POSTER 70

Modelling Packed Bed Structures

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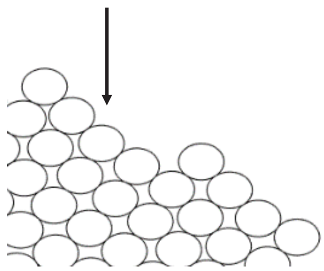
Introduction

Agglomeration is where particles join together during isolation to form clusters, known as agglomerates. These agglomerates then cause issues for further processing, due to varying sizes, strengths and potentially containing impurities, which often results in the material having to be reprocessed or discarded.

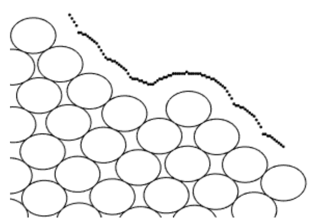
Aims and Objectives

The initial aim of this project is to produce a model that can simulate the packing of spherical particles in both 2D and 3D. This model will then be used to investigate the properties of the packed bed, such as the strengths of the contact points, impurity transport throughout the bed and how clusters form when the bed breaks apart.

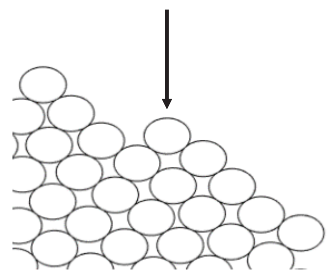
2D Bed Creation



1. An initial particle location is determined randomly.



2. The possible points of rest near the impact point are determined

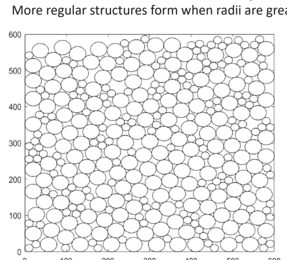


3. The particle iterates through these points until it finds a depression

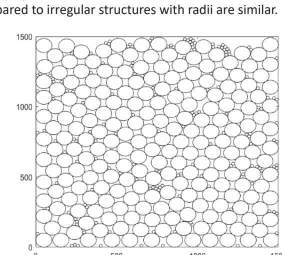
Results

Multiple Size Particle Systems

The model can produce systems with varying sizes of particles.
More regular structures form when radii are greatly different compared to irregular structures with radii are similar.



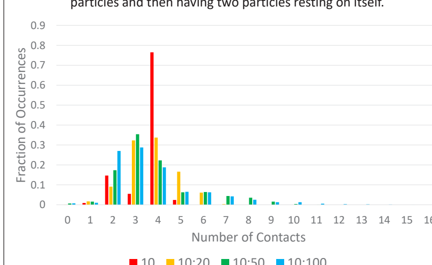
Radius 10 and 20



Radius 10 and 50

Contacts

The number of contacts each particle had was also determined, with most having three to five.
Four is the expected value, in the generic case of a particle resting on two particles and then having two particles resting on itself.



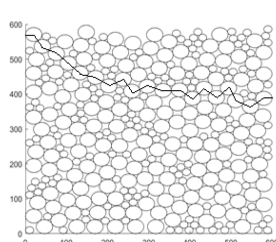
Packing Fractions

The packing fractions of the beds created by the model were calculated. They remain consistent with a minor increase in the systems with a larger difference between radii

	Packing Fraction			
Particle Radii	Repeat 1	Repeat 2	Repeat 3	Average
10	0.768	0.764	0.754	0.77 ± 0.01
10 & 20	0.773	0.768	0.756	0.77 ± 0.01
10 & 50	0.776	0.774	0.784	0.78 ± 0.01
10 & 100	0.781	0.795	0.792	0.79 ± 0.07

Percolation

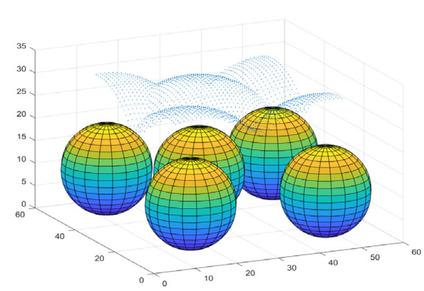
Percolation structures, a chain of large particles connecting the sides of the box, were also investigated.
Beds were created with different ratios of large to small particles to determine the threshold at which these structures no longer formed.



Radius 10 and 20 at a 1:1 addition

3D Systems

The model is also able to create 3D systems, using a similar method as the 2D algorithm, however rolling in both the X and Y planes.



Future Work

- Functionality to determine the forces present at the contact points between particles
- Functionality to create systems with non-spherical particles