ENGINEERING
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Simulation of Powder Spreading Process for Binder Jetting Additive Manufacturing

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Introduction

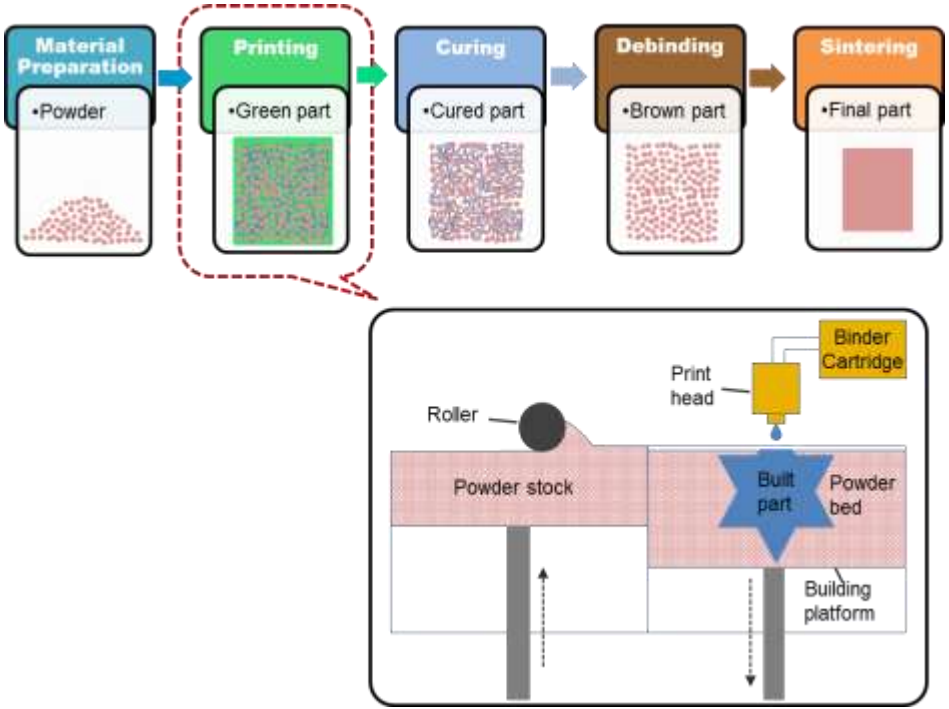


Figure 1. Binder Jetting Printing Process and Printer

- Binder jetting (BJ) has little shape and material limitation, and is easy to scale up.
- Powder spreading is an important part of BJ and will affect the powder bed density and final part density.
- Simulation of powder spreading process can provide guidance for print setting optimization, printer design, and materials development.

Discrete Element Method (DEM)

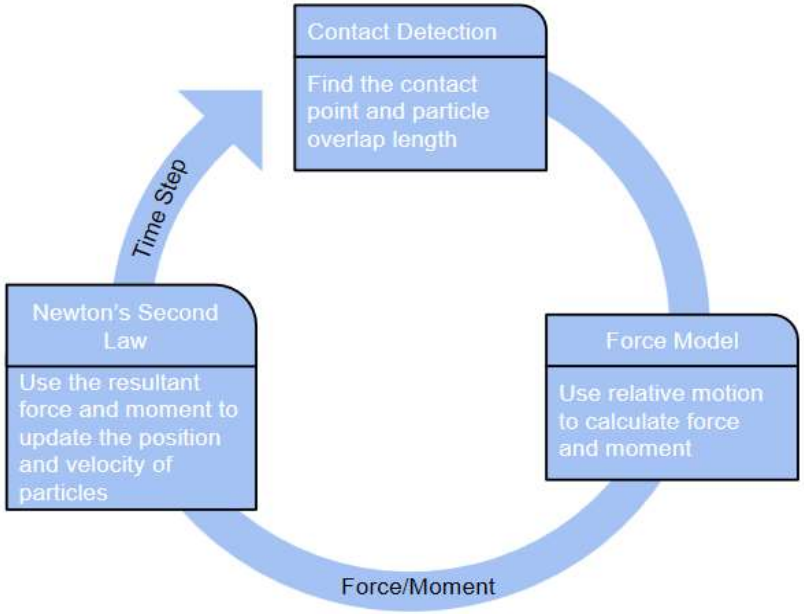


Figure 2. DEM Simulation Flowchart

- Discrete element method is a numerical method used to compute the motion and forces of a large number of individual particles.
- In each time step, the positon, velocity, and force (acceleration) of every individual particle will be calculated and updated.
- This is a proper method to simulate the behavior of powder materials used for binder jetting printing.

