

# HPC Simulation of Metal Powder Segregation in the Manufacturing of Cored Wire

## Organizations

**CEDIE** is a Spanish manufacturing SME that produces more than 10,000 tons of cored wire filled with metal powders per year specially designed for steel mills and foundries.

**GOMPUTE** is a Swedish simulation and HPC solution provider.

**CITMaga** is the Galician Centre of Research and technology transfer in the field of Industrial Mathematics that supports industry and organizations.



End User



Domain Expert

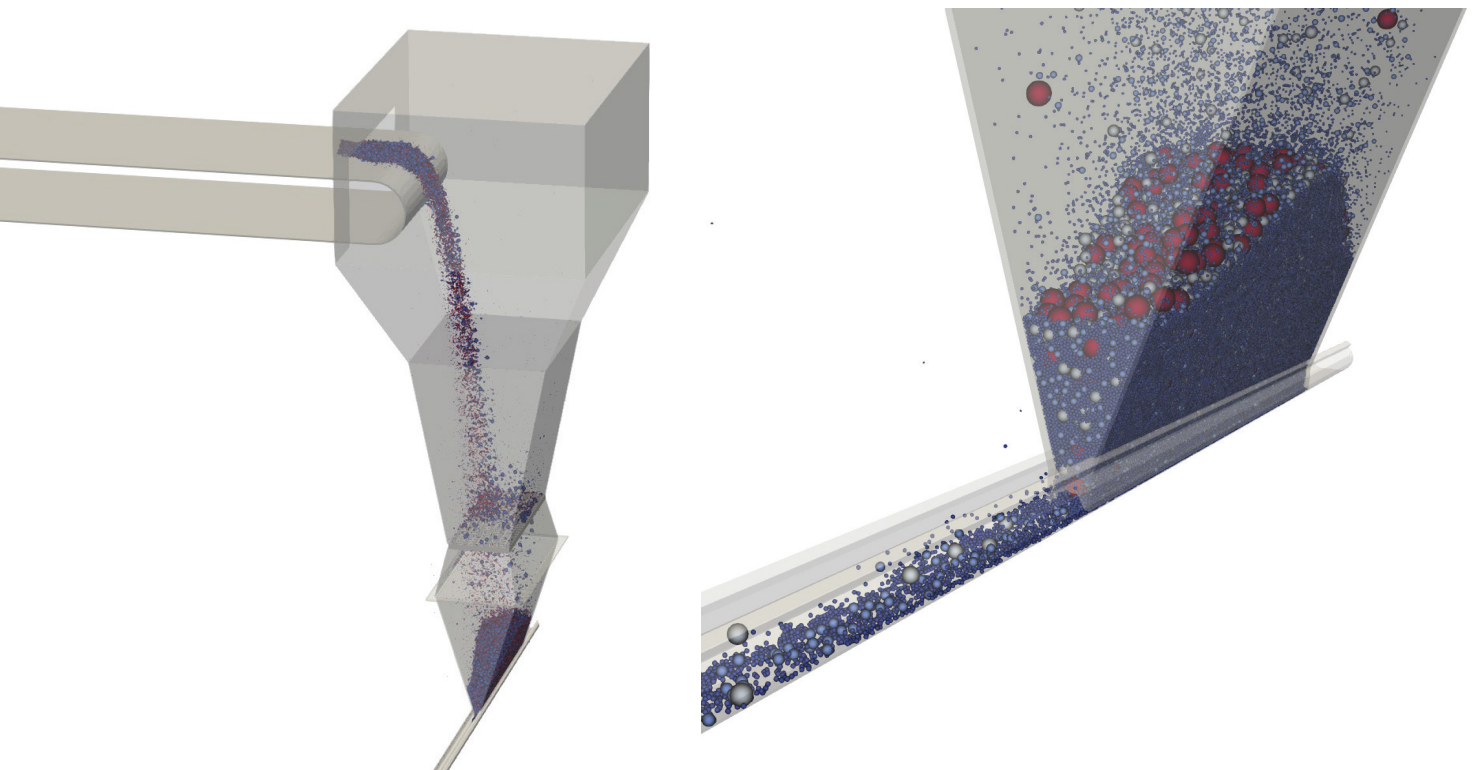


HPC Provider



## The Challenge

Cored wires manufactured by CEDIE are used as additional material in the steel and foundry industries. This product allows its clients to make fine adjustment to the physical properties of their final products. As it is the last step of its clients' process, the cored wire quality (i.e. composition) is of the utmost importance. As the core of the continuous wire must contain a metal powder made of a mixture of poly-disperse granular materials of very different densities and particle sizes, undesirable segregation between the different metal particles occurs during the wire filling process, especially at the beginning of the production, making the first portion of the final manufactured cored wire unsuitable due to its high inhomogeneity. On average, an annual 1.5% of the coils' length produced by CEDIE are rejected because of a lack of uniformity. This leads to inefficiencies in production, generation of material waste, and, consequently, high economic losses. The goal of the experiment was to optimise the wire filling process to reduce segregation in the final product, contributing to a more economically and environmentally sustainable manufacturing process.





Industry Sector  
**Manufacturing**

Technology used:  
**HPC,  
DEM Simulations**

## The Solution

The Discrete Element Method (DEM) – implemented by CITMAGA with open-source code - was used to predict the segregation during the initial production stage of the cored wire. The material parameters were calibrated via studies performed for granular flows in simplified configurations. The model was then validated against experimental measurements obtained during production.

Since DEM simulations require a huge computational effort, execution on HPC resources, provided by GOMPUTE, is essential.

## The Impact

The experiment enables CEDIE to improve the manufacturing process of cored wire by reducing deficiencies. The savings in material waste are estimated to be 90%, resulting in an estimated cost reduction of up to €375,000 over 4 years. In practical terms it provides a detailed understanding of the process, opening a window for exploring new designs for bins and conveyor layouts as well as new types of mixtures in the medium term. Thus, CEDIE's competitiveness will increase by developing new products before competitors and maintaining a cost-efficient and more eco-friendly production. These business levers determine the framework for assuring its sustainability.

For CITMAGA and GOMPUTE, knowledge gained from the experiment is valuable for consulting projects regarding DEM simulations in other industrial sectors.

CEDIE is located far from high-density industrial regions and from the centre of gravity of steel and foundry production in Europe. Despite this being a strong drawback, this experiment contributes to sustaining and consolidating highly qualified employment in a depopulated region.

## Benefits

- Savings in material waste of 90% compared to the current process, leading to an increase in profit for CEDIE of up to € 375,000 over 4 years.
- CEDIE has a tool to increase the intrinsic quality of its products and its competitiveness in relation to principal competitors.
- In the medium term, there will be revenue from the testing and commercialisation of new powder mixtures for CEDIE.
- CITMAGA broadens knowledge in DEM modeling and expects to apply this technology to other industrial sectors (e.g. pharmaceutical) and SMEs, with estimated revenues associated above €30,000 per year.
- GOMPUTE improves its capacity and expertise for providing services, as DEM models have extraordinary computing demands. It expects to attract new customers in the field of HPC DEM simulation with a projected revenue of €20,000 per year.