

## REGISTER ONLINE:

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**REGISTRATION DEADLINE September 11, 2023**

### Send registrations to:

SME Meetings Department  
E-mail: [meetings@smenet.org](mailto:meetings@smenet.org)  
Phone assistance: 720-738-4085  
12999 E Adam Aircraft Cir.  
Englewood, CO 80112  
Additional info: [admrcr.mining@mcgill.ca](mailto:admrcr.mining@mcgill.ca)

### CIM, SME, AusIMM, and SAIMM Members

\$2,550 USD (excluding taxes)

### Non-members

\$2,750 USD (excluding taxes)

Title: \_\_\_\_\_ Name: \_\_\_\_\_

SME, CIM, AusIMM or SAIMM Member #: \_\_\_\_\_

Job Title: \_\_\_\_\_

Employer: \_\_\_\_\_

Postal Address: \_\_\_\_\_

City: \_\_\_\_\_

Prov./State: \_\_\_\_\_ Postal/Zip Code: \_\_\_\_\_

Country: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Email: \_\_\_\_\_

I will bring a laptop:  Yes  No

Payment:  Visa  Mastercard  Amex  
 Cheque  Wire Transfer

Card Number: \_\_\_\_\_

Expiry Date: MM/YY Amount \$: \_\_\_\_\_

CCV Code (3 digit code on back of card): \_\_\_\_\_

Name on Card: \_\_\_\_\_

Signature: \_\_\_\_\_

Registration includes course notes, lunch, and morning and afternoon tea.

Participation in this course may be a valid activity towards continuing professional development with **up to 26 contact hours**. Participants receive a Certificate of Completion.

Notification of Cancellation received in writing up to **September 11, 2023** (minimum of 10 working days before the course) will incur a 20% cancellation fee. No refund will be made after this time. An alternative participant may be nominated. If cancellation done by the organizer, travel expenses including penalties for booking cancellations will not be reimbursed to registered participants. Please ensure that all travel arrangements done can be cancelled as we will not be responsible.

## INSTRUCTORS

**David F. Machuca, Ph.D., P.Eng.** is a Principal Consultant in Geostatistics at SRK Consulting Canada. David has around 20 years of experience in mining operations, academic research and consulting related to the evaluation of various types of mineral and energy resources. His areas of expertise include the application of standard and advanced geostatistical methods for mineral resource modelling, grade and geological uncertainty and risk assessment and value of information studies. His consulting activities also include the auditing of mineral resource estimation processes, due diligences of mining projects in various stages, as well as the preparation of technical reports and training. He holds a PhD from the University of Alberta and a Postgraduate Diploma in Mining Geostatistics from MINES ParisTech. Prior to joining SRK, David was a research associate at COSMO – Stochastic Mine Planning Laboratory where he conducted research on advanced geostatistical simulation methods. He has taught basic and advanced geostatistics and sampling theory courses in English, Spanish and French for universities and the industry in Canada, Africa, and Latin America.

**Roussos Dimitrakopoulos** is a Professor and Canada Research Chair (Tier I) in Sustainable Mineral Resource Development and Optimization under Uncertainty, and Director of the COSMO – Stochastic Mine Planning Laboratory. He holds a PhD from École Polytechnique de Montréal and an MSc from the University of Alberta. He works on risk-based simulation and stochastic optimization, as well as on artificial intelligence applications in mine planning and production scheduling, along with the simultaneous optimization of mining complexes and mineral value chains under uncertainty. He has taught short courses and worked in Australia, North America, South America, Europe, the Middle East, South Africa and Japan. He received the Synergy Award of Innovation in 2012 by the Governor General of Canada for research contributions to mining science and engineering and his long-standing partnership with AngloGold Ashanti, Barrick Gold, BHP, De Beers, IAMGOLD, Kinross Gold, Newmont and Vale. In 2013, he received AIME's Mineral Economics Award, was a CIM distinguished lecturer in 2015-2016 and became a CIM Fellow in 2018.

## VENUE DETAILS

McGill University  
Department of Mining and Materials Engineering  
3450 University Street  
Frank Dawson Adams Building, Room 105  
Montreal, Quebec, Canada H3A 0E8  
[admrcr.mining@mcgill.ca](mailto:admrcr.mining@mcgill.ca)

## LOGISTICS

Lectures are given from 9 AM (refreshments at 8:30 AM) to 5 PM with two 15 minute coffee breaks and a one hour lunch break.



[cosmo.mcgill.ca](http://cosmo.mcgill.ca)

**COSMO – Stochastic Mine Planning Laboratory**, a global center for leading-edge research and graduate education in "orebody modelling and strategic mine planning with uncertainty", is supported by AngloGold Ashanti, Barrick Gold, BHP, De Beers, IAMGOLD, Kinross Gold, Newmont, Vale, and the Canada Research Chairs Program, NSERC, and CFI.

