Gysbert Basson ITASCA

Numerical Modeller, Software Engineer and Seismologist

Expertise

Numerical Modelling (Boundary Element Method, Discrete Element Method, Finite Element Method, Material Point Method, Seismic Source Kinematic Modelling), Software Development, Mine Seismology, Mathematical Modelling, Seismic Waveform Processing, Machine Learning Models, Hydraulic Fracturing for Preconditioning in Mining, Seismic Hazard Analysis, Mine Re-entry, Trigger Action and Response Plan, Seismic Source Mechanism Analysis

Education

Ph.D. (Applied Mathematics), 2022
University of Tasmania, Hobart, Tasmania, Australia

M.Sc. (Applied Mathematics), 2011
University of Stellenbosch, Stellenbosch, Western Cape, South Africa

Honours, B.Sc. (Applied Mathematics), 2007
University of Stellenbosch, Stellenbosch, Western Cape, South Africa

B.Sc. (Mathematical Sciences), 2006
University of Stellenbosch, Stellenbosch, Western Cape, South Africa

Professional Experience

2023 – Present	*Itasca Australia Pty Ltd, Hobart, TAS, Australia* *Numerical Modeller, Seismologist and Software Engineer*
2010 – 2022	*Institute of Mine Seismology, Kingston, TAS, Australia* *Seismologist, Software Developer and Numerical Modelling Expert in Mining*
2007 – 2010	*ISS International, Stellenbosch, Western Cape, South Africa* *Seismologist, Software Developer and Numerical Modelling Expert in Mining*

Project Experience

(2018 – 2022) Ph.D. dissertation: The project makes 4 major contributions to numerical simulation for mining applications. First, a new numerical solver known as the Material Point Method (MPM) is modified to address quasi-static mining related problems. With this, a new meshing technique is developed for the MPM (also applies to *FLAC3D*) such that it can be used to simulate models of large mining layouts. Second, a method is developed to extract seismic events from elasto-plastic regions in the model. Third, an algorithm of the coupled MPM is proposed to handle problems of fluid- and solid mixtures in mediums with heterogeneous permeability. Fourth, a new method for handling fractures as well as fracture propagation is proposed. This is used to simulate hydraulic fracturing preconditioning in mining where a dense fracture network is created within a small volume of rock such that stress is redistributed away from the area and becomes less seismically hazardous. These additions to numerical modelling in mining allow for addressing a wide range of problems, all with the goal to have better control over mining-induced seismicity.

(2007 – 2022) Research and Development of Numerical Solvers for Deep Underground Mining: Researched and implemented various numerical simulation techniques, namely the Boundary Element Method, Finite Element Method, Discrete Element Method and Material Point Method, to research and address various mining related problems. These tools were successfully used in numerous mining projects to address a diverse set of problems.

(2010 – 2022) Research, Development and Application of Micro-Seismic Analysis Software for Mining: Developed micro-seismic software for mining; large event analysis, seismic hazard assessment, seismic waveform processing, blast reentry analysis, trigger action and response plan, seismic ground motion analysis, CAD, routine seismic reporting.

(2021) Machine Learning Models for Classifying Seismic Waveforms: Researched and implemented various supervised machine learning methods to classify raw seismic waveforms recorded from a mine's seismic systems.