



Sustainable Sand Management Control and Solutions - Balancing Performance, Costs, and Environment

20–21 AUGUST 2024 | KUALA LUMPUR, MALAYSIA



Low-Cost Numerical Simulation for Sand Screen Retention Test (SRT) Lab

Abdul Adri Bin Haji Wardi
Universiti Teknologi Brunei



OBJECTIVES

- Match SRT lab permeability tests through numerical simulations
- Minimize computational costs:
 - Batched simulations with smaller domains
 - Utilizing spherical particles
 - Harmonic averaging

METHODOLOGY

- Discretize filter cake model using Particle Size Distribution (PSD) data utilizing Discrete Element Method (DEM)
- Fluid flow simulation using Finite Element Method (FEM) + Smoothed Particle Hydrodynamics (SPH).
- Primary software (Open-Sourced):
 - Yade 2023.02 (CPU)
 - DualSPHysics v5.2 (GPU)

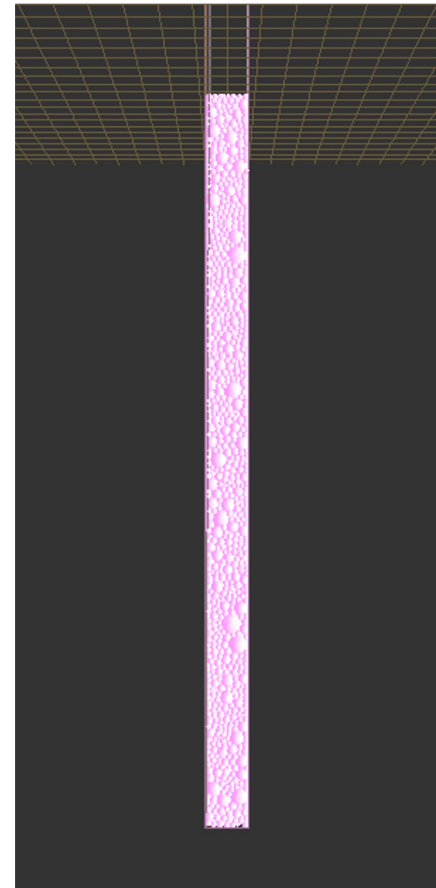
SIMULATION SETTINGS

Setup:

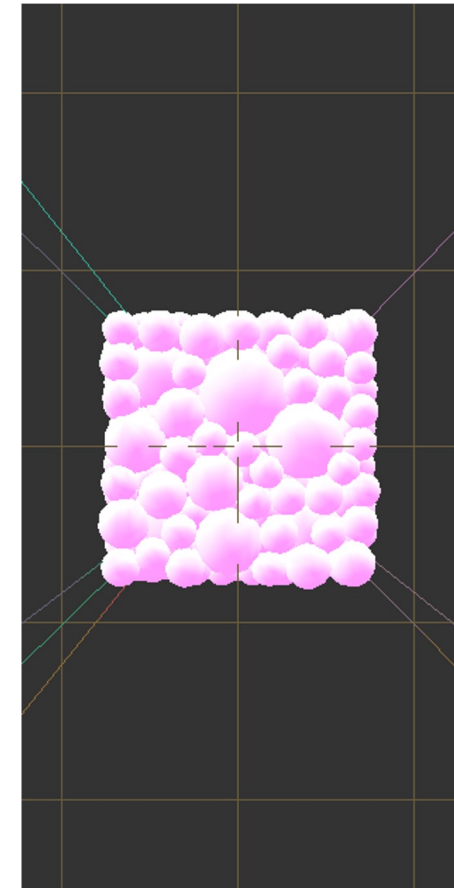
- Dimensions (1mm x 1mm x 100mm)
- Sphere properties
- Inlet velocity

Post-processing:

- Flowtool to measure flow rate
- Differential pressure
- Permeability calculation



