

An Indian-Australian research partnership

Project title **Modelling of fracture formation in sedimentary rocks due to fluid pressure**

Project number:

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Research Academy theme/s

The research academy theme/s that is relevant to the project

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure engineering
3. Clean energy

The research problem

Fracture formation in sedimentary rocks is important for many geoscience and geomechanics applications. For example, fracture can occur in geothermal energy systems, rock slopes in mining, grouting or liquid or gas pumping operations such as in CO₂ sequestration, pressuremeter or packer testing, and hydraulic fracturing in oil or gas production. The modeling of fracture formation in intact material is generally based on linear elastic fracture mechanics concepts. There are several problems associated with this approach. For instance, the strength of sedimentary rocks can be such that under high confining stresses, they behave in more ductile manner, similar to a soil, hence the applicability of linear elastic fracture mechanics is questionable. Also, the application of linear elastic fracture mechanics requires mesh rezoning as the crack propagate hence not suited for multiple crack initiation and propagation, and consideration of fluid flow through newly formed cracks is cumbersome. This project proposes to use 'cohesive crack model' to simulate fracture development in these rocks which can cater for both linear elastic behavior and material plasticity.

Project aims

The main aims of the project are:

- Develop cohesive crack properties for economically important sedimentary rock types under both Mode I and Mode II and mixed mode fracture.
- Develop cohesive crack modeling using finite element/finite difference involving material discontinuities.
- Apply the new method to selected field applications as noted above.

Expected outcomes

The outcomes will be development of new knowledge in fracture properties of (soft) rocks subject to different confining stresses under both Mode I, Mode II and mixed mode fracture conditions. Other major outcome will be the development models to more realistically analyze economically and environmentally important 'energy' related field applications.

Which of the above Theme does this project address?

Primarily the project addresses infrastructure engineering, clean energy and advanced computation and manufacture.

How will the project address the Goals of the above Themes?

The project will be based on both experimental and numerical modelling. The project will address sustainable infrastructure and mining and resources engineering (clean energy) that underpins the economy of a country.