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Development of a finite element code to solve thermo-hydro-mechanical coupling and simulate induced seismicity.

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Coupled thermo-hydro-mechanical modeling is essential for CO_2 storage because of (1) large amounts of CO_2 will be injected, which will cause large pressure buildups and might compromise the mechanical stability of the caprock seal, (2) the most efficient technique to inject CO_2 is the cold injection, which induces thermal stress changes in the reservoir and seal. These stress variations can cause mechanical failure in the caprock and can also trigger induced earthquakes.
To properly assess these effects, numerical models that take into account the short and long-term thermo-hydro-mechanical coupling are an important tool. For this purpose, there is a growing need of codes that couple these processes efficiently and accurately. This work involves the development of an open-source, finite element code written in C ++ for correctly modeling the effects of thermo-hydro-mechanical coupling in the field of CO_2 storage and in others fields related to these processes (geothermal energy systems, fracking, nuclear waste disposal, etc.), and capable to simulate induced seismicity.
In order to be able to simulate earthquakes, a new lower dimensional interface element will be implemented in the code to represent preexisting fractures, where pressure continuity will be imposed across the fractures.