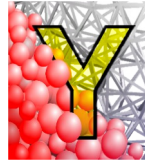
Side view



Top view

WORKFLOW

Yade



Filter cake modelling

export as FEM

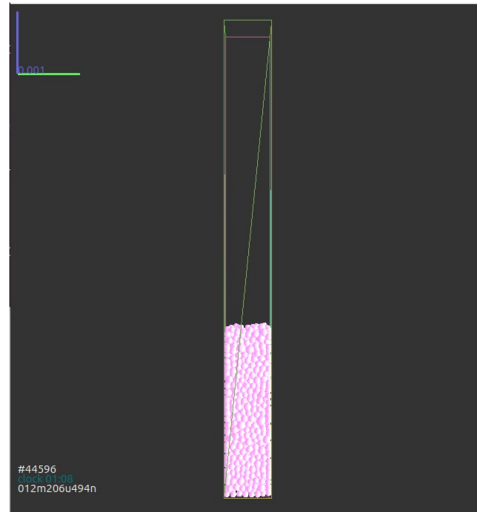
DualSPHysics



Fluid flow simulation

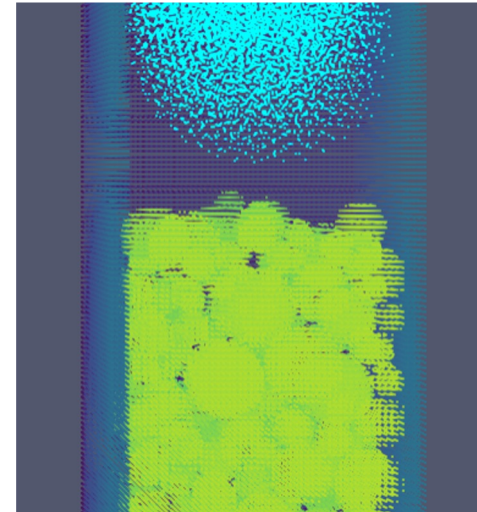


Before

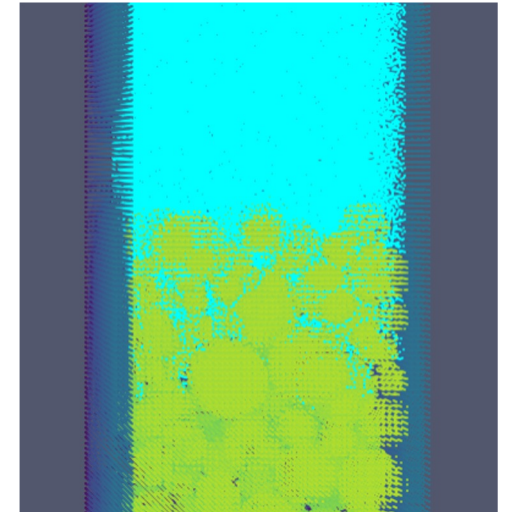


