MASTER'S DISSERTATION AT GEOTECHNICAL ENGINEERING

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PRESENTATION
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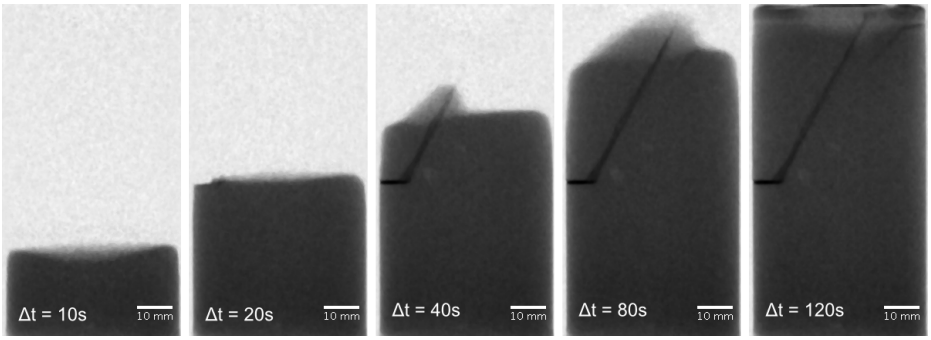
NUMERICAL SIMULATION OF FLUID FLOW IN A ROCK SAMPLE



Source: http://lup.lub.lu.se/record/7513562

BACKGROUND AND AIM WITH THESIS

The permeability of soil materials is an important parameter in the design of tunnels, subterranean depots as well as in Hydrocarbon extraction and CO2 sequestration, amongst other things. As it depends on different factors, as joints, material, porosity, and specific surface, the available equations, which are derived from empirical studies on large- and meso-scale geology samples, are not sufficient to describe its local inhomogeneity. Therefore, it is essential to study the permeability in small-scale experiments, with the help of full-field methods to better determine the applicability of the available empirical laws.

A commonly used method in the field is X-ray imaging. The X-rays attenuate through hard material which is practical for depicting solid material. However, it is not suitable for displaying fluids in a rock sample.

Neutron radiography is a more appropriate method to distinguish water, due to the strong attenuation of the hydrogen that results in a higher contrast of the images. Accordingly, the presence of water is more easily detectable with neutron radiography than traditional X-ray methods. Hence, neutron radiography is explored as a new method in order to study fluid flow through geological samples.

In this work experimental data collected using neutron radiography during water flow into sandstone samples, at the laboratory scale, both intact and deformed, will be considered. The displacement of the water front will be numerically simulated and compared to the experimental results. The long term perspective is to understand how localised deformation, and consequent change in porosity, affect the local permeability.

METHOD

Analysing the flow using Finite Element Method in ABAQUS, I aim to create a 3-D model of the tested sample and simulate the water front to match the images taken using neutron radiography.

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