Predicting Powder Flow from Containers with Flexible Walls

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Project Overview

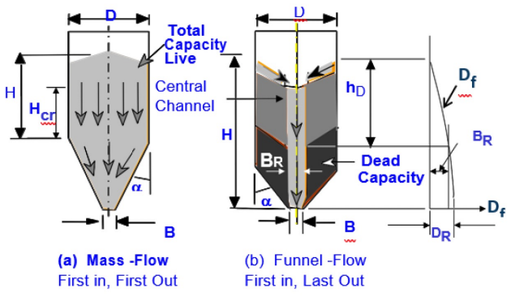
- Exploring innovative methods to understand discharge from Flexible Intermediate Bulk Containers (FIBCs).
- Integrating experimental, theoretical, and numerical approaches to enhance comprehension of FIBC discharge phenomena.
- Investigating industry challenges such as arching, ratholing, and storage conditioning sensitivity to improve inefficiencies material handling.

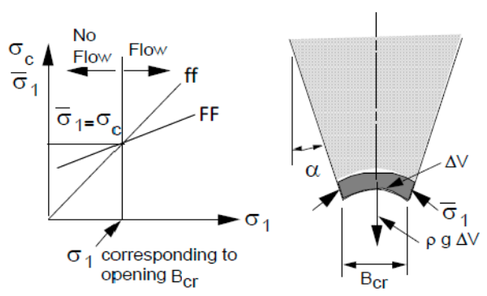
Literature Review

- Extensive literature review conducted on powder flow prediction, surrounding granular mechanic behavior, flow theories, characterization methods, and recent research.
- Flexibility factor (AS3774):

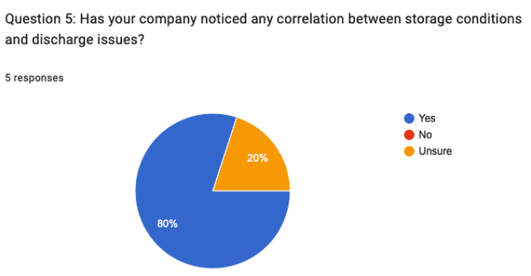
$$\psi = 1 - \alpha$$

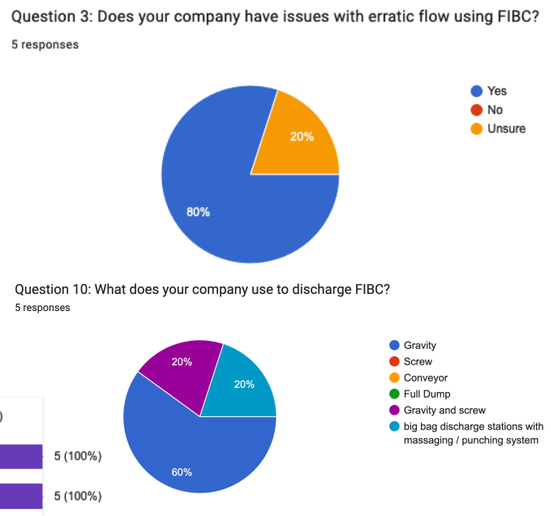
$$\alpha = \frac{E_s R}{E_w t}$$

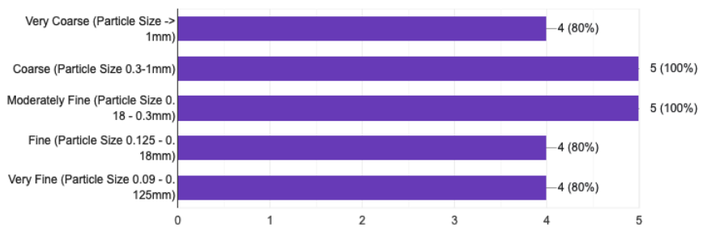




Survey Results

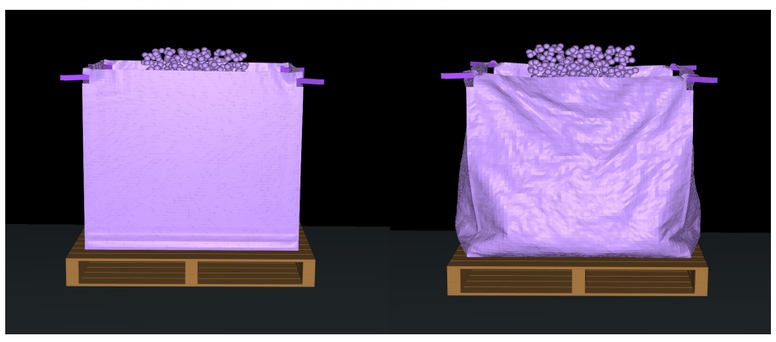






Numerical Modelling – Discrete Element Model

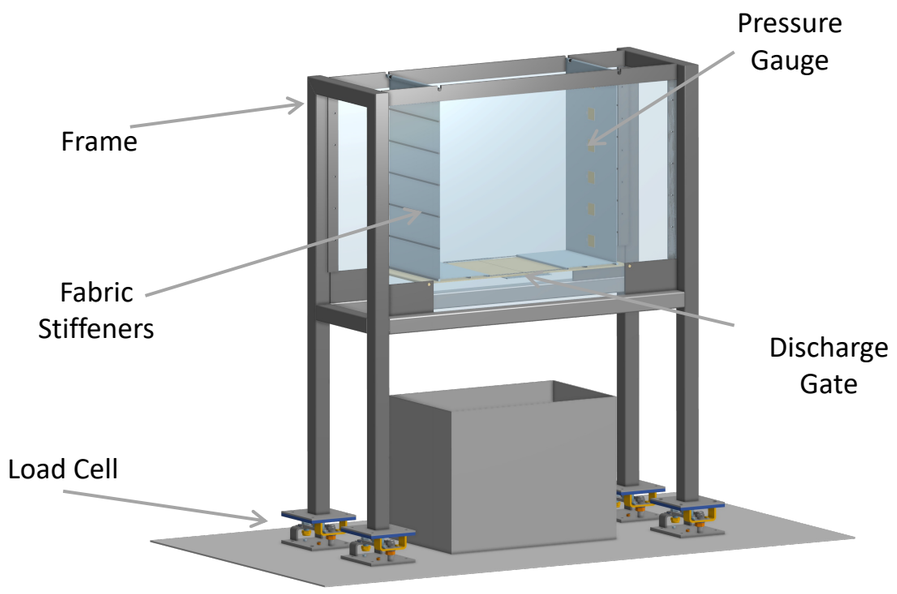
- Assessing the feasibility of numerical approaches for visualization, validation, verification, and prediction of FIBC characteristics through Discrete Element Modelling (DEM).
  - Individual Particle Modelling
  - Capturing Collisions, Friction, and Cohesion
  - FIBC Modelled as 'Particle Shell'



Preliminary Experimental Trials

Phase 1 – Experimental Design

- Early preliminary testing has underscored the necessity of constructing a scaled model.
  - 2D Visualization of flow regimes
  - Quicker repeat testing
  - Testing both fill and discharge scenarios, providing a flexible test bed
  - Understanding our needs prior to Phase 2 rig design and construction
- Currently being commissioned
- Experimental Testing to begin in the coming months
- Results to influence Phase 2



Next Steps

- Material characterization of selected samples for key characteristics determination.
- Conducting simulations (DEM, FEA) to investigate FIBC flow patterns.
- Commencing experimental analysis to measure and model discharge behavior.
- Reviewing flow theory for flexible walled containers, including stress distribution prediction focus.