

Analysis and optimisation of mine water management

To optimise any system one needs to fully understand the effect of its various parameters. This can prove especially difficult in large scale and complex mining thermal fluid systems, where the assessment of any modifications on the actual site is often not possible or means costly downtime. Due to the nature of mining operations, even seemingly small improvements in efficiency can lead to substantial energy saving over the long term. This drives the need for a complete thermal fluid design and analysis solution. This is where new simulation technology of Flownex can provide invaluable insight, by translating the details of each process into system-level performance and energy consumption. Initially developed to solve air and water distribution networks in mines, Flownex software has evolved and been extended over the years to deal with dynamic simulations of networks with time-dependent flow and multiple fluids including non-Newtonian slurry, gas mixture and two phase flow. Flownex has full heat transfer capability as well, which extends capability to systems where water is used as a thermal energy carrier. In such systems it is not only flow and pressure that are taken into account, but temperature and heat exchange as well.

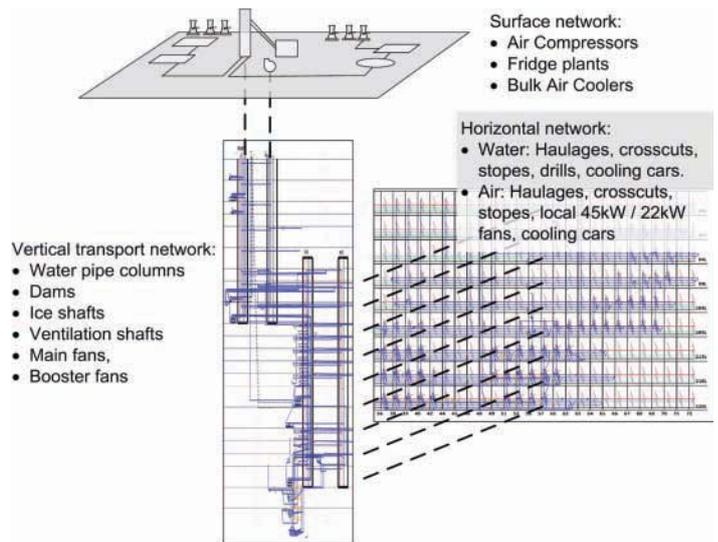
Flownex works by simultaneously solving mass, pressure (momentum) and energy conservation on a system level through application of the Implicit Pressure Correction Method. This allows engineers to analyse almost any thermal fluid systems, including water management systems, from the perspective of energy usage.

The value of this approach was proven in some of the world's deepest mines in South Africa, where water is used as the energy carrier to remove up to 100 MW of heat from a mine that is 3,800 m deep. To optimise this system, an analysis of the interaction between all the various heat sources and water flow rates throughout the mine was performed. The client reported electricity savings in the megawatt-range because of improved understanding of the system. A paper presented in February, at the annual SME meeting

in Salt Lake City, by HJ van Antwerpen, entitled *Combined system simulation of cooling and ventilation for the world's deepest mine* drew attention to the impact of this type of simulation.

Flownex has also been used for predictive control and online optimisation of water management systems that comprise several reservoirs connected by various pumps and pipelines. An example of this is a case where it was necessary to determine the status of South African water utility Midvaal Water's existing reticulation system in terms of flow rates, flow distribution, pressure drops and the integrated effect on pump performance in pumping stations while accounting for multiple end user demand during peak and off-peak periods. The ability to model the entire distribution network provided several benefits such as identifying areas of concern and possible future modifications. Along with establishing a basis model for pump scheduling, whereby the systems energy consumption can be optimised through shedding the load during hours when power demand is low. Flownex helped avoid any unplanned water shortages or water cut offs to nearby mines due to incorrect water reticulation system changes, that could of resulted in costly claims.

The strength of the software is not limited to the assessment of existing water handling infrastructure, but has many applications during the design stage. Such as the ability to perform a lifecycle cost optimisation i.e. finding the optimal pump/pipeline size combination to minimise pumping power and capital cost. Pressure



fluctuations due to the water hammer effect can be investigated during a transient analysis and the results conveniently plotted to determine the required minimum pipe wall thickness and pipe material to avoid costs associated with pipes rupturing. This same transient analysis can be used for the sizing of protective equipment and identifying the best possible locations for pressure accumulators. The ability to calculate unbalanced transient fluid forces, that occur especially at changes in direction such as elbows, help limit the overdesign of pipeline support structures while still being able to guarantee safety.

The Flownex solver allows fast simulation speeds (in the order of real time solution, depending on network size) and is capable of having a simulation model alongside the SCADA to do comparative fault-finding. Flownex was developed by consulting company, M-Tech Industrial, to solve real word problems and is represented in the US market by Phoenix Analysis and Design Technologies (PADT), which aims to help companies use simulation effectively and efficiently by providing the support and training they need. www.flownex.com

RIEGL makes further LIDAR changes

RIEGL Laser Measurement Systems has been developing the world's first survey-grade Unmanned Air System (UAS) LiDAR sensor, the VUX-1. Last month saw the official launch event, at the International Lidar Mapping Forum (ILMF), which took place in Denver from February 17 to 19 where the VUX-1 was presented for the first time. RIEGL states: "The innovative sensor was designed to meet the challenges of emerging surveying solutions by UAS, gyrocopters, and ultra-light aircraft, both in measurement performance and in system integration." The VUX-1 is an ultra lightweight LiDAR sensor with less than 4 kg overall weight, that can easily be mounted onto professional

UAS/RPAS. It has a 300° field of view and produces extremely high quality LiDAR data users expect from the RIEGL product. Internal storage offers the ability to collect data for several hours at altitudes/ranges up to more than 1,000 ft. Mining and mineral exploration represents a key market for this scanner application. "By introducing the VUX-1, RIEGL is



the first to offer a LiDAR sensor that has been especially developed for the UAS and RPAS markets. We expect tremendous growth in these fields and are proud to support these with the breakthrough VUX-1," said Dr Johannes Riegl, RIEGL's Chief Executive Officer.

RIEGL also recently announced that since the release of version 10.2 of the ESRI ArcGIS product family, the RIEGL scan database is now directly supported in ArcCatalog, ArcMap, ArcScene and ArcGlobe for data import. ESRI is based in Redlands, California and is a global supplier of Geographic Information Systems (GIS). Its ▶