After

Gravity Deposition



Before

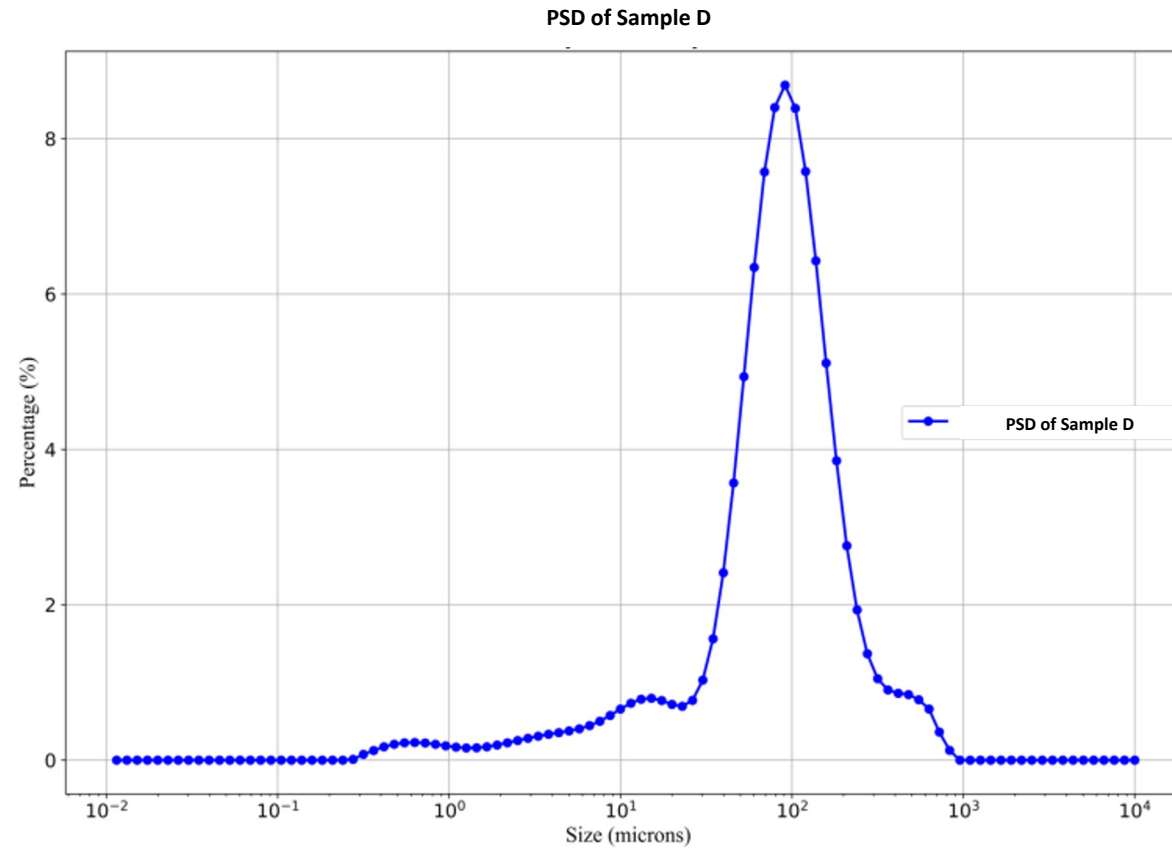


After

Fluid flow through filter cake

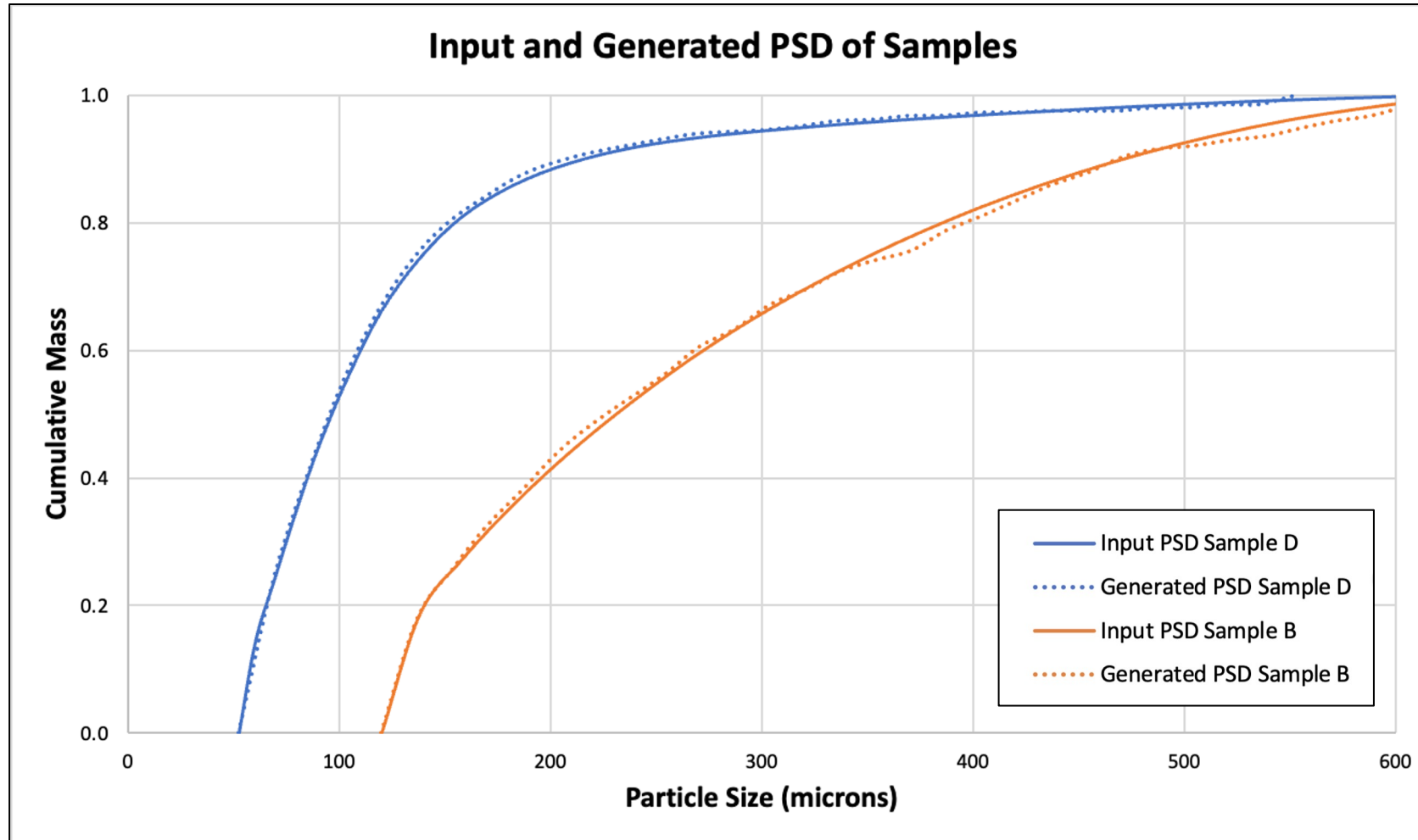
DATA AVAILABLE/USED

- 9 Samples
- PSD ranges:
 - 53 - 180 μm
 - 53 - 600 μm
 - 63 - 212 μm
 - 125 - 600 μm
 - 150 - 180 μm



