Etienne Lavoine

Geotechnical Project Engineer

Expertise	Numerical modeling in geomechanics and hydrogeology. Civil engineering - Fractured media - Nuclear waste disposal.
Education	Ph. D. in Earth Sciences, University of Rennes, France, 2020 Engineering diploma in numerical geosciences, Ecole Nationale Supérieure de Géologie, Nancy, France, 2016

Professional Experience

2023 – Today	*Itasca Consultants S.A.S., Lyon, France* *Project engineer, "Civil engineering" team*
2020 – 2023	*Fractory, Rennes, France* *Research engineer*
2016 – 2020	*Fractory, Rennes, France* *PhD student*
2016	*Technodigit, Lyon, France* *Software engineer*

Project Experience

Consulting in civil engineering: tunnels, underground storage, dams, slope stability...

Consulting on fracture network analysis: analysis of fracture data and site model building, characterization and analysis of hydromechanical properties of fractured media.

Numerical development: algorithms for Discrete Fracture Network generation, and block stability analysis.

Training courses: numerical modeling for engineers (continuous and discontinuous).

Communication: communication materials (flyers, posters, social media) and software tutorials.

Projects

Underground storage:

- 3D modelling of tunnel intersections, as part of the Cigéo project of the French National Radioactive Waste Management Agency (ANDRA), including short- and long-term analyses of the surrounding rock and support elements.
- 3D modelling of cross-level galleries, as part of the Cigéo project (ANDRA).
- Comparison between the so-called 'phenomenological' and 'engineering' approaches concerning constitutive laws used to simulate the short- and long-term behaviour (creep) of the Callovo-Oxfordian clay as part of the Cigéo project (ANDRA).

- Sensitivity analysis on various elements (backfill type and geometry, centre-to-centre distance between galleries and orientations, clay constitutive law, excavation fractured zone extension, etc.) for connection galleries and long-lived-medium-activity cells, as part of the Cigéo project (ANDRA).
- Predictive mechanical stress models for radioactive waste disposal sites.

Civil engineering:

- Mechanical modelling and flexibility matrix calculation for infrastructure foundations for EPR nuclear reactors.
- Modelling of instabilities observed during the excavation of ventilation shafts as part of the Lyon-Turin transalpine rail link (TELT).
- Stability analysis of the Morena dam (San Diego, USA).

Mining engineering:

- Development of an open-pit block detection tool based on a Discrete Fracture Network (DFN) approach, and stability analysis (kinematic method).

Research et development:

- Calculation of the effective mechanical properties (elasticity and strength) of fractured media using a Discrete Fracture Network approach.
- Development of algorithms to generate "genetic" fracture networks from simplified mechanical laws.
- Quantification of the spatial variability of fracture densities in 2D and 3D.