



**HAL**  
open science

## **DFN.lab: software platform for Discrete Fracture Network models.**

Romain Le Goc, Benoît Pinier, Caroline Darcel, Etienne Lavoine, Diane Doolaeghe, Silvia de Simone, Jean-Raynald de Dreuzy, Philippe Davy

### ► **To cite this version:**

Romain Le Goc, Benoît Pinier, Caroline Darcel, Etienne Lavoine, Diane Doolaeghe, et al.. DFN.lab: software platform for Discrete Fracture Network models.. American Geophysical Union Fall Meeting 2019, Dec 2019, San Francisco, United States. , pp.H41H-1778, 2019. insu-02402555

**HAL Id: insu-02402555**

**<https://insu.hal.science/insu-02402555v1>**

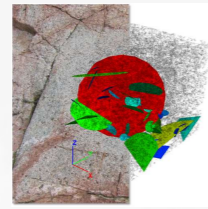
Submitted on 14 Sep 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

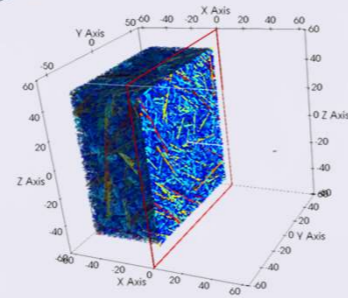
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

DFN.lab is developed by the **Fractory**, a joint laboratory between Itasca France, the CNRS and the university of Rennes.

Missions: Research, Consulting R&D and teaching

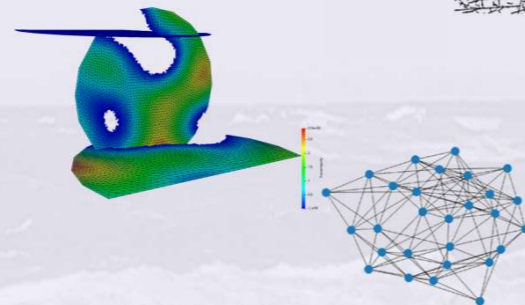
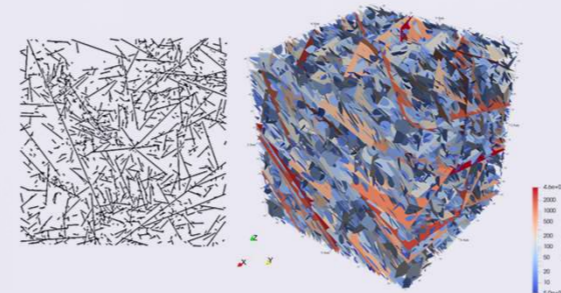


## Features



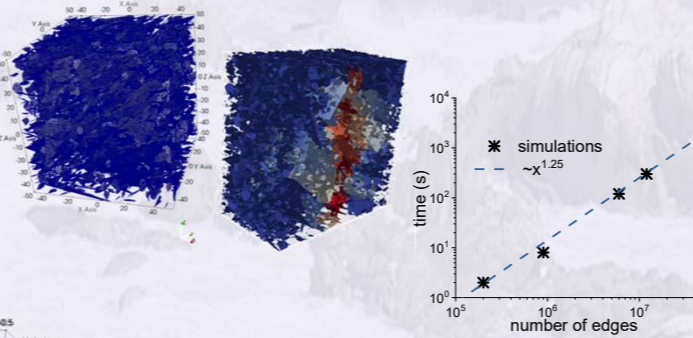
**Various geometries**  
Polyhedral systems  
Planar convex fractures  
1D boreholes, tunnels

**DFN generation**  
Statistical fractures  
Genetic models based on fracture mechanics

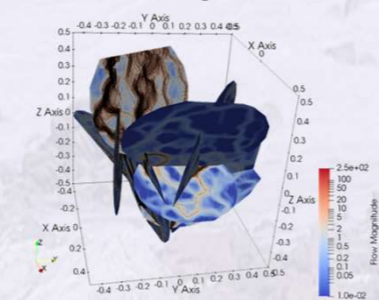


**Heterogeneous properties**  
Sealing, transmissivities  
**Advanced graph algorithms**  
structural analyses

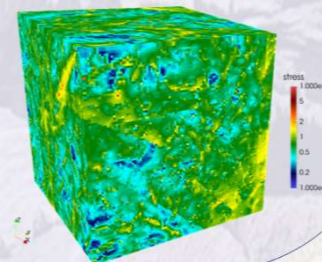
**Conforming mesh**  
millions of fractures  
**Flow simulations**  
steady-state, transient  
MHFE scheme  
Efficient solution  
**Flexible conditions**  
permeability, pumping