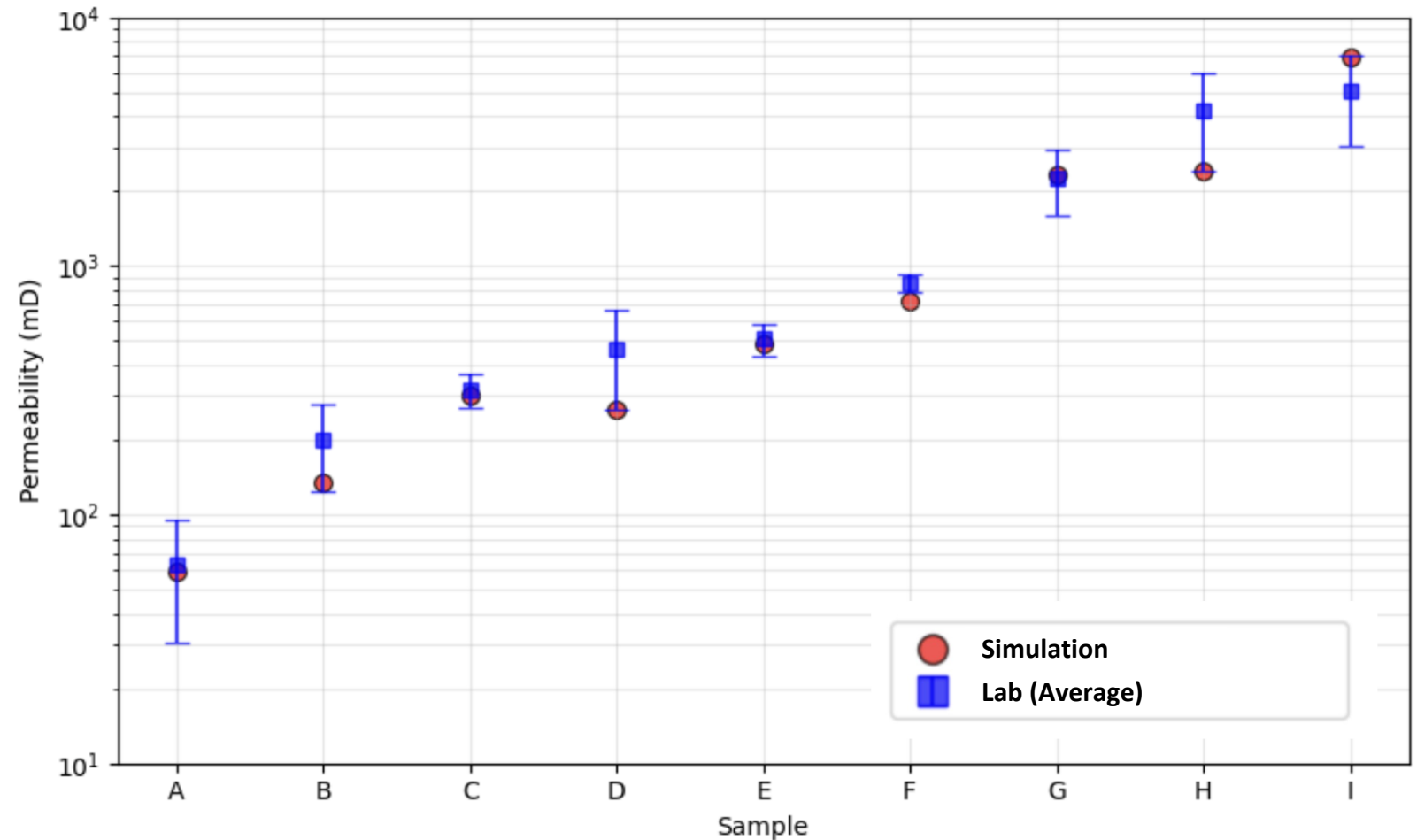
| | |
|-----|----------------------|
| d10 | 196.43 μm |
| d50 | 81.62 μm |
| d90 | 16.49 μm |

RESULTS - PSD Generated



RESULTS - Experimental vs Simulation Permeability

- 88% in range



OBSERVATIONS

- Successfully duplicate experimental permeability values
- With minimal computational requirements, possible to achieve consistency in results

FUTURE WORKS

- Clay content: model clay behavior (cohesion)
- Intermolecular forces effect on mesh and permeability results
- Integrate non-spherical assumptions whilst minimizing computational costs
- Solid produced utilizing fully DEM + SPH