful Orange County, nestled between Los Angeles and San Diego counties and only five miles from Southern California's sunny shores. A cornerstone of Irvine, one of the safest cities in the U.S. and home to Southern California's burgeoning tech coast, UCI is the perfect place to study, work, live, and play. Irvine combined the best of a college town community with the vibrant opportunities of a bustling city. Our proximity to shopping, amusement parks, premier arts and cultural centers, and industry leaders make UCI a destination unlike any other.

Postdoctoral applicants should submit a cover letter, curriculum vitae, publications, and contact information for three references. Apply by submitting your application to our online RECRUIT system at: https://recruit.ap.uci.edu/JPF08710

Ph.D. applicants should submit their full application form through the official UCI website to the Civil and Environmental Engineering program. https://apply.grad.uci.edu/apply/

For questions, please contact Professors MJ Qomi (mjaq@uci.edu) or Russ Detwiler (detwiler@uci.edu).

Screening of applicants will begin immediately and continue until the positions are filled.

The University of California, Irvine is an Equal Opportunity/Affirmative Action Employer advancing inclusive excellence. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, age, protected veteran status, or other protected categories covered by the UC nondiscrimination policy.