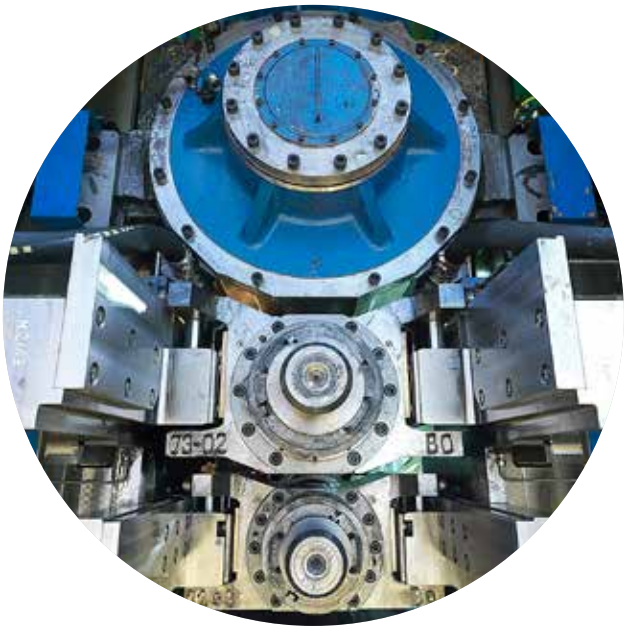


ROLL ECCENTRICITY COMPENSATION (REC)

Rolls in rolling mills are never completely round but have eccentricity which can be caused by:

- grinding inaccuracy
- non-uniform thermal expansion
- asymmetrical adjustment of bearing rolls shell via drive keys

Each eccentricity consists of a base frequency which is the rotary frequency of the roll and several harmonic frequencies. Every roll of each roll stack can show such eccentricities which lead to thickness and tension errors which also lead to disturbances in neighboring stands. The result is a mixture of many cyclic disturbances in the exit thickness that in most plants add up to a significant percentage of the total thickness error.

CHALLENGE

The first step is to find out the degree of improvement of the exit thickness which can be expected by installing an eccentricity compensation. This is a challenge due the large number of different eccentricity frequencies which all change with roll speed.
At high rolling speed the frequencies of eccentricities are much too high to be compensated by a closed loop control such as a mass flow control or a strip tension control.

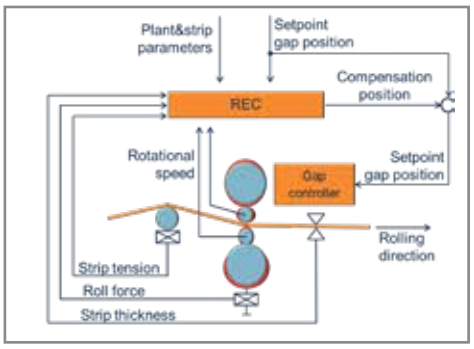
Moreover REC should compensate only roll eccentricities to avoid inappropriate reaction to other kinds of disturbances. This is difficult as all the available measurement signals contain many other disturbances. Moreover there is no possibility of measuring the eccentricity directly. Therefore the eccentricity needs to be determined by indirect measurement.

The best signal for determination of eccentricities is the stand exit thickness. This however is not available for most stands. Therefore a compensation has to use other, less convenient, signals.
Finally filtering a single eccentricity frequency is difficult as a pair of rolls has very similar diameters and therefore very similar frequencies.

