Professional Development Courses

SIMULATION OF MINING SYSTEMS

SIMULATION SOFTWARE ARENA

SIMULATION OF MINING SYSTEMS

Location

U of A Campus, Edmonton, Alberta, Canada

Dates

September 24th-27th, 2019- 4 days, 8:30-16:30

Early Registration Deadline - 15% Discount

Friday, August 16th, 2019

Registration Deadline

September 16th, 2019

Course Fee

CDN $3200 (excluding taxes)

Instructor

Hooman Askari is a professor of mining engineering in the School of Mining and Petroleum Engineering at the University of Alberta, Canada. He teaches and conducts research into mine planning & design and simulation of mining systems. Hooman is a registered professional mining engineer with 22 years of operational, consulting, research, and teaching experience in the area of open pit mine planning and design. He has a strong track record of success in leading the Mining Optimization Laboratory (MOL) research team sponsored by industry partners into development, testing, and delivering mine planning optimization prototype software and mine simulation models to major mining companies. He consults as the Principal Engineer on long-term to short-term open pit production scheduling optimization and simulation of mining-systems through OptiTek Mining Consulting Ltd.

Registration

Send the completed registration form to: registration@optitek.ca

For more information, contact **Hooman Askari** at: hooman@optitek.ca

Phone: +1 (780) 893-9365

Who Should Attend

The Simulation of Mining Systems is a comprehensive four-day course covering fundamentals of Discrete Event Simulation (DES) modeling and its industrial applications to mining systems. The course is intended for mining disciplines and participants who would like to use simulation to design and optimize real-world mining and systems. Arena Simulation Software by Rockwell Automation is used as the primary modeling simulation tool.

Cancellation Policy

Notification of cancellation received in writing by **September 16th, 2019** will incur a 20% cancellation fee. No refund will be made after this time.

Mining Optimization Laboratory (MOL)

The Mining Optimization Laboratory (MOL) is an industrial research consortium sponsored by mining companies. The MOL research focuses on two major themes:

- Mine Planning and Design.
- Simulation Optimization of Mining Systems.

MOL research focuses on using operations research and advanced analytical methods such as mathematical modeling, optimization, discrete event/continuous simulation, and intelligent agents to arrive optimal or near-optimal solutions to complex, large-scale mine planning/operations decision-making problems.

http://www.ualberta.ca/MOL/

Participants are required to bring a Laptop

Software will be provided for the Course

First Name: _____

Last Name: _____

Company Name: _____

Job Title: _____

Address: _____

_____

City: _____

Prov/ State: _____

Country: _____

Email: _____

Phone: _____

Visa ☐ Master Card ☐

PO ☐ By Phone ☐

Card # _____

Expiry _____/_____

CVV: _____

(Fee + 5% GST) CDN$ _____

Name on Card: _____

Signature: _____

Professional Development Courses

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COURSE DESCRIPTION

Simulation Software: Arena

Fundamentals of Discrete Event Simulation (DES) modeling and its industrial applications to mining and processing systems are presented. Theoretical and statistical aspects of simulation, including input and output analysis, experimental design, and variance reduction techniques are presented. Arena Simulation Environment (by Rockwell Automation) is used as the primary modeling simulation tool for explaining simulation concepts. The course focuses (three days) on modeling detail truck-shovel simulation models that uses the historical dispatching data, road profiles, and short-term mine plans as input into the simulation model. The simulation models need to be calibrated, and verified to link the short-term mining schedules to the operational plans in presence of uncertainties of cycle times, scheduled and unscheduled down times, shift changes, etc. The rest of the course will focus on combined continuous and discrete-event simulation of processing systems. Size classifications including sieves and hydrocyclones; comminution operations including crushing machines, grinding, and semi-autogenous mills; solid-liquid separation including thickeners and filtration; and also gravity and magnetic separation modeling will be covered by examples. The course is intended for mining and processing engineering disciplines and participants who would like to use simulation to design and optimize real-world mining systems. On completion of this course, successful attendees will have an in depth understanding of principles and methodologies, of discrete event simulation. Also, they will be able to use Arena Simulation Software (Rockwell Automation) as the simulation modeling tool for simulating and optimizing real world systems. A series of labs using Arena Simulation Software (Rockwell Automation) are undertaken to model and optimize real world systems. Students undertake a complete simulation modeling/analysis project.

Outcomes of the course include:

In the first two-days:

- A review on probability and statistics and fundamental simulation concepts.
- Review of main truck-shovel time charts such as definition of work, ops delay, ops standby, short down, down service, down technical, down waiting, and out of system.
- Review of main truck-shovel KPIs such as definition of physical availability, use of availability, operating efficiency, effective utilization, tonne per net operating hours, etc.
- Truck-shovel simulation modeling using resources, queues, and basic animation to calculate fleet productivity.
- Assess the uncertainty associated with the fleet productivity, haulage costs, and cash flow analysis to support decision making.
- Mixed fleet truck-shovel simulation modeling using resources sets and maintenance schedules.
- Introduction of resource failures with defining probability distribution functions for mean time between failures and mean time to repairs of trucks, shovels, and crushers.
- Truck dispatching using station-route and assessing the reliability of the system.

The rest of the course - two days - will focus on combined continuous and discrete event simulation of processing systems.

- Comminution operations including crushing machines, grinding, and semi-autogenous mills,
- Bulk material terminal modeling including arrival of trains, stockyard cells, stockpile blending, stackers and reclaimers, and the ships loading section.

Day 1

- Probability and statistics review,
- Fundamental simulation concepts,
- A guided tour through Arena,
- Variables, entities, entity flow and attributes,
- Resources, capacity constraining, queues,
- Using basic process module in Arena to model:
  - Entity flow and attributes
  - Capacity constraining (Resources)
  - Attributes, Variables, and Queues
- Flow control, input/output (I/O)
- Animation of variables (scoreboard),
- Variable spreadsheet module,
- Truck-Shovel Basic Modeling
  - Resources and Queues – Seize, Delay, Release
  - Decisions and Statistics, Replications
  - Truck Shovel Queue and Resource Animation

Day 2

- Read/Write into and from external files
- Use resource sets, schedules, and states
- Resource Failures
- Modeling Detailed Operations
- Submodels & Iterative Looping
- Station and Route
- Truck-Shovel Advanced Modeling
  - Resource Sets & Mixed Fleet Modeling
  - Maintenance Schedules
  - Truck and Shovel Major and Minor Failures

Day 3

- Input Data Analysis and Modeling
- Output Data Analysis and Modeling
- Process Analyzer
- Batch and Separate
- Coal/Iron Ore Terminal Stockpiling and Ships
- Modeling Discrete/Continuous Models
- Flow Process Template – To Model Flow
- Tanks, Regulators and Regulator Sets
- Seize Regulator and Release Regulator modules
- Trigger actions using a Sensors
- Animate Flow of material

Day 4

- Continuous to discrete conversion
- Crusher and Conveyors
- Storage bins and stockpiles
- Comminution machines
- Gyratory Crusher
- Semi-Autogenous Mills