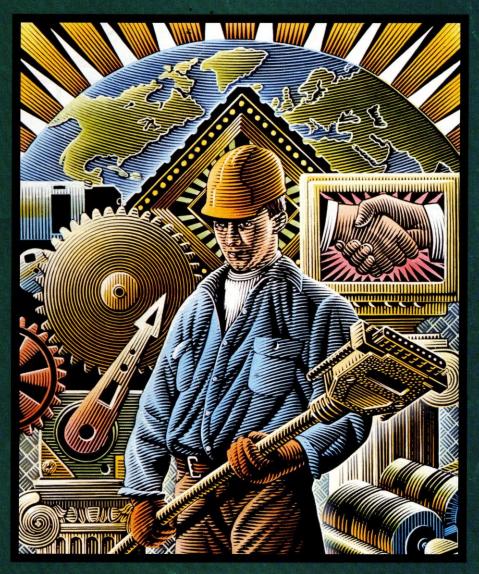# 2002 SME Annual Meeting & Exhibit

February 25-27, 2002
Phoenix, Arizona

- APCOM 2002 – 30th Application of Computers & Operations Research in the Mineral Industry
- WAAIME 86th Annual Meeting

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and an appropriate learning method. Statistical analysis results of the estimated values, showed that ANN and ANFIS are not only more accurate than the widely used regression models, but also tends to reproduce the variability of the initial data, while regression models generate a smooth representation of reality.

Genetic Programming for the Design of Underground Mining Methods: *Q. X. Yun* and *S. H. Lu*, Xian Univ. of Architecture & Technology, Xian, China

This paper presents an approach to design underground mining methods by genetic programming. It consists of five parts: 1) represent the layout of mining methods by terminal set (openings or blasting holes) and function set (conjunctions of terminal set); 2) generate the initial population by random selection from these two sets; 3) calculate net present value as fitness for all alternatives; 4) improve the quality of population by genetic operations such as reproduction, crossover, and mutation; and 5) terminate the iterations according to the variation of fitness. The new approach has been successfully used to design a sub-level caving method with draw raises.

Application of Artificial Intelligence Technique to Study the Environment Management for Coal Mines: *L. Xinchun* and *Z. Youdi*, China Univ. of Mining & Technology, Xuzhou, China

AI is one of the computing method, it performs its calculation by simulating the intelligent behavior of human beings. It is regarded as one of the most important scientific achievements in the 20th century. By over viewing the research results of AI application in mineral engineering, it is found the most of the application are focused on single AI method, especially ES and ANN. If the problems are too complicated, the single AI method may be incapable to solve them because of its limited functions. An integrated AI system has been developed for coal mines environment management, the system is composed of the following subsystems: 1) evaluation of the coal mines environment by an ANN and 2) making the administering technique and management measure of the coal mines environment by an ES.

Application of Meta-Synthetic AI Technique for Mining Conditions Evaluation: *Y. Zhang*, China Univ. of Mining & Technology, Xuzhou, China; *W. Han*, Tengji Univ., Shanghai, China; and *X. Li*, China Univ. of Mining & Technology, Xuzhou, China

Meta-synthetic technique for large systems engineering has been placed on the agenda. The meta-synthetic AI approach should involve the integration of digital and knowledge info, from qualitative to quantitative analysis, etc. Some algorithms of meta-synthetic technique such as ANN-ES and GA-ANN are introduced. A case study follows -- mining conditions evaluation by meta-synthetic AI methods, including: setting up the structure of evaluation indexes system, deciding their grade of membership by ANN-ES algorithm; determining the weight values of evaluation factors by GA-ANN algorithm; and developing the integrated evaluation model.

Mining Textural Features with Artificial Ant Colonies - Towards a Dynamic and Continuous Classification of Polished Marble Slabs: *V. C. Ramos*, *P. Pina*, and *F. Muge*, Instituto Superior Technico, Lisbon, Portugal

A novel methodology is presented in order to classify automatically polished slabs of marble based on a multidisciplinary approach. It appeals to digital images analysis and mathematical morphology techniques to perform the extraction of the samples visual textures and to artificial lite techniques to perform the dynamic classification of samples, namely, allowing to self-organize data performing simultaneously image retrieval as a consequence of inter dynamic synergistic relationships in artificial ant colonies.

SIMULATION & MODELING OF MINING SYSTEMS I

2:00 PM   Yuma 29-34

Chairs: K. Bode, VSB as, Prague, Czech Republic
          J. R. Sturgul, Univ. of Idaho, Moscow, ID

Simulation Modeling of Platinum Operations Using GPSS/H: *M. R. Dawborn* and *F. W. Taylor*, Hatch, Johannesburg, South Africa

Simulation modeling of portions of two platinum mines using General Purpose Simulation Software (GPSS/H) is presented in this paper. Both mines, located in the Bushveld Igneous Complex of South Africa, exploit Merensky and UG2 reef horizons, which are processed separately and therefore handled individually from the stope face to surface, requiring duplication of storage arrangements and batch operation of transport facilities. The first simulaton assignment concerns the upgrading of a shaft system operating exclusively on Merensky ore, to hoist UG2 ore and increase production. The second assignment comprises a simulation of rock flow from the stope face to surface by way of tramming, inclined conveying and vertical hoisting. Development ends and stope boxholes were modeled down to individual hoppers demonstrating the versatility of the GPSS/H language.

