

# Assessment of tailings dams using Model Order Reduction

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## ABSTRACT

Tailing dams are structures built up during the mining process by compacting successive layers of earth. They contain the (usually toxic) left over after the process of separating the valuable fraction from the uneconomic fraction of an ore. This kind of dams exhibit a high rate of sudden and hazardous failures and, therefore, monitoring its state is a key process in the mining industry.

The recent surge in the availability of sensors (e.g. Internet of Things) allows enhancing the data that can be gathered to monitor the mechanical and hydraulic state of the dams. Numerical models, on the other hand, can be used to enrich the local information collected by the sensors and provide a global view of the state of the dam. Although, for monitoring purposes, numerical models are only useful if they provide results fast enough to react to an unsafe state.

In this presentation we describe the results presented in [1] and [2], where model order reduction techniques are applied in the context of data assimilation to learn about the state of tailing dams. A transient nonlinear hydro-mechanical model describing the groundwater flow in unsaturated soil conditions is solved using Reduced Basis method [1]. Hyper-reduction techniques (DEIM, LDEM) are tested and show time gains up to 1/100 with respect to standard finite element methods [2].

## REFERENCES

- [1] C. Nasika, P. Díez, P. Gerard, T.J. Massart and Sergio Zlotnik, "Towards real time assessment of earthfill dams via Model Order Reduction", *Finite Elements in Analysis & Design*, doi:10.1016/j.finel.2021.103666, (2022).
- [2] C. Nasika, P. Díez, P. Gerard, T.J. Massart and Sergio Zlotnik, "Discrete empirical interpolation for hyper-reduction of hydro-mechanical problems in groundwater flow through soil", *International Journal for Numerical and Analytical Methods in Geomechanics*, doi:10.1002/nag.3487, (2022)