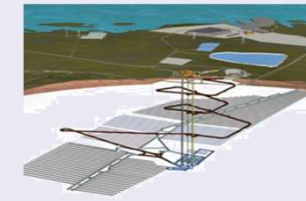
**Transport in fractures**  
particle tracking method  
millions of particles  
**Analyses**  
Breakthrough curves, channeling



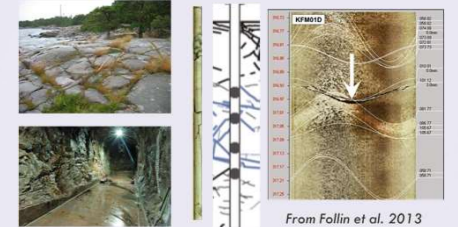
**Linear elastic mechanics**  
Strain/Stress/displacement fields in and out of fractures  
Stress intensity factors  
Effective rock mass properties



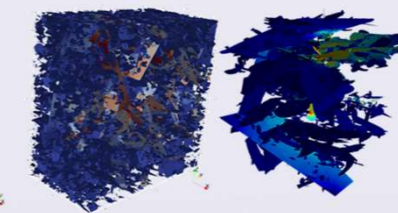
## Applications



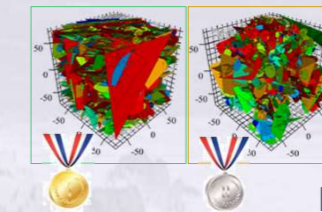
**Risk assessment studies for nuclear waste repositories**



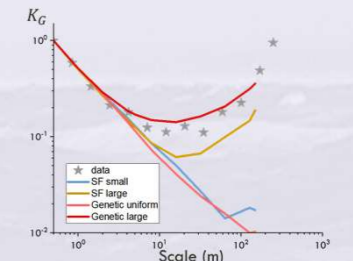
Data integration: definition of site-scale DFN models



Statistical characteristics of flow: permeability and channeling



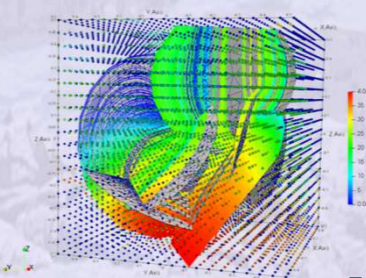
Large scale Pumping tests with 2 order of magnitudes between  $l_{min}$  and  $L$



Evaluation and discrimination of models

Further details: *Davy et al.* H41H-1760

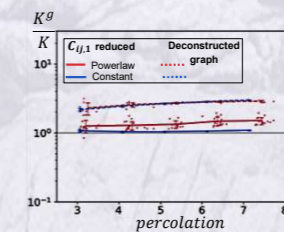
**Heat transfer in fractured rocks**



Heat transport in fractures with Lagrangian methods coupled with matrix diffusion.  
Dynamic fractures' aperture modifications

Further details: *de Simone et al.* H41H-1786

**Fast estimation of flow with graph methods**



DFN transformed into graph for fast estimation of flow and transport in fractures

Further details: *Doolaege et al.* H34A-01

**Fast, efficient, state-of-the-art**

High-performance core in C++  
Python API  
Dynamic application-oriented development  
Compatible with Jupyter Notebook

**Modularity**

Divided in modules  
Complete workflows from DFN generation to advanced simulations

**Reliability**

Testing, Versioning  
Publications in peer-reviewed journals  
Q/A for industrial applications

**Publications**

Pinier et al. *Computation of flow and transport properties on large heterogeneous 3D fractured media*, to be published

Lavoine et al. *A Discrete Fracture Network with stress-driven nucleation*, *Frontiers in Physics*, accepted.

**Contact**

[www.fractory.org](http://www.fractory.org)

<https://gitlab.com/fractorylab/dfnlab>

fractory@itasca.fr