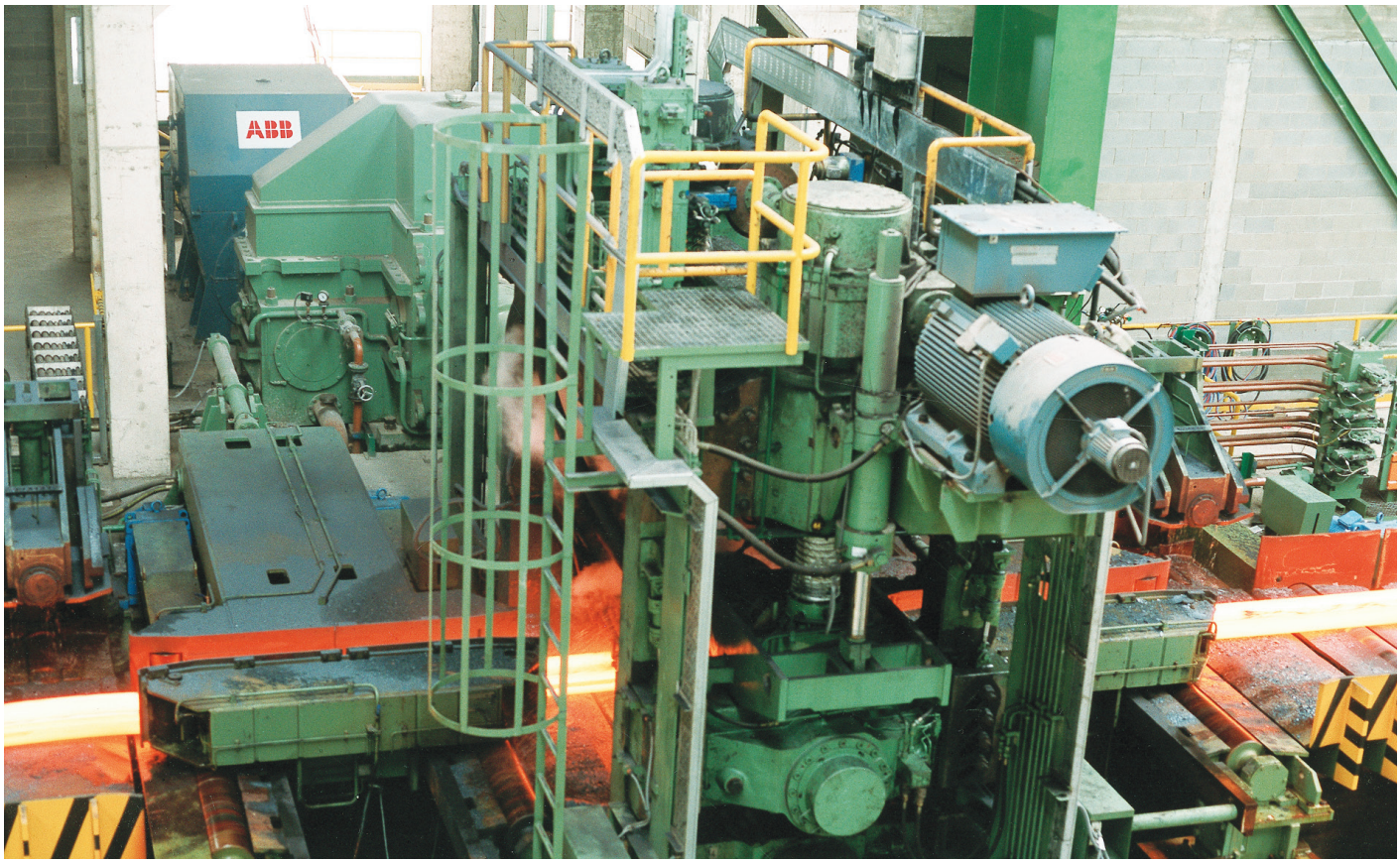
Value added service offering

ProfileOpt
Optimization and simulation service for profile mills



What is ProfileOpt?

