

PhD Studentship: Next-Generation Fracture Modelling

Background: Fractures transform Earth materials. They change their mechanical and flow properties and create intricate subsurface networks that enhance permeability at local and regional scales. We develop next-generation simulators that simulate in great detail how large groups of fractures and faults grow, and how growth affects the properties of the system. We seek to understand how growth is affected by heterogeneities at multiple scales, and how the interplay between fluid flow and mechanics affects these interactions.

Description of Research Project: We are currently recruiting a PhD student to conduct research that will contribute to understanding the effect of the small scale on the mechanical and flow properties of growing fractures. The objective of this project is to develop methods to computationally model the effect of multi-scale heterogeneities on rock fracturing processes. Specifically, the student will contribute to the development of an existing advanced simulator, written in C++, and develop methods for high- and low- level optimization of rock fracture growth numerical simulation methods, ranging from algorithmic re-design using isogeometric methods and machine learning strategies, to physical analysis of fracture interaction effects on permeability and growth.

Requirements: Applicants should have an undergraduate degree in engineering, physics, geophysics, applied mathematics, material science, computer science, or alike. Experience in one or more of the following is desirable:

- Solid mechanics: knowledge of continuum mechanics and fracture mechanics.
- Numerical methods: knowledge of finite element methods, isogeometric methods, or machine learning for partial differential equation resolution and optimisation.
- Scientific programming: ability to program in a scientific programming language such as C/C++, Fortran, Matlab.
- Communication: excellent writing and presentation skills.

Other details: This is a 3.5-year PhD studentship, paying a non-taxable bursary of £17,000 per year, and covering UK/overseas tuition costs. The student will work under the supervision of **Dr Adriana Paluszny**, and includes interactions with **Prof Robert W Zimmerman** from the Rock Mechanics Group at Imperial College London.

Application Procedure: Please apply online at:

<https://www.imperial.ac.uk/study/pg/apply/how-to-apply/apply-for-a-research-programme/>. Please also submit an email to apaluszn@imperial.ac.uk registering your interest for the PhD project. The closing date for applications is **15 June 2021**.

Consistently rated amongst the world's best universities, Imperial College London is a science-based institution with a reputation for excellence in teaching and research.

Applications from women and underrepresented groups are particularly encouraged.