

Geomechanics Specialist

Expertise	Brittle Failure, Rockbursting, Deformation-Based Support Design, Continuum (FLAC, RS2) and Discontinuum (PFC) Numerical Modelling, Mining-Induced Seismicity, Stochastic Modelling (ETAS Models), Re-entry Protocols
Education	Ph.D. (Geological Engineering), to be completed in 2026 Queen's University (QU), Kingston, Ontario, Canada M.Sc. (Mining Engineering), 2019 University of Chile, Santiago de Chile, Santiago Province, Chile B.Sc. (Mining Engineering), 2017 National University of Colombia, Medellin, Antioquia, Colombia
Honors	Best Paper and Presentation Award, RaSiM 11, Luleå, Sweden, 2025 Winner of RockBowl Competition, Trondheim, Norway, 2025 Dr. Al Gorman Teaching Assistant Excellence Award for GEOE 313, QU, 2023 Paul and Coryn Hemsley Teaching Assistant Award for GEOE 151, QU, 2023 Dr. Al Gorman Teaching Assistant Excellence Award for GEOE 151, QU, 2021

Project Experience

Impact of Loading System Stiffness (LSS) Contrasts with the Rockburst Intensity of Hard Brittle Rocks during Uniaxial Compression Using Discontinuum Modelling in PFC2D:

It was demonstrated that rock properties control the failure process when the LSS is stiff, and that the severity of bursting is dominated and amplified by the external LSS and the associated excess elastic strain energy input when the LSS is soft. In stiff settings, such as during single tunnel advances, the brittleness of the rock dominates the spalling severity. In soft settings, such as during late-stage mining or on footprints of caving operations, the mine's LSS at the time of bursting controls the rockburst severity in terms of displaced volume and the rockburst intensity in terms of ejection velocity.

Redefined the Cohesion-Weakening (CW), Frictional Strengthening (FS), and Dilatancy Mobilization (DM) Rationale in Continuum Numerical Modelling, e.g., FLAC2D, as a Function of the Independent Variable, the Major Vertical Strain (ϵ_1):

Laboratory test results and constitutive behaviour emerging from verified and calibrated discontinuum simulations in PFC2D were used to calibrate and validate the proposed approach in FLAC. Traditionally, the CWFSDM rationale is defined in terms of the dependent variable plastic shear strain. As highlighted by Crouch (1970), ϵ_1 is the independent variable in deformation-controlled testing. Volumetric and associated plastic shear strain become increasingly non-objective once strain localizes into thin shear bands. This is because faulting separates the rock specimen into rigid bodies with large lateral and shear strain fluctuations.

Evaluation of Rock Mass Response to Mining and Preconditioning:

Applied stochastic models (e.g., Epidemic Type Aftershock Sequence [ETAS]) to quantify seismic hazard, background noise, seismic decay rate, and aftershock sequence productivity during tunnel development at El Teniente mine, characterizing rock mass response before, during, and after hydraulic fracturing and destressing. This stochastic approach has been implemented to evaluate alternative preconditioning designs and can also be applied to characterize seismicity patterns in geotechnical domains.