FROM THE DIRECTOR'S DESK

Welcome to the Future!

Welcome to the first newsletter from the Wits Mining Institute, (WMI). As the proud director of this vital research initiative, my passion is 21st century mining and the WMI's contribution is to identify 'gadgets' that work above-the-ground, give these inventions work to do below-the-ground, and then inspire talented researchers to make it happen.

South Africa needs a competitive mining industry for its sustainable economic development. As the foundation of the country's economy, the mining sector can contribute substantially to the objectives of the National Development Plan, reducing poverty and inequality.

Reports on their own will not create jobs; we need tangible technological advancements leading to the development of a new 'thing' that can lead to prosperity for Africa and its mining sector. This is what makes the WMI different; here, our researchers work on real-life mining problems.

We produce either new knowledge or new applications, which means proof of concept and laboratory testing (at Masters level) and new technology development or application (at Doctorate level); each output comes complete with an implementation plan following a systems approach.

Selected undergraduate students then get the opportunity to work with the postgraduates to test and refine the functionality of our research outputs. We also make sure that research groups are multi-disciplinary, and are supported by the university as well as national and international partnerships.

The digital mining research group (DigiMine) has several exciting projects; some are already complete while others are at an advanced stage. Like me, I think you will be tremendously impressed by the completed higher degree projects, which are listed under 'Highlights' below.

I hope that you will become a regular reader of the WMI's newsletter; there is much in store from us. Coming soon is news on underground drones and monitoring of SA's latest earthquake!

Highlights

The WMI has already completed a number of projects at higher degree level:

- Spatial positioning of sidewall stations in a narrow tunnel environment: A safe alternative to traditional mine survey practice' by Hendrik Grobler is a PhD study sponsored by the University of Johannesburg. This research proves that it is no longer necessary for surveyors to install control stations in the hanging wall of excavations. Hennie's work informs thinking on the functionality of a 'smart peg', which reduces risks associated with working from heights and fall of ground.

- Limit equilibrium and numerical modelling approaches in slope stability analyses with regard to risk assessment for open pit mining' by Mpoyi Kanda is an MSc study sponsored by the European Union and Gold Fields. This research proves that advanced numerical modelling techniques are suitable to model risks associated with slope stability.

- Simulation of product transportation in open pit mines' by Ali Mohsin is an MSc study sponsored by the National University of Science and Technology (NUST) in Pakistan and Gold Fields. This research developed CADD-based computer models to simulate product transport and has significant implications for mine optimisation.

- Towards automated tunnel traversing for the survey control of deep level mining' by Glenn Stacey is an MSc study sponsored by Gold Fields. Although the report for this work was never submitted, Glenn's work proves that points in a cloud measured by a scanner can be used as beacons for machine positioning and navigation at depths unsuitable for human access.

- Evaluation of flooding-induced mining seismicity with a view to characterise safety margins for surface structures under existing and flooded conditions in Central Rand, Johannesburg' by Ali Sarfraz is a PhD study sponsored by NUST University, Gold Fields and Sibanye Gold. The impact of seismicity on mine safety is significant and we need to grow the body of knowledge on the link between seismicity, excavation design and support. There is no doubt that advanced numerical modelling is contributing to such knowledge.
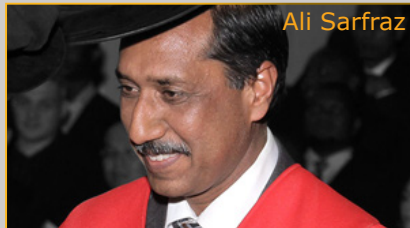
Ali Sarfraz

Tariq Feroze

- An initial investigation of room and pillar ventilation using CFD to investigate the effects of last through road velocity' by Tariq Feroze is a PhD study sponsored by NUST University, Gold Fields and Sibanye Gold. Apart from the significant impact on ventilation design, Tariq's work made ventilation flow and air quality 'visible' through simulation. The next phase of this work has started already – and that is on the ability to show worker and equipment positions relative to risks associated with mine ventilation.

- Towards a digital mine: A spatial database for accessing historical data on mining and related activities' by Samkelisiwe Khanyile is an MSc study sponsored by the National Research Council (NRF) and Sibanye Gold. It is not possible to integrate mining data without a properly designed spatial database; Sam's research led to a database that is our foundation for streaming all sources of data into DigiMine.

- Mineral development for growth: Developing a mineral policy framework and mining cadastre system for Pakistan' by Hamid Ashraf is a PhD study sponsored by NUST University and Sibanye Gold. Hamid's framework was presented in Pakistan, after which he was invited to become part of the team developing mineral policy in Pakistan.

- Autonomous 3D mapping and surveillance of mines with MAVs' by Stuart Edwards is an MSc study sponsored by the NRF and Sibanye Gold. A first-generation prototype to proof concept formed part of Stuart's work.

- Channel modelling and analysis of Wits mock-mine with different antenna parameters' by Intikhab Hussain is an MSc study sponsored by NUST University, Gold Fields and Sibanye Gold. Intikhab's research drew significant international attention, as the research has implications for understanding the relationship between Wi-Fi signals and steel/cable infrastructure. As a direct result of his excellent Masters project, he was recruited to become part of a North American research group.

- Adaptive resource allocation for underground mine wireless communication systems' by Stephan Chabalala is a PhD research study that is part of DigiMine's objective to develop reliable, wireless communication systems that are suitable for underground use.

See you next time, when I will discuss one of our current projects.
Professor Fred Cawood

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

WITS MINING INSTITUTE