Dust Management in Mining

Using numerical methods to investigate complex phenomena

Engineering is an applied science, meaning that engineers use scientific principles to solve problems. Many problems can be solved using simple models from physics (for example, the equations of motion) or empirical information such as hands-on experience or experiments. There are some phenomena that are so complicated, the relatively simple methods mentioned above cannot be used. This is where numerical modelling can help. Numerical modelling uses mathematical models of complex systems that are converted into iterative computer simulations. Numerical modelling is regularly used to understand the complexities of fluid dynamics (the movement of liquids and gases).

One complex problem for industry is dust management. Dust in the air is a hazard to people, to the environment, is tough on equipment and in some instances, like in the potash industry, can be salable product that is being lost. The team at Prairie Agricultural Machinery Institute (PAMI)/WESTEST proposed a pilot project to determine if numerical modelling could be effectively used to model dust propagation – a complex phenomenon involving solid particulates moving within air. The project, called **Dust Management in Mining - Preliminary Investigation to Highlight Dust Propagation Mechanisms**, proposed to investigate if numerical models could be created of dust propagation in transfer chutes. Transfer chutes are pieces of formed sheet metal that help guide material from one conveyance to another conveyance or location.

The project researchers developed numerical models that used both discrete element method (DEM) for the solid particles coupled to a computational fluid dynamics (CFD) model. This allowed the solid particles to be modelled, along with the fluid (air) and to have each model affect each other. The objective was to determine if the programs could create predictive models of the airflow in and around ore transfer chutes and to see the effects of ore flowrate and chute geometry. Both an inline (straight) chute and a 90-degree chute were investigated. The researchers were able to create these simulations, creating data around the velocity of the air in and around the chutes, resulting mass airflows entering and exiting the chutes, and on the turbulent kinetic energy, a measure of the intensity of turbulence.

Having the ability to simulate these highly complex flows allows for analysis and decisions around process performance without having to build a real prototype or resorting to trial and error. For example, the results of this project can help mining companies optimally place dust suppression systems around their conveyance transfer points. This successful project combined two numerical modeling methods into one – allowing companies to test out new ideas faster and cheaper and to create better solutions to complex problems.

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Project Duration: Sept 2019 – Feb 2020

Project Cost: $35k

IMII	**$25K**
WESTEST	**$10K**

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