

# COMPENSATION OF COIL ECCENTRICITY EFFECTS (CECO)

When metal sheet is wound on to a mandrel the coil is not completely round. This eccentricity can be caused by:

- the strip head on the mandrel (belt wrapper)
- the strip coming out from the gripper slot
- reversing mills: After several passes there is a thickness step from initial thickness at head and tail to the reduced thickness in the body
- eccentricity of the mandrel itself

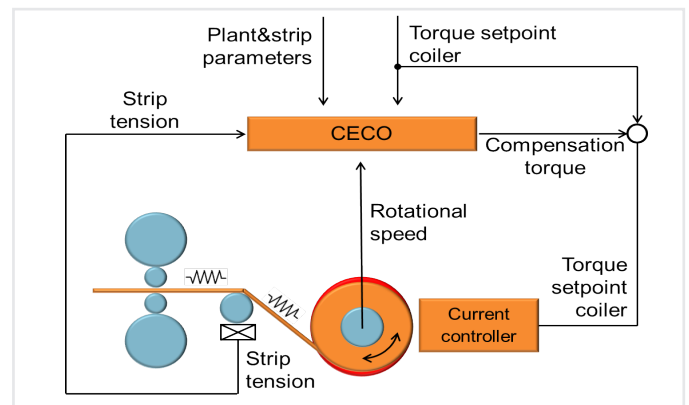
This coiler eccentricity causes tension oscillations in the strip which in turn can lead to thickness errors and surface defects.

## CHALLENGE

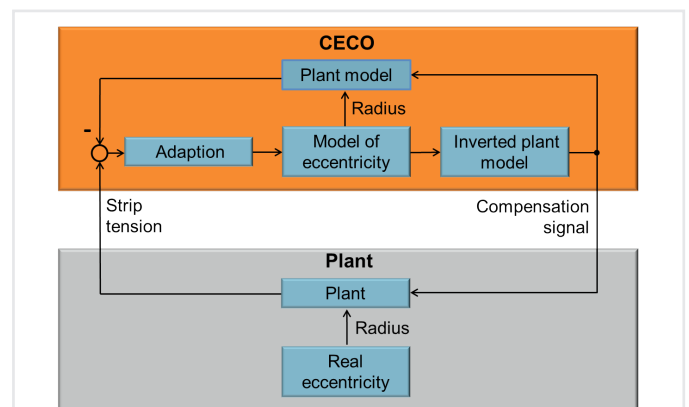
Since this tension disturbance is repeated with each revolution of the winder, its frequency depends on the rotational speed of the winder. At high rolling speeds this periodic tension change is much too fast to be compensated by the closed loop tension controller. Moreover the behavior of the system to be controlled changes dramatically with speed, coil diameter, strip geometry and pass reduction.

## OUR SOLUTION

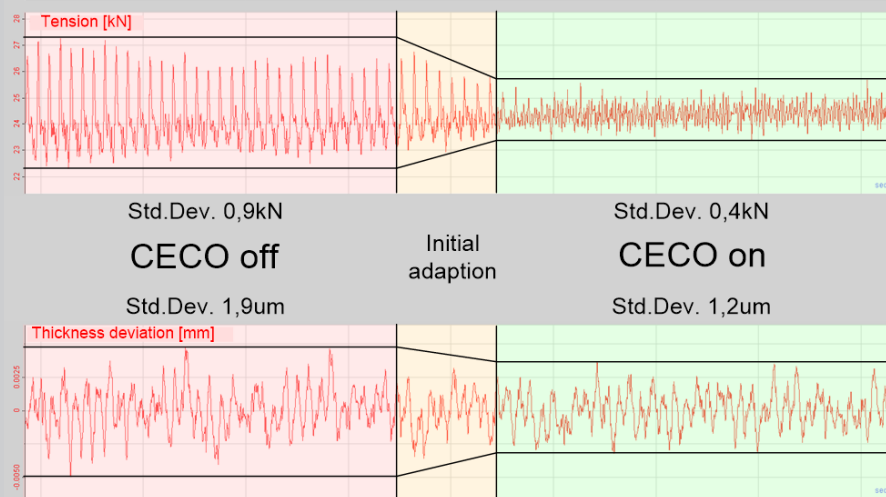
The coil eccentricity compensator CECO is a model based control which uses the fact that the shape of the eccentricity remains relatively constant during coiling. It can therefore model the eccentricity over several revolutions. Using an inverted plant model this eccentricity is transformed into a compensation torque for the coiler drive (pre-control).



Control concept



Structure of the control



Influence of CECO on strip tension and thickness in a reversing cold mill

## PRODUCT FEATURES

The CECO control is designed to adapt to all eccentricities occurring during winding.

- Thanks to the model based approach the CECO is stable and has a very high compensation rate:
- For all speeds (up to 22 Hz!)
- During acceleration
- For all strip types
- For all coil diameters
- For all pass reductions

The CECO is designed to meet the following restrictions:

- No excitation of the winder shaft resonance frequency
- No risk of exceeding the torque limits
- No tooth-flank rattle to protect the gear box
- Maximum compensation frequency
- Maximum compensation amplitude

## SUMMARY

The winder is accelerated by the CECO in such a way that the fast diameter changes caused by the coil eccentricity have no effect on tension and thickness. The model based approach in combination with the modelling of the eccentricity over several revolutions enables the control to be stable in all situations and to provide high compensation rates up to disturbance frequencies of 22Hz.

## MAIN BENEFITS

- **Better strip quality** – stable strip tension leads to better strip thickness tolerances, better strip surface
- **Maintenance friendly** - using existing sensors and instrumentation for strip tension and coiler rotation, no additional sensors or instrumentation needed
- **Fast CAPEX**- Easy to implement in existing basic automation environment

## FIELDS OF APPLICATION

- Unwinder and rewriter of SCM: Improvement of tension and thickness quality
- Unwinder of batch TCM: Improvement of tension and thickness quality
- Rewinder of tandem mill or processing lines: As the coil eccentricity has only a very limited effect on the thickness the CECO can only improve the tension quality



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