Modeling Particle Motion in a Rotary Dryer

TCU Department of Engineering - Senior Design

Background

- Design a lab-scale model of a cylindrical rotary dryer
  - Drying of mined limestone
  - Increase efficiency
- Model particle motion within dryer
- Parameters
  - Lifter type
  - Lifter length
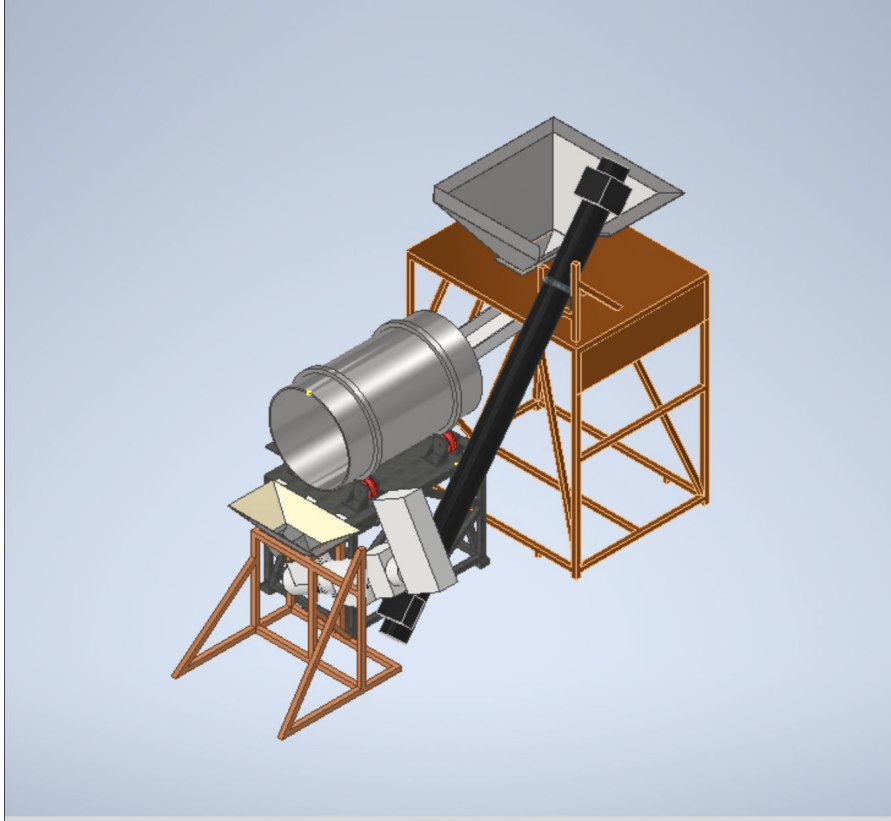 - Revolution rate of the dryer
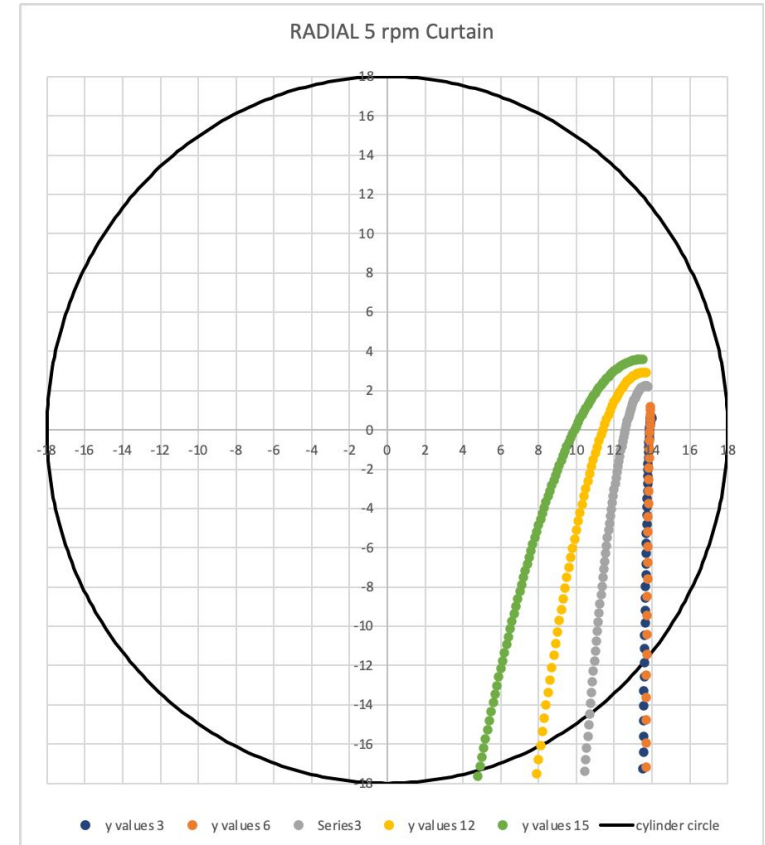 - Angle of 5 degrees

