Complexity of Slope Stability

The South African mining industry is well known for the advancements in underground, especially ultra-deep, mines. But it has also made significant contributions to open pit mining and the stability of slopes. The SAIMM hosted a symposium on slope stability as early as 1970 (book S2 in the symposium series), which was conceptualised by the SAIMM because open pit mines were getting bigger and deeper, and the sharing of knowledge and experience from the industry was required. Over 300 local and international delegates attended the symposium, including technical, industry, and academic leaders in open pit mining and rock mechanics. Incidentally, two of the speakers would go on to found two international mining consulting firms. Again, recognising that pits were being planned much deeper than ever before, The SAIMM planned the first International Symposium on Stability of Rock Slopes in Open Pit Mining and Civil Engineering in 2006, which has since been held 10 times in 8 different countries (now informally referred to as simply *The Slopes Conference*). This symposium was again organised by the SAIMM in 2015. This special edition of the journal serves as a further commitment to the development of the science and engineering of rock slopes, with the very high response of papers dealing with some interesting and pertinent developments. Topics covered include: slope stability analyses, groundwater interactions with slopes, forecasting of failure, detection of underground cavities, and the back analysis of a very large slope failure.

Significant developments have taken place in the last two decades in monitoring and numerical modelling of rock slopes. These often overshadow the importance of understanding the actual mechanics of big slopes, and how to reliably design them. Many advances in technology have provided the tools to aid in this, but there is a long way to go in understanding the complex interplay of the geological complexity (including varying rock types, geological structure, alteration, and weathering), complex groundwater systems (often grossly over simplified), strength properties, appropriate failure criteria, slope geometries, blasting, et al. These complexities are impossible to include in any single analysis or model, so the design and understanding of large slope behaviour still require contextualising multiple over-simplified models and determining how their interaction results in the limitation of slope equilibrium. Furthermore, how to manage all of that in the implementation of big slopes. This complexity means that slopes require the inputs from many specialists and an understanding of the limitations of their science and models. So much more is needed in the development of rock slope engineering.

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