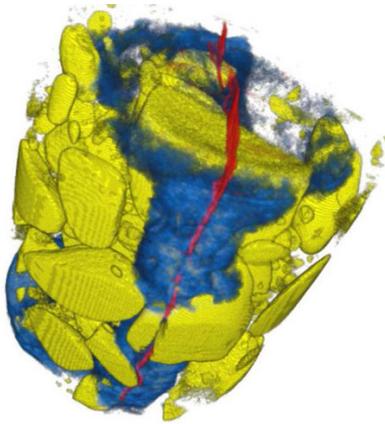


PhD Position

« Fluid phase change simulation in porous and cracked media based on multimodal full-field measurements »

Project summary

The performance of reinforced concrete containment structures is analysed with respect to their ability to prevent a fluid from percolating through the wall. For concrete structures, the leaks break down into two flows, one of which passes through the porous networks of the cement matrix and the other passes through eventual cracks. Conventionally, the fluids used to test the tightness are either liquid water or a neutral gas. In reality, the percolating fluid could be more complex, consisting of a mixture of air and hot water vapour.



Concrete sample 3D rendering from Neutron tomography at the end of the injection test (yellow: gravels, red: initial crack, blue: wet zones).

The present project aims to pursue towards the quantitative experimental analysis and numerical multi-physics modelling of the two-phase (hot steam and air) flow and condensation processes during injection into fractured concrete material. Indeed, first ever experiments of in-situ quantitative visualisation of vapour condensation in cracked concrete through high-speed neutron radiography have been performed revealing a complex interplay between pressure and sorption flow phenomena and a significantly different behaviour between dry and saturated sample.

Since samples with intermediate saturation states cannot be easily obtained, this project will rely on numerical simulations of fluids in solids in order to investigate the intermediate saturation rate effects (after a throughout calibration of multi-physics models on the experimental results obtained in extreme cases). The global aim is to establish a direct physical link between the material microstructural content and the pre-inserted fracture network with fluid flow that will allow reaching a step further in well predicting the structural reliability and durability concrete structures.

Location and practical aspects

The successful applicant will be hosted by the laboratory 3SR in the “RV” team. He/she will work under the supervision of Dr Briffaut Matthieu from Laboratory 3SR and Dr Sechet Philippe from Laboratory LEGI. The gross salary will be 1787 euros/months, equivalent to a net salary of 1414 euros/month.

Qualifications of the applicant

Strong background in fluid mechanics or background in computational mechanics (solid or fluid) is expected. However, profiles within the fields of geophysics or material science with focus on the transfer in porous media will also be regarded with interest.

Image analysis and knowledge of python (or C++) programming language are considered as a plus.

Applications

Interested candidates should send their CV and cover letter to matthieu.briffaut@3sr-grenoble.fr , Philippe.Sechet@legi.grenoble-inp.fr , bratislav.lukic@esrf.fr .

Deadline for the application: 20 June 2021