Simulation of Ornamental Stones Textures Based on Mathematical Morphology, Geostatistics and Genetic Algorithms: *P. Pina*, *V. Ramos*, *A. J. Sousa*, and *F. Muge*, Instituto Superior Tecnico, Lisbon, Portugal

It is proposed to exploit the potentialities given by mathematical morphology in the characterization and simulation of structures together with the similar potentialities provided by geostatistics. Novel methodologies to simulate structures by explicitly incorporating granulometric features together with other features (orientation, dispersion, connectivity) apealing to concepts of mathematical morphology and geostatistics for its methodological conception and to genetic algorithms for practical geometric optimization procedures are presented. It intends to contribute to: 1) help in certification procedures; 2) construct artificial slabs with similar visual properties of the natural ones; and 3) reduce wastes with a consequent higher recuperation of stone deposits.

Modeling of Auxiliary Ventilation Systems by Use of DAVENTS Software: *B. Krstev* and *D. G. Mirakovski*, Faculty of Mining and Geology, Stip, Macedonia

The paper presents models of auxiliary ventilation systems with leaky ducts and algorithms for calculations of pressure loss, air leakage, and volume flow ratio and pressure fans. Two basic models are discussed: first model for a duct with leakage through the flange joints and second model for a duct with an equivalent longitudinal aperture. The present analytical system has been successfully applied to developing of computer software named DAVentS. A sample problem is used to illustrate efficiency and accuracy of DAVents software in solving most common problems in process of designing AVS.

Analyzing Plane Failures Using Wedge Failure Analysis Software: *E. B. Kroeger*, Southern Illinois Univ., Carbondale, IL

Plane failure in slopes is usually caused by the intersection of a discontinuity plane with a slope. These discontinuities are typically analyzed to determine the stability of a particular slope. Methods for planar stability analysis are two-dimensional and have difficulty with planes oblique to the slope face. Past research has stated that planar failures are a special case of wedge failure. Wedge analysis techniques can effectively be used to determine the stability of planar features. One advantage to wedge analysis is the tension crack can be non-vertical and oblique to the slope face during analysis, closely matching field conditions.

Load-Side Electric Demand Management System for Underground Mines: *S. K. Ganguli*, *J. Sottile*, *J. C. Yingling*, and *G. T. Lineberry*, Univ. of Kentucky, Lexington, KY

Demand Management has been widely used in commercial and some industrial installations to reduce electric demand surges. One of the important benefits of demand management is a reduction in utility bills through reduced maximum demand. However, most of the demand management systems developed so far use relatively straightforward algorithms, with predetermined load shedding procedures. This approach works well where loads are cyclic and easy to predict. But in systems with large random variation in electric loads such as mining operations, a predetermined shedding procedure may not provide an optimal solution. Hence, in this paper a demand management system using a dynamic control technique is proposed. The control system that has been designed is applied to a simulated mine. The performance of this control algorithm will be tested on the simulated mine. Discussion of the simulation results will be presented along with recommendations for future work.

Eolaval - A Mine Ventilation Planning Software: *K. Fytas*, Laval Univ., Quebec City, PQ, Canada and *S. Perreault*, Barrick Gold Corp., Tanzania

This paper presents Eolaval, an integrated mine ventilation design software. In its new expanded version it is a user friendly and fully interactive computer package. The features of the new version are a graphics interface fully compatible with Autocad files, an integrated database of fan characteristics and the optional use of the thermodynamic approach in carrying out network simulations. This software can be used in underground mine ventilation planning: mine ventilation network analysis and simulation, economic design of airways, auxiliary ventilation design, calculation of a mine air heating plant, and evaluation of the natural ventilation and pressure losses in a mine shaft. This paper presents a case study illustrating the use of the computer package in mine ventilation design.

APCOM Keynote Session

Monday, February 25
8:00 AM
Yuma 26-32
Phoenix Civic Plaza

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Document Summary

for "Design Process And Equipment Selection For Auxiliary Ventilation Systems"

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Author	Mrakovski, D. G. ; Krstev, B.	
Society / Organization	SME	
Summary / Abstract	The paper presents models of auxiliary ventilation systems with leaky ducts and algorithms for calculations of pressure loss, air leakage, and volume flow ratio and pressure fans. Two basic models are discussed: 1st model for a duct with leakage through the flange joints; 2nd model for a duct with an equivalent longitudinal aperture. The present analytical system has been successfully applied to developing of computer software named DAVentS. A sample problem is used to illustrate efficiency and accuracy of DAVentS software in solving most common problems in process of designing AVS.	
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