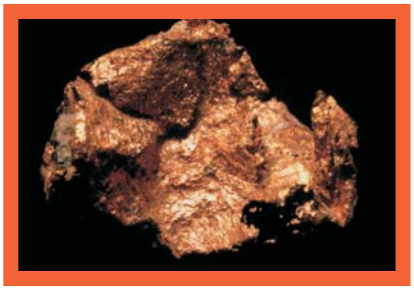
IPCOS

# CASE STUDY: NEW MPC CONTROLLER CRUSHES TRADITIONAL APPROACH TO COPPER ORE GRINDING

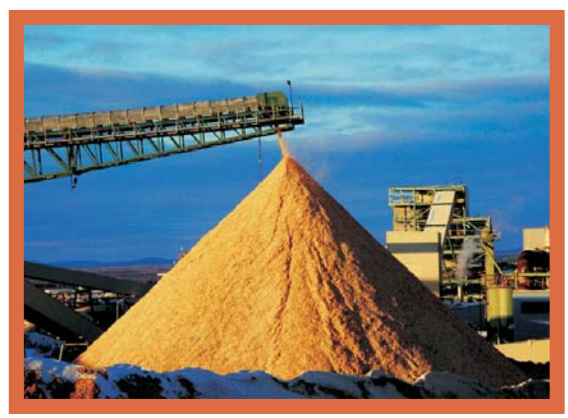


*Model Predictive Control (MPC), usually confined to petrochemical applications, was applied in the non-traditional area of copper ore grinding at a US mill. The successful implementation drove the line to its optimum operating point, maintaining control through variations in ore characteristics.*

The mill processes ore to produce copper concentrate. Sitting between upstream ore handling and downstream flotation operations, there are eight grinding circuits in total; each circuit is made up from a combination of rod and ball mill operations together with cyclone separation devices. The original regulatory control system, in place before the MPC scheme was commissioned, managed the grinding circuits by manipulating the feed rate to control particle size. The required particle size specifications were entered by the operator and the control system maximised the throughput. Alternatively the operator could disconnect the particle size controls altogether and simply fix the feed rate. Although established in the industry, this control scheme was unable to manage all the grinding lines simultaneously and did not take into account equipment loading constraints or variations in ore characteristics.

Patrick Thorpe and his team carried out a 'proof of concept' study on the mill which suggested it as an ideal candidate for a Model Predictive Control scheme, an approach more usually associated with the petrochemical industry. Using Predictive Control Ltd's MPC product Connoisseur, they created an application which optimised the feed rate to each grinding circuit without violating operating limits, including maximum particle size, cyclone overflow density and cyclone pump current. They addressed key issues for the mill, including

- mill overloads
- varying ore characteristics
- variable process gains
- variable and complex process dynamics, including inverse response
- multiple process constraints
- changing equipment capacity
- changing feed availability
- difficult process measurements
- abrupt upsets.



Each of the eight grinding circuits was allocated a separate multivariable controller, each controller having access to a number of process models which represent the process dynamics under different operating regimes. The controller automatically selects the best control model according to the prevailing conditions. The controllers themselves are designed to modify their models to adapt to longer term drifts in operation, such as mill wear, and incorporate a linear program optimisation scheme that optimises the operation of each line. Feed is distributed evenly across the operational lines to optimise overall equipment utilisation and minimise wear. Mill overload, previously a main constraint to operations, is avoided by on-line analysis of key process measurements and appropriate action by the controller, for example, to reduce feed rate or re-distribute the feed.

The implemented MPC scheme provides optimum operation of the ore grinding circuits under all feed conditions, maximising production rate and utilising the grinding circuits in the most efficiently and wear-reducing way.


For more information please contact us at

IPCOS (UK) Ltd

Tel. + 44 (0)1223 833228
Fax. + 44 (0)1223 834162
Email info@ipcos.com
Web www.ipcos.com