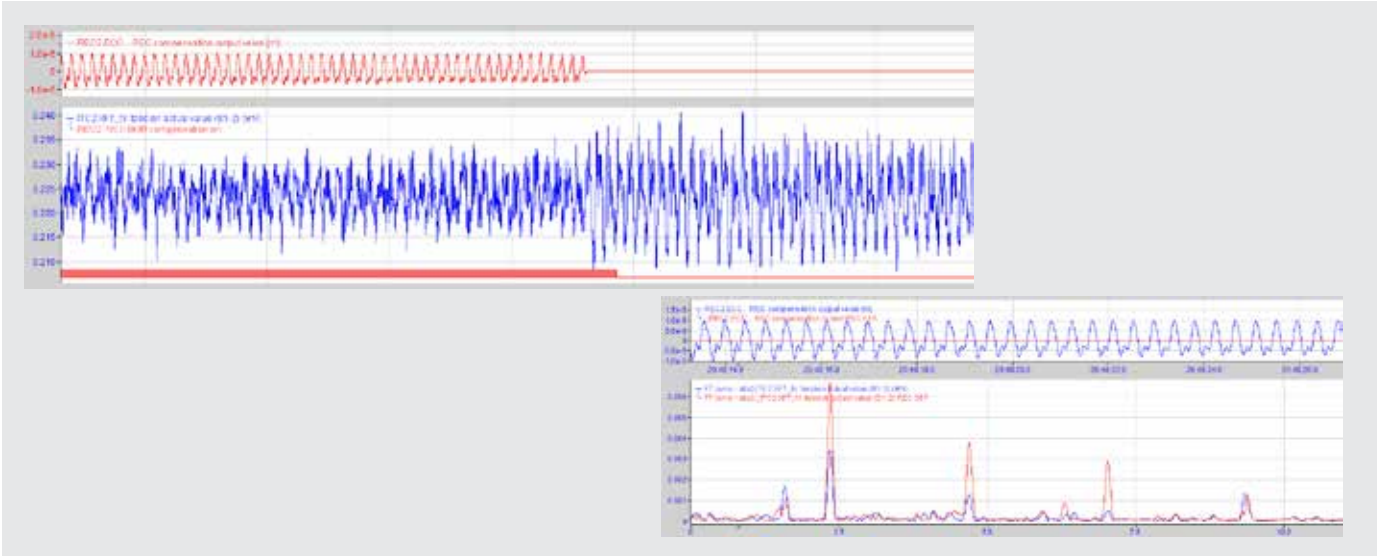
OUR SOLUTION

Primetals Technologies delivers hard- and software for eccentricity compensation. The REC is a fully digital model based control, which uses the fact that the eccentricity of each roll remains relatively constant during rolling to model its shape over several revolutions. Using an inverted plant model this modelled eccentricity is transformed into a compensation setpoint for the gap control (pre-control) moving the gap in a way that eliminates the influence of the eccentricity on strip thickness or tension.

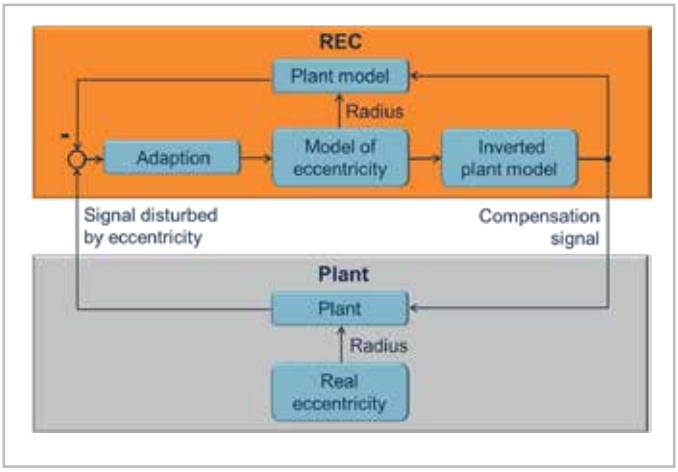
As input the REC uses, depending on availability, a combination of the exit thickness, entry strip tension and roll force to extract the eccentricities.



Control concept



Exit gauge versus time depending on the eccentricity compensation status



Structure of the controller

MAIN BENEFITS

- **Better strip quality** - improved thickness tolerances also at high rolling speeds
- **Maintenance friendly** - using existing thickness, roll load or strip tension measurements as feedback for control, hence no additional sensors or instrumentation are needed
- **Less roll changes** - applicable to compensate backup-, intermediate- and work roll eccentricities
- **Fast ROI** - easy to implement in existing basic automation environments

PRODUCT FEATURES

Can be installed in:

- Every stand
- For every roll
- All types of Cold and Hot Rolling Mills

Can work with all kinds of measurement setups. The following possible input signals can be combined for better disturbance differentiation:

- Exit thickness
- Entry strip tension
- Roll force

Stability and high compensation rate:

- For up to 4 harmonic frequencies per roll
- For high speed levels (up to 22Hz)
- For all strip types
- During acceleration
- For changing eccentricities during rolling
- When other disturbances exist

No need for additional sensors , e.g. for synchronizing

Primetals Technologies Germany GmbH
A joint venture of Mitsubishi Heavy Industries and partners

Bunsenstr. 43 | 91058 Erlangen | Germany
primetals.com

Order No. T10-1-N236-L2-P-V3-EN
Printed in Linz | © 2020