The Marini Spreading PyRoll Plugin

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This plugin provides a spreading modelling approach with Marini's formula for flat rolling, adapted on groove rolling by an equivalent rectangle approach.

1 Model approach

1.1 Marini's spread equation

Marini [1] proposed Equation 3 for estimation of spreading in flat rolling. Where h and b are height and width of the workpiece with the indices 0 and 1 denoting the incoming respectively the outgoing profile. A and B are parameters introduced by Marini. R is the roll radius and μ is the friction coefficient.

$$A = \frac{\sqrt{\Delta h}}{2\mu\sqrt{R}} \tag{1}$$

$$B = \sqrt{\frac{\Delta h}{R}} \tag{2}$$

$$b_1 = b_0 + \frac{2\Delta h b_0 \left(R - \frac{h_0}{2}\right) B}{h_1 b_0 + \left(\frac{b_0(h_0+h_1)}{2}\frac{1+A}{1-A}\right)\frac{0.91(b_0+3h_0)}{4h_0} + 2h_1 RB} \tag{3}$$

To archive consistency with previous models, equation 3 is reformulated to calculated the spread β of the roll pass. Values denoted with $'$ are equivalent values, these are calculated using a suitable approach for calculation of a equivalent flat roll pass.

$$\Delta b' = \frac{2\Delta h b_0 \left(R - \frac{h_0}{2}\right) B}{h_1 b_0 + \left(\frac{b_0(h_0+h_1)}{2}\frac{1+A}{1-A}\right)\frac{0.91(b_0+3h_0)}{4h_0} + 2h_1 RB} \tag{4a}$$

$$\beta = 1 + \frac{\Delta b'}{b'_0} \tag{4b}$$

Table 1: Hooks specified by this plugin. Symbols as in Equation 3.

Hook name	Meaning
`marini_parameter_a`	Parameter A of Marini's spreading equation