Model Setup

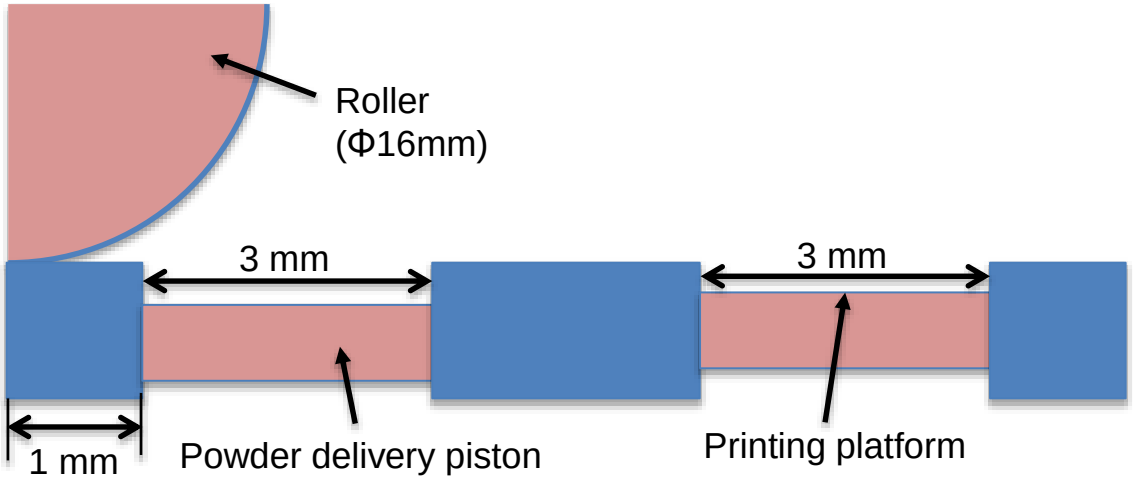


Figure 3. DEM Simulation Setup

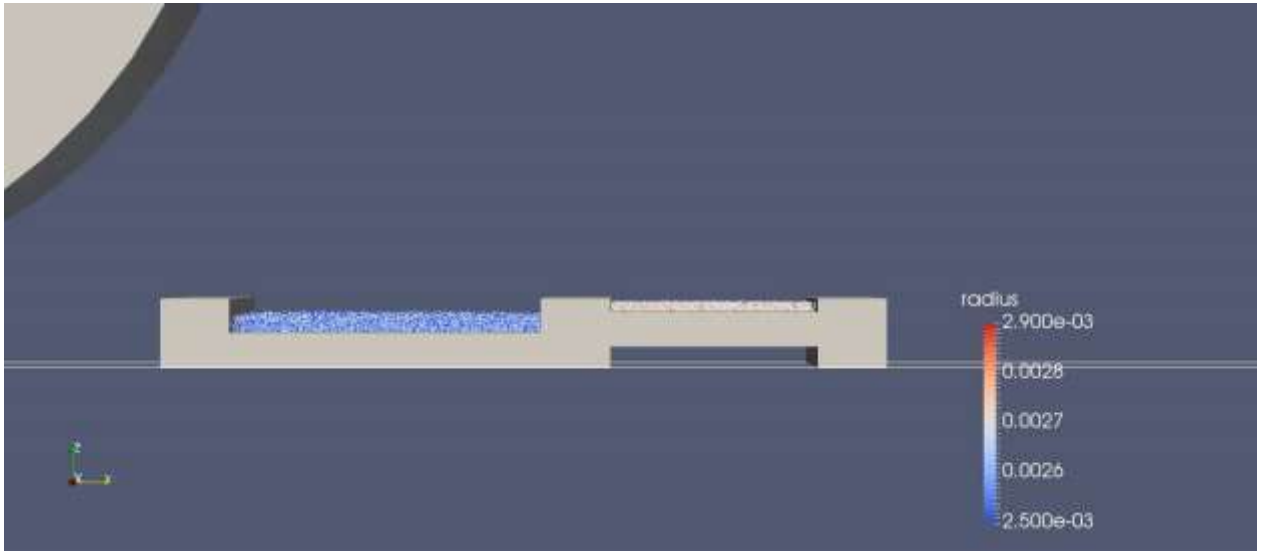
Input parameters

- Particle size distribution
- Particle material
- Roller shape and size
- Roller translational speed
- Roller rotating speed
- Layer thickness

Output parameters

- Particle stress
- Packing density

Simulation Result



- Software: LIGGGHTS
- Cluster: Ada
- Number of cores: 8
- Memory: 5000 MB/core
- Run time: 48 h

Future Directions

- Validate the simulation result using the commercial Microjet ComeTrue T10 binder jetting printer
- Study the spreading behaviors of crushable granules
- Predict the particle stress and guide the powder preparation process

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