Heterarchical Comminution Model for Rotary Mills

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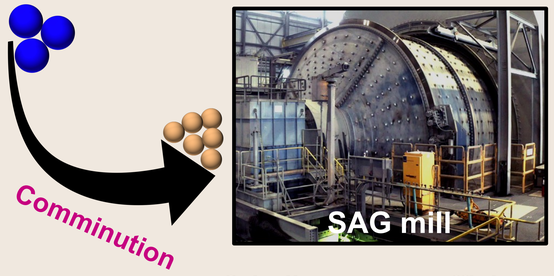
Introduction

Mineral processing industry consumes a significant amount of global energy.



Grinding energy efficiency of SAG is less than 1%.

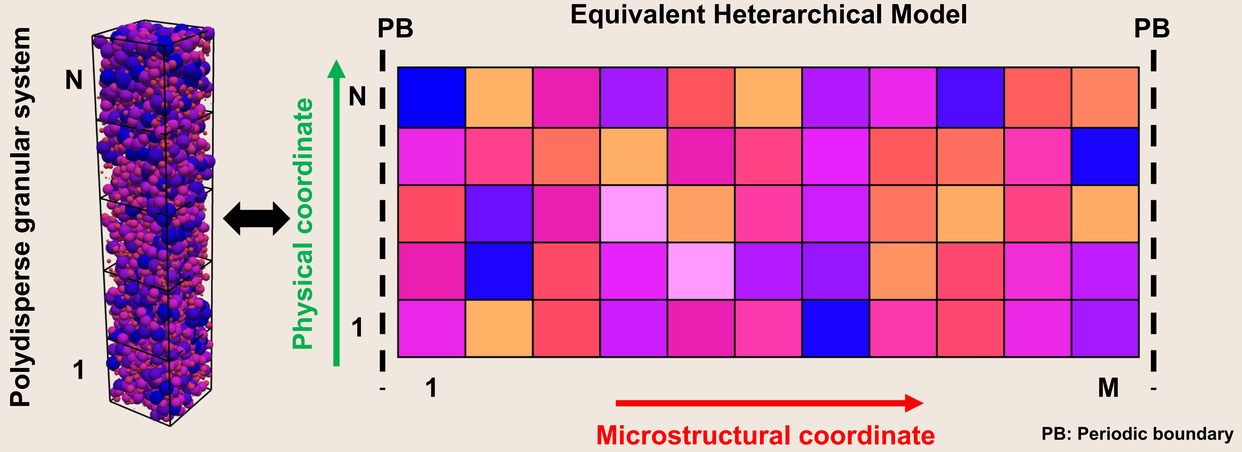
We need to understand what happens inside the SAG mills to improve their efficiency.

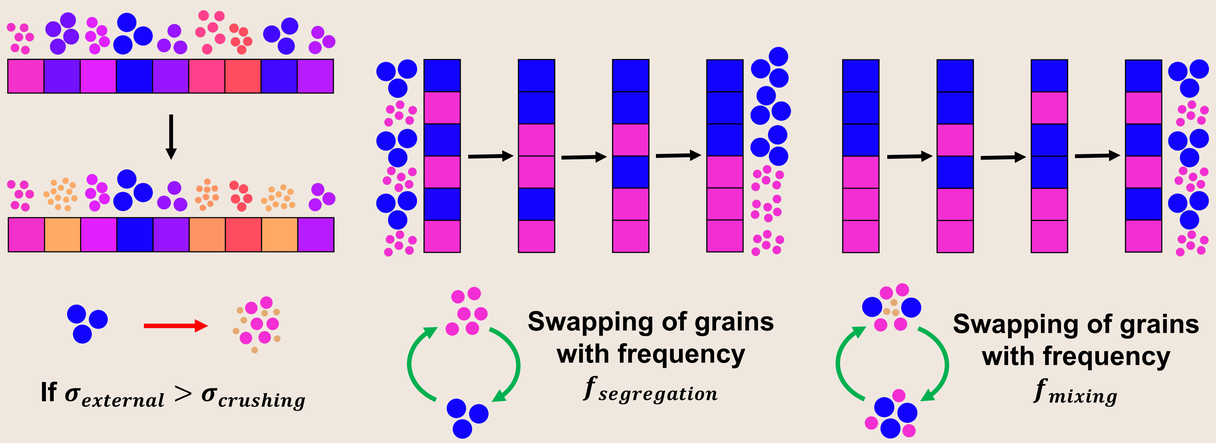
We use a novel approach based on multi-scale heterarchical model to study comminution in rotary mills. We integrate heterarchy along the barycentric streamlines for the granular flow covering the entire mill domain.