ProfileOpt is a powerful simulation and optimization service for bar and wire rod mills. It suggests optimum mill setup values for achieving minimum rolling power, maximum productivity etc. It is developed using state-of-the-art physics based models with ABB's rich process know-how.

These models can be customized for the current mill configuration, e.g., number of stands, types and size of groove etc. The models can be adapted for current mill operation for any product such that the model predictions match the measurements, e.g. rolling power, temperature, exits bar dimensions etc.

The customized and adapted models can predict material spread, torque, power and temperature at the exit of each stand of the mill. The models can be used to optimize rolling energy consumption, thermal energy consumption, productivity while keeping groove utilization and stand loading at desired level and generate pass schedule values as speed and roll gap set points.

Apart from optimization, ProfileOpt can simulate rolling conditions very well, and also advise operators on the effects of various process parameters on rolling process and exit material dimensions by the powerful feature of Sensitivity and Uncertainity Analysis.

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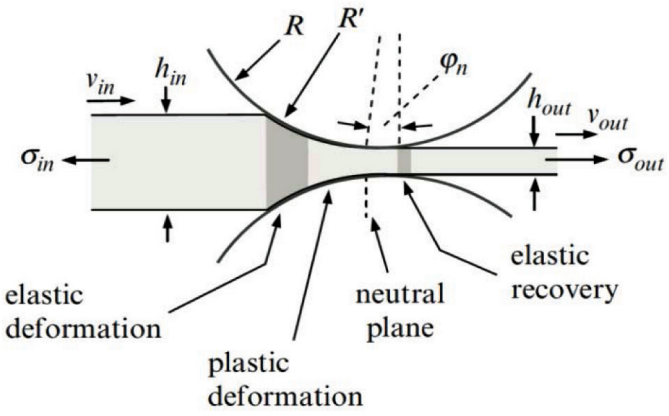
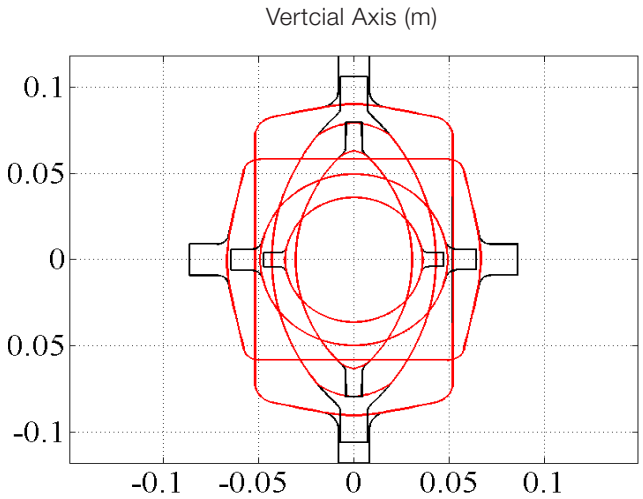
Benefits
Customer can achieve tangible benefits from this service, e.g. 4~10% reduction in rolling power consumption or 8~12% productivity improvement depending on process and operational constraints.
Key benefits to the customer include -
- Reduction in rolling power and thermal power consumption
- Maximization of productivity at reduced specific energy consumption
- Optimum groove utilization, and load sharing at various stands
- Better understanding of the mill setup via what-if simulations, sensitivity analysis and Monte Carlo analysis.

Features
- State-of-the-art physics based model for hot profile rolling
- Customization to actual mill configuration
- Provision to incorporate different groove shapes to predict material deformation
- Model Adaptation for actual rolling conditions
- Configurable Optimization objectives and process constraints
- Monte Carlo Analysis
- Sensitivity Analysis
- Quantitative Outputs - Practically implementable mill pass schedules within process constraints



Model Adaptation
Success of any mathematical model depends on the accuracy of its predictions with respect to the real mill conditions. To ensure this, ProfileOpt has a powerful feature to adapt the model for major process parameters, e.g. rolling power, speed, temperature etc.