Approach

- Develop governing equations for a simple case to determine free fall trajectory of particles
  - "Curtain"
- Basic kinematics
- Assumptions:
  - No friction
  - No centripetal force
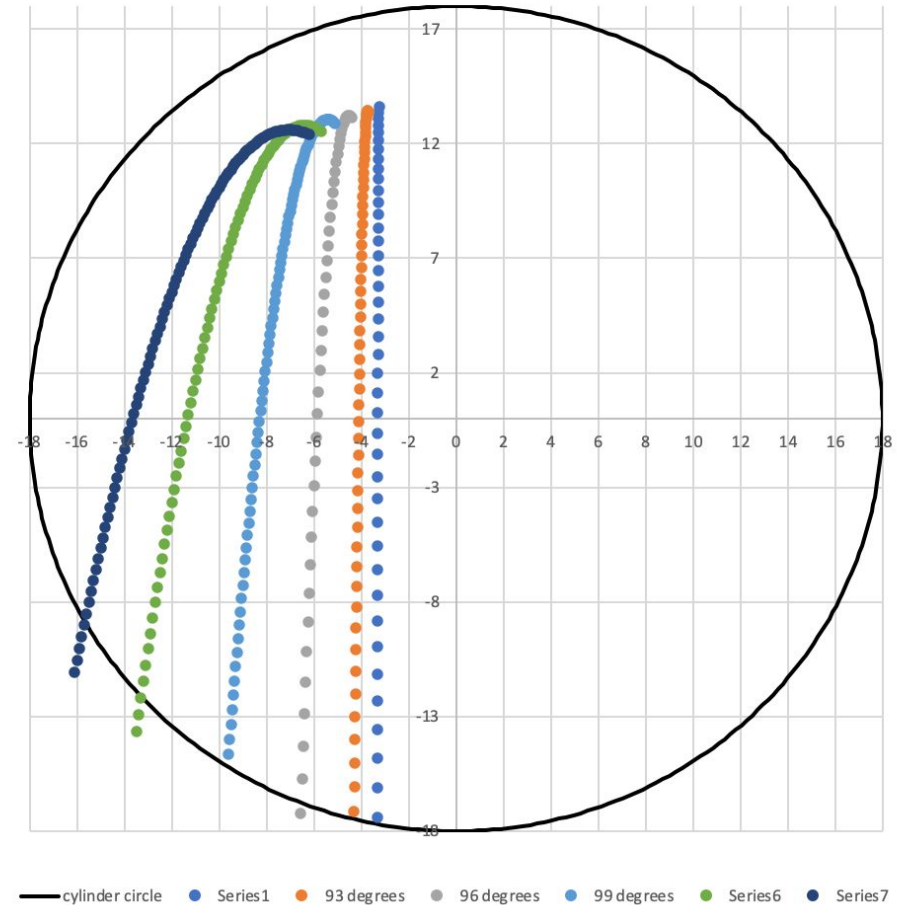 - No bouncing of particles
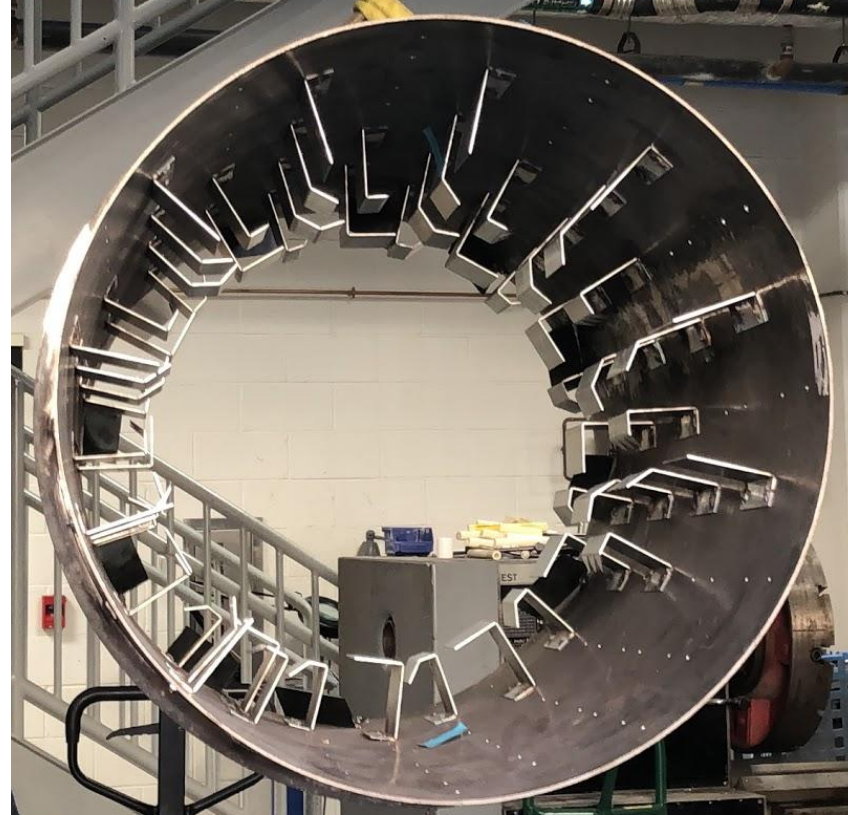
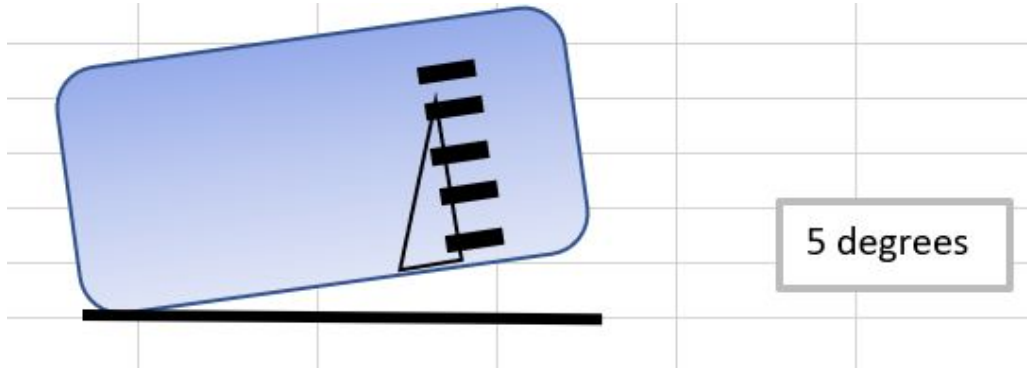# System

Lifter 1 - Radial Lifter

Lifter 2 - 90 Degree Lifter

90 Degree Lifter at 5 RPM

Residence Time in the Cylinder

5 degrees

- Calculated total residence time based on the rotation speed of cylinder

- Used trigonometry to find longitudinal distance traveled with each rotation to be 1.98 inches

- Based on the 60 inch length of the cylinder, calculated it would take 71.18 seconds to leave the cylinder at 5 rpm