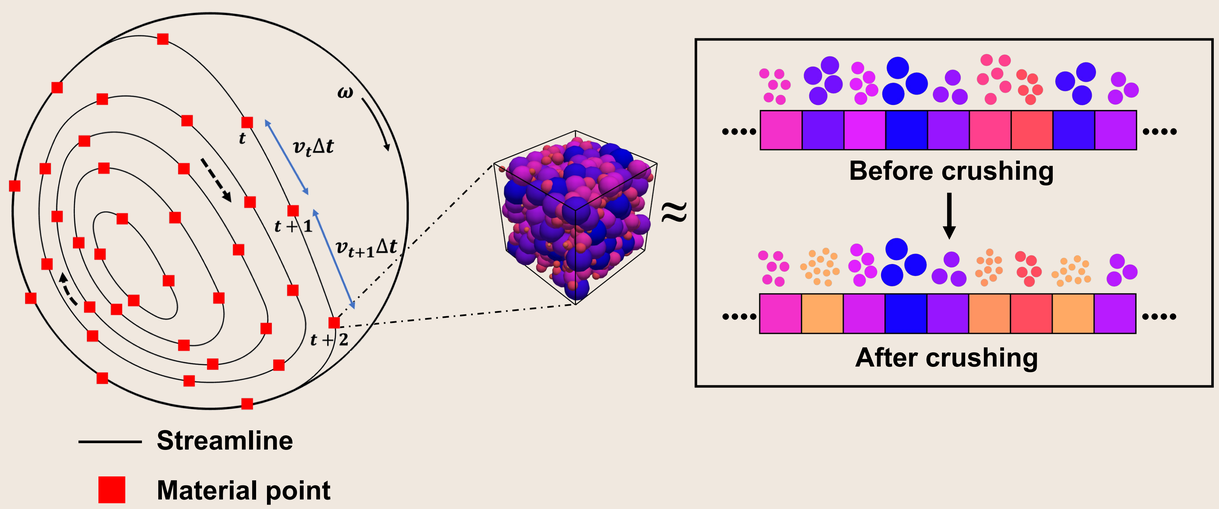
This study aims to:

- Model particle size distribution at any point in space and time.
- Obtain energy cost of grinding.
- Reduce consumable wear.
- Optimize the grinding energy efficiency.

Model

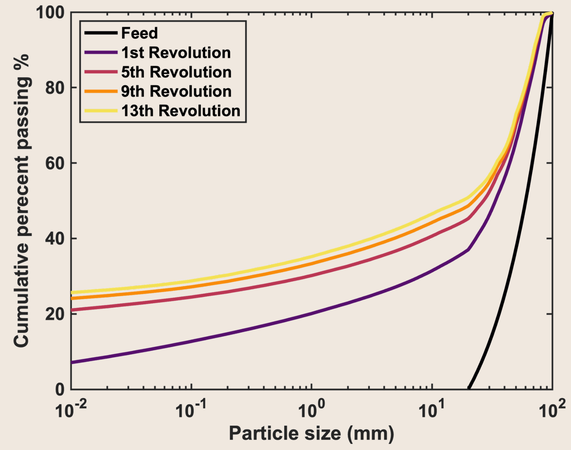


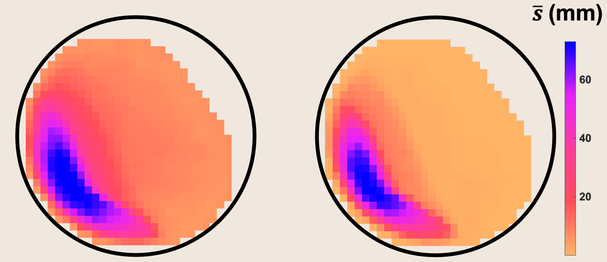




Results

Particle size evolution in space and time

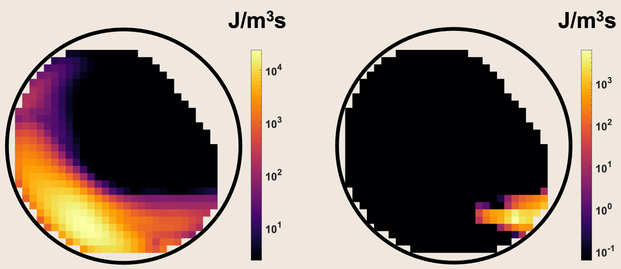




After 1 revolution

After 13 revolutions

Energetics of comminution



Frictional energy dissipation

Fracture energy dissipation

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