Post-failure runout analysis from tailings dams using viscosity bifurcation rheology

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Motivation of work

• Integrate soil mechanics-rheology transition, allow for prediction of mass of failed tailings

• Runout – Linked to state of tailings in the deposit (density, stress state, ?)

• Is Bingham rheology good enough?
What has been done before?

There is a review in the paper. With respect to rheology, most previous studies assume a Bingham rheology, chosen to give a good fit to the known run-out.
Why would we bother with advanced rheology?

We will see that a more realistic rheology can either result in longer runouts, or potentially rewards the tailings pond operator for improving their tailings.
Viscosity Bifurcation: what is it?

\[ \frac{d\lambda}{dt} = \frac{1}{T} - \alpha \dot{\gamma} \lambda \]

Figure from Mizani and Simms 2016 Minerals Engineering
Simulation of small flume deposition
Deposition With no Delay Time
Deposition With Delay Time
Images from a similar flume test with delayed deposition
Simulations of 2D 100 m by 200m long Dam Break
Coussot model
2D SPH
200m x 100m x 50 m Dam Break 3D FEM Simulation
Time to verify: at the largest scale possible
Facility wall and access stairs
Plan (Top) view: Interior dimensions

6 m

4 m
Cross-section

Walls are Ø1 m thick

Reinforced concrete
Conclusions

• Very important for runout analysis to be realistic
• Ideally, the state of tailings should bear on the runout analysis
• Proper rheology of the failed mass of tailings is important