



# FLATNESS EXPERT

## NEW MODEL-BASED TECHNOLOGY FOR FLATNESS CONTROL

High-quality cold strip production requires advanced and fast flatness control that makes full use of all available actuators and thus offers tight shape tolerances in terms of flatness and strip performance. The new model-based flatness technology control from Primetals Technologies is the smart solution to achieve this requirement.

### CHALLENGE

The flatness quality of the finished strip product is a direct result of the actual roll gap profile. If the roll gap profile has not been adapted exactly to the incoming strip profile, a non-uniform pressure distribution across the strip width will be the result. This non-uniform pressure distribution leads to differences in elongation across the strip width, which results in flatness errors.

The high strip tension during the rolling process may cover up the flatness error until the strip is finished. After rolling, the flatness deviation becomes visible as waves.

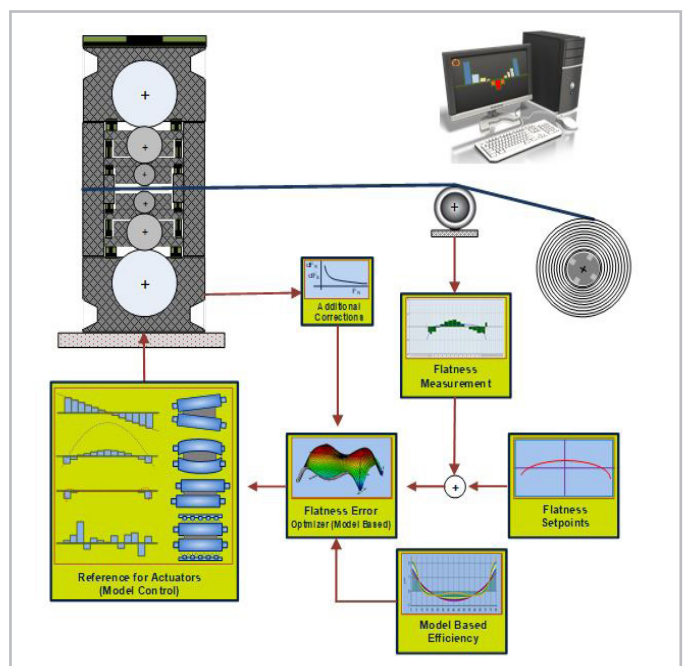
Flatness errors can also cause other problems, like lateral shift of the strip, pinching and strip breaks. These would reduce strip speed and productivity, which will ultimately impact the overall mill performance.

### OUR SOLUTION

The new Primetals Technologies Flatness Expert incorporates the latest flatness control principles, including model-based technology and simultaneous optimization of all actuators available in the mill stand to ensure the best possible flatness result of the strip. Using the actual

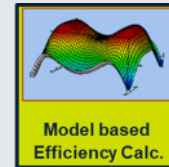
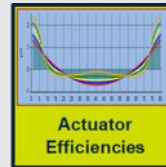
flatness deviation and the effectiveness of the actuators, the intelligent algorithm generates commands for the mechanical actuators reducing flatness errors up to three times faster than previous controls, resulting in less off gauge length.

The exact knowledge of the actuator effectiveness's is essential for the precise and fast flatness control.



Flatness control for all types of Cold Mills and Processing Lines

**Model based**  
Actuator Efficiency Calculation

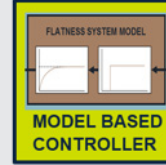


**Model based**  
Flatness Optimizer

$$\begin{aligned} \min f(x) \\ \text{s.t. } Ax \leq b \\ l \leq x \leq u \end{aligned}$$

Flatness Error Optimizer

**Model based**  
Flatness Controller



Newly developed models for flatness control

## PRODUCT FEATURES

### Complex algorithm

Newly developed processing boards allow usually time-consuming algorithms to run in fast cycle times

### BlockBuilder

Primetals Technologies' new development BlockBuilder allows conversion of complex mathematical functions into run-time optimized program blocks.

### Modeling

Expansion of model-based approach from L2 to online running L1 systems. Multiple actuators are optimized simultaneously.

### Modular application software

Clear software structure for easier understanding and faster start-up.

### Model-based actuator efficiency calculation

Physical roll gap model-based actuator efficiency adjusting.

### Minimized wear

Minimized stress on mechanical equipment with optimized actuator setup to reduce wear.

### One software source

One modular application software for all cold mill types.

## FIELDS OF APPLICATION

All types of Cold Mills and Processing Lines

## MAIN BENEFITS

- Improved shape control with regards to flatness results
- Optimized set-ups due to fast control results
- Reach flatness target 3 times faster
- Less off gauge length

## ADVANTAGES

- Elimination of flatness errors up to 3 times faster than classic control, reducing off gauge length.
- Fastest feedback controller in the market – reduction of scrap strip length at head and tail of coils for increased mill productivity.
- Flatness control stand-alone or integrated into an existing automation solution.
- Avoidance of edge / center buckles due to high dynamic reactivity.
- Controller/model parameter settings dependent on mill configuration data – Control preadjustment possible in advance.
- Easy control adjustment for reduced start-up time – No gain adjustment necessary, only adjustment of filter time settings to smooth control behaviour at high speeds.

**Primetals Technologies**  
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