PROFESSIONAL  
DEVELOPMENT SERIES

2023



STRATEGIC RISK QUANTIFICATION AND MANAGEMENT  
FOR ORE RESERVES AND MINE PLANNING

GEOSTATISTICAL EVALUATION OF  
MINERAL RESOURCES AND THEIR  
UNCERTAINTY UNDER THE NEW  
REGULATORY ENVIRONMENT

David F. Machuca  
SRK Consulting, Canada

Roussos Dimitrakopoulos  
McGill University, Canada

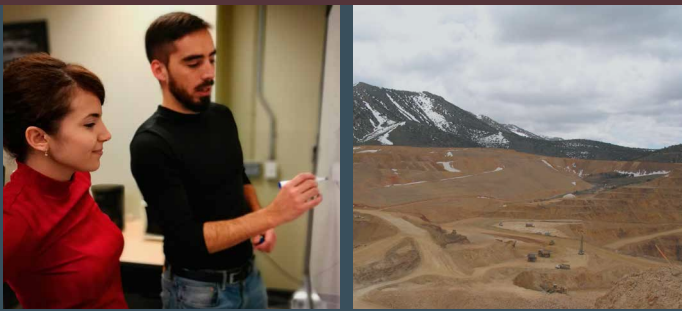
September 25–29, 2023  
Montreal, Canada



AusIMM  
THE MINERALS INSTITUTE

SAIMM  
THE SOCIETY OF AMERICAN INSTITUTES  
OF MINING AND METALLURGY





## CONTENT AND OBJECTIVES

This course aims to show how state-of-the-art statistical and geostatistical techniques help answer the requirements of the latest regulations on Mineral Resources public reporting in an objective and reproducible manner. A particular emphasis is placed on understanding the various sources of uncertainty and error through the mineral resources estimation process and how to characterise the geological confidence through the application of quantitative and qualitative criteria for mineral resources classification. Within the broader context of the engineering modelling discipline, this course provides a comprehensive overview of the industry best practices for mineral resources modelling.

Attendees will learn:

- How to conceive of and produce mineral resource models that address the short- and long-term needs of mining companies
- How to extract geological insights from the statistical analysis of data
- The sources of error and uncertainty at different stages in the mineral resources modelling process
- The advantages and limitations of different estimation and simulation methods
- How to incorporate the knowledge of geological controls of mineralisation in the mineral resources workflow
- How to validate and reconcile mineral resources estimates
- How to communicate mineral resources estimates and their confidence in compliance with the standards of NI43-101, SEC Mining Disclosure Rules and JORC
- The various uses of conditional simulations, such as quantification of the uncertainty in mineral resources and value of information studies, strategic mine planning and project evaluation
- How to integrate orebody simulations into mining planning

## COURSE OUTLINE

### The practice of mineral resources estimation within the context of the new regulatory environment

- Resource models and the mining business cycle
- Meeting the definition of mineral resources and mineral reserves
- International standards for public reporting
- The place of geological uncertainty in mineral resources reporting

### Mineral resources modelling within the context of scientific and engineering modelling

- Scientific and engineering modelling as a discipline
- Uncertainty and error
- Computer simulation

### The data and information bases

- Geological data acquisition
- Elements of sampling theory
- Quality Assurance and Quality Control

### Resource model design and fundamentals

- Stationarity, heterogeneity, spatial dependence
- The random field paradigm
- The support effect
- Short vs. long term models
- Designing an effective resource modelling process
- Incorporating geological controls of mineralisation beyond 3D wireframing

### The geo-spatial modelling framework

- The geological setting
- Geological interpretation and modelling
- Coordinate transformations
- Resource domains and trends

### Data analysis for resource modelling

- Representative statistics in a geological context
- Univariate and multivariate statistical characterisation
- Comparative statistics for different domains and data types
- Identification and treatment of outliers

### Modelling the spatial continuity

- Measures of spatial continuity in a geological context
- Interpretation and modelling of variograms
- Spatial continuity and change of support

**Please note:** It is strongly recommended that participants bring a laptop. No previous exposure to statistics and geostatistics is required.

### Estimation

- Estimation is more than interpolation
- From point to block estimation
- Modern estimation methods
- Multivariate estimation
- Conditional bias and design of the estimation plan
- Validation of estimated models

### Simulation

- From estimation to simulation
- Simulation methods for categorical and continuous variables
- Multivariate simulations
- Validation of simulated models
- Post-processing and application of simulated models
- Quantitative geological uncertainty assessment
- Introduction to Value of Information studies

### Mineral resources classification and reporting

- Definitions
- Integrating quantitative and qualitative classification criteria
- The role of geological uncertainty in classification
- Best practices and applications of technical and economic constraints

### Use of simulations in mine planning

- Integrating geological uncertainty to production planning and risk quantification
- Less risk and higher value
- Geological risk in mineral value chain optimization

### Special topics

- The information effect
- Reconciliation
- Modelling of geotechnical and geometallurgical variables

## WHO SHOULD ATTEND

Exploration and mine geologists, resource analysts, mining engineers, and anyone acting in the role of "qualified" or "competent person".



2018 Springer publication entitled:  
**"Advances in Applied Strategic Mine Planning"**  
 (Editor Roussos Dimitrakopoulos)  
 is included with the course materials.