Energy consumption minimization
Minimizing energy consumption is one such optimization choice available in ProfileOpt, while at the same time allowable upper and lower limits are defined for bar width, area, speed, interpass tension, roll gap and motor speed. The finishing dimension and production speed are kept unchanged. Optimizer then solves this nonlinear minimization problem and returns the optimal rolling energy consumption value, or power, as well as the influence of the determined parameters (usually roll gaps and reduction factors) on width, area, tension etc. The complex dependencies between process parameters are handled by consistent rolling models linking mass flow, spread, interpass tensions, torque and power. Controlling bar width and area, so called groove utilization control is not only of importance when reducing roll wear but it also plays an important part in preventing damage to the bar by ensuring it does not overfill the roll groove.
Other optimization objectives include but not limited to:
- Maximization of production speed
- Matching of individual stand powers to pre-defined targets
- Matching of individual bar exit widths and cross section areas with predefined targets



What-if simulations and sensitivity analysis
Another important feature of ProfileOpt is the simulation functionality. It allows predicting bar width, area, speed, interpass tension at each stand depending on process inputs as roll gap, motor speed, billet temperature. This feature is very useful when analyzing the effect of small changes or disturbances to the process parameters – so called sensitivity analysis.

Scope of delivery

ProfileOpt is an advanced service offering to the customers from ABB. One service offering includes data collection, model adaptation, simulation and optimization of predefined objectives for one specific grade of material and size. ABB will deliver a detailed report that includes recommendations for achieving optimized rolling conditions in terms of pass schedule values.

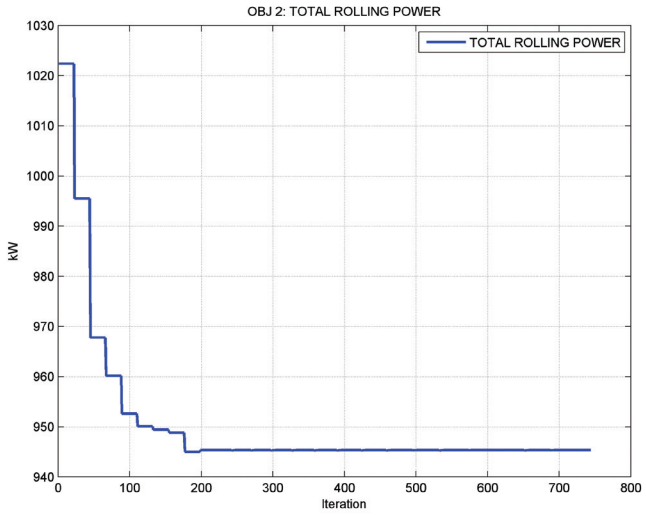
Methodology

Upon receipt of order, ABB will visit the site to collect all inputs that is required to run the simulation and optimization functions. At ABB premises, the models are configured and run as per the inputs collected. Final visit to customer site will be made to present the findings. As this is an offline service offering, source of data can be any kind of reliable data loggers and readings from the mill floor and mill automation system.

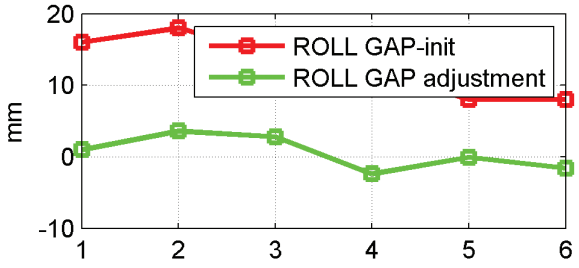
A real mill example

ProfileOpt was run for energy minimization objective after customizing and adapting the model with real mill configuration and process measurements. Some specimen results are presented.

Rolling Power (kW)

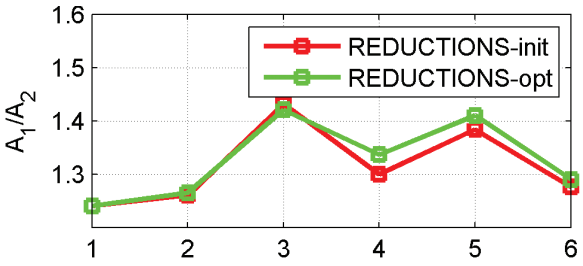


Roll Gap Adjustments



Stand No.

Reductions



Stand No.

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