Athena Pirayehgar ITASCA

Geomechanics Consultant

Expertise	Geomechanics, Numerical Modeling, Microseismics
Education	Ph.D. (Civil/Geomechanics Engineering), 2016 University of Waterloo, Waterloo, Ontario, Canada
	M.Sc. (Mining/Petroleum Engineering), 2009 University of Tehran, Tehran, Iran
	B.Sc. (Mining/Exploration Engineering), 2006 University of Tehran, Tehran, Iran

Professional Experience

2020 – Present	*Itasca Consulting Canada Inc., Sudbury, Ontario, Canada* *Geomechanics Consultant*
2018 – 2020	*RockEng Inc., Kingston, Ontario, Canada* *Geomechanics Consultant*
2017 – 2018	*Itasca Consulting Inc., Calgary, Alberta, Canada* *Geomechanics Consultant*

Project Experience

Pallas Green Feasibility Study: Geotechnical site characterization and assessment of appropriate mining methods. Geomechanical modeling via *FLAC3D* to assess pillar and stope stability, geotechnical assessment of the crown pillar using numerical and empirical methods, evaluation of infrastructure siting, recommendations on stope sizing, support design, backfill, and recovery requirements and mine sequence.

Mequillon Underground Feasibility Study: Geotechnical site characterization, geomechanical stress modeling via *FLAC3D*. Geotechnical assessment of the crown pillar using numerical and empirical methods. Geotechnical assessment of pillar and stope stability using empirical methods with input from numerical modeling results, evaluation of infrastructure siting.

Mesamix Pit Pushback Design: Data review and gap analysis. Geotechnical site characterization.

Island Gold Mine: Numerical stress modeling and geomechanical assessment including data review and gap analysis and geotechnical site characterization. Numerical model development via *FLAC3D*, preliminary model calibration to seismic data, definition of additional data collection and refinement of site characterization, model calibration refinement, forward simulations and interpretations, and technical documentation.

Scanline Procedure at Eleonore Mine: Site preparation and collection of scanline data, including RQD measurements, structural orientation data, and characteristics of discontinuities.

Reyna de Plata Geomechanical Study: Data review and gap analysis. Geomechanical site characterization, including rock mass characterization, structural analysis using DIPS, rock mass classification, delineation of geotechnical domains and design quadrants, rock strength estimation. Engineering pit design, including

kinematic analysis of bench stability, and empirical and numerical analyses of slope stability. 3D numerical modeling via RS3 and *FLAC3D* for stability analyses to represent geotechnical domains and large-scale structures and governing mechanics of rock behavior. Worked with the Rocscience technical support team providing QA and product testing RS3. Interpreted numerical results and documented study conclusions and recommendations.

Kazzinc Prefeasibility Study of Obruchevskey and Dollinoye Underground Mines: Numerical simulations of governing mechanics of the rock behavior using RS3 and *FLAC3D*. Evaluating geomechanical risks and opportunities related to the mining method, sequencing, and infrastructure siting. Interpreting numerical results and documenting the study conclusions and recommendations.

Canadian Royalties Pit Optimization: Logging cores for five geotechnical holes to assess stability of the pit walls as part of the pit design. Geomechanical site characterization, including rock mass characterization, structural analysis using DIPS, rock mass classification, delineation of geotechnical domains and design quadrants. Engineering pit design and analyzing bench scale and multi-bench scale slope stability using empirical and numerical methods. Finalize pit design using kinematic analysis (DIPS) and numerical analysis (RS2).

Numerical Modeling of Hydraulic Fracturing for Cave Pre-Conditioning for Newcrest Inc.: Generate a 3D numerical model using *3DEC* to simulate hydromechanical coupling mechanism. Develop a calibrated model for back analysis of HF treatment efficiency based on the field data provided by Newcrest. Further advance the state-of-practice for numerical simulation of HF propagation and rock mass response, with particular focus on the application of this strategy for rock mass pre-conditioning in underground mines.

Pit Expansion Study for Barrick Gold Corporation: Development of 3D numerical models using *FLAC3D* to analyze the current rock mass conditions to interpret state of stability for current pit slopes, forward simulations of planned pit expansion, and calibration of numerical simulations to the measured ground response data.

Microseismic and Geomechanical Evaluations: Performing a geomechanical interpretation of the seismic moment tensor inversion (MTI) data to enhance the microseismic interpretation of the hydraulic fractures and construction of a discrete fracture network.

Induced Seismicity Hazard Investigation and Mitigation Recommendations: Creating a geomechanical model via *3DEC* to simulate seismicity associated with the hydraulic fracturing and calibrate the model to represent the recorded seismicity. Performing a parametric sensitivity study to assess various completion and injection design factors impacting the modeled induced seismicity relative to the calibrated response.

Hydraulic Fracture Modeling Calibrated to Microseismic Data: Performed a geomechanical model via *3DEC* to optimize the hydraulic fracture injection volume and rate as well as to investigate potential fault activation.

Influence of Jointed Fabric and Stress Ratio on Deformation and Fluid Flow: Developed effective control of energy release from deviatorically stressed rock masses via *UDEC*. Developed appropriate ways to enhance fracture network conductivity to help drainage passageways develop in a complex interconnected jointed system. Evaluated the influence of fabric and in-situ stresses on fracture deformation and fluid flow. Conducted a parametric study on the effects of geometrical attributes on fluid flow in a jointed system.

Modeling of Waste Injection Operations: Conducted a feasibility study of a numerically modeled deep well disposal injection operation using *UDEC*. Modeled different types of injection strategies for two different case studies along with shut-in conditions. Results have been submitted as a patent application on May 2016.

Smart Underground Monitoring and Integrated Technologies for Deep Mining (SUMIT): Numerically modeled hydraulic injection via *UDEC* and studied the effect of in-situ stresses on fluid flow, evaluated the effect of injection distance on the stimulated zone.

Determination of Petrophysical Cut-off Values based on Petrophysical Analysis and Core Data in order to Increase Accuracy of Hydrocarbon Reservoirs Estimation: Conducted a sensitivity analysis on effective parameters such as porosity, permeability, water saturation, etc. Presented a model to estimate petrophysical cut-off values for the corresponding field.

Geomechanical modeling of Asmari Formation: Implemented conventional methods in rock physics to estimate values of seismic waves and then geomechanical parameters. Utilized MATLAB and Neuro Solution to predict geomechanical properties. Evaluated accuracy of each method by comparing outputs with real data. Built a Mechanical Earth Model (MEM) to evaluate drilling risks and avoid unexpected problems or increased well costs using PETREL.