Lime Kiln DEM Analysis with ROCKY

To remain a world leader in the lime industry, Cimprogetti uses the latest and most advanced technologies: ROCKY Dem has proved to be the best solution for simulating the transportation and handling of granular material with different shaped particles. With technical support from EnginSoft we have developed a project that can analyse and optimize limestone dynamics inside a lime production kiln. The results have been excellent, and future experimentation in improving the efficiency of our plants will definitely proceed.

Eng. Valerio Colombari
Head of New Product Development Unit
Cimprogetti

CIMPROGETTI®
LIME TECHNOLOGIES

Cimprogetti was founded in 1967 by Pierluigi Rizzi, former President and current Sole Director, in Bergamo (Italy), the 2nd most important industrial province in Europe, located in Lombardy, a region rich in tradition and expertise in the production of lime, cement, ground carbonate, etc.

The entrepreneurial skill of the company's founder, along with the experience and determination of the staff, has allowed Cimprogetti to rapidly expand its operations into sixty countries worldwide, spanning the five continents.

The company's product range spans from vertical kilns for the calcination of limestone and dolomite to complete quicklime hydration units. Over several decades, Cimprogetti has consolidated its distinctive business approach: to provide comprehensive lime plants from A to Z, from know-how and engineering design to an EPC basis delivery and to supply innovative and high-performance plants based on well-proven design, adopting tailor-made solutions whenever needed, to meet the customers' specific needs.

Process Engineering is vital for any industrial plant development. Its broad scope ranges from site visits, surveys and discussing issues with operators, to long-term project development. Our Process engineers design and optimize chemical processes,
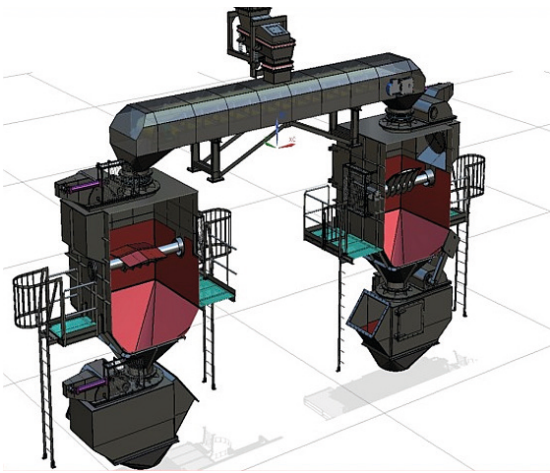
Figure 1 - Lime Klim model

The use of ROCKY DEM in design

Cimprogetti is a worldwide leader in designing equipment and plants for the lime industries. As far as lime kilns are concerned, they can be located in different plant configurations, such as chemical plants, construction sites, steel plants or lime producers. Typically, the handling and the storage of the lime that feeds the kiln, it will vary continuously according to the customer's specific plant requirements, whereas the load part on top of the kiln remains unchanged. This is organized in a way that manages and optimizes any lime distribution situation coming from the kiln upstream. The aim of the activity carried out by Cimprogetti in collaboration with EnginSoft, was to perform a dynamic analysis of the kiln's lime feeding process, starting from the typical plant configuration with skip fed by a weighing hopper, until the charging of limestone into SRT hopper of the new kiln loading system designed with the last Vanguard® kiln technology .

The tool used for the analysis is ROCKY, a DEM (Discrete Element Modeling) code. The software, starting from the CAD provided by Cimprogetti, has allowed us to virtually reproduce the whole lime transportation phase, handling the skip, the conveyor belt and the internal flap of the SRT hopper. An important part of the simulation has been the calibration of the particle's characteristics, both physical (friction and impact) and geometrical (real and not spherical shape) ones. The simulation has showed how the limestone reach the top of the kiln and has therefore allowed us to improve the design of kiln loading system with the result of a uniform stone distribution.
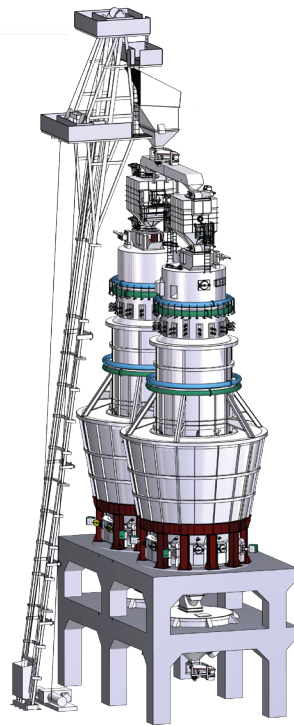
advise on process safety issues, analyze and interpret laboratory and plant data and, generally speaking, provide technical support to customers with the aim to ensure the technical integrity of equipment and plants. The Lab forms part of our design department and is equipped with state-of-the-art 3D CAD and CAE workstations to support all the engineering phases of a project. The use of simulation tools allow to predict the behavior of design solutions. It is possible prove innovative concepts and optimize designs, starting from the early stage of the design and engineering process until to the product validations and to a better understanding of the implications of design decision on the plant performances.
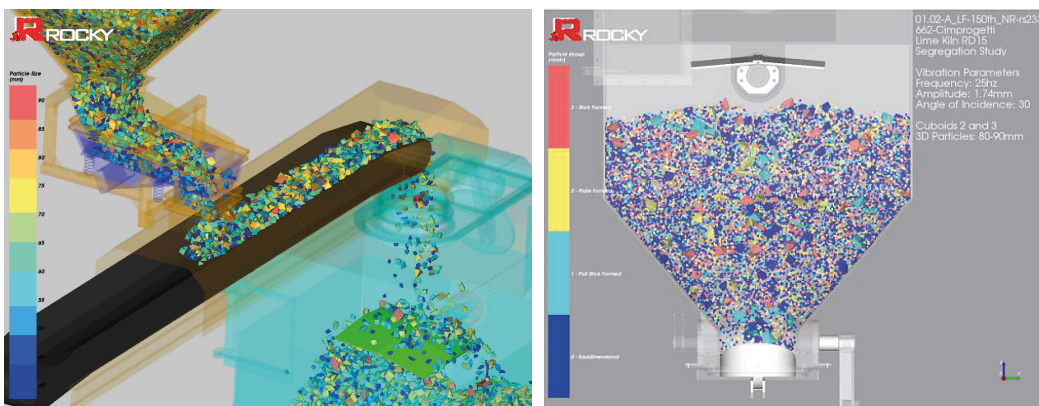

Figure 2 - Lime klim

Figure 3 - Rocky DEM simulation

ROCKY is a powerful, 3D Discrete Element Modeling (DEM) program that quickly and accurately simulates the granular flow behavior of different shaped and sized particles within a conveyor chute, mill, or other materials handling equipment.
Several capabilities set ROCKY apart from other DEM codes, including non-round particle shapes, the ability to simulate particle breakage without loss of mass or volume, the visualization of boundary surface reduction due to wear, and more.
ROCKY is supported in Europe by EnginSoft. For more information: Massimo Tomasi, EnginSoft - m.tomasi@engisnoft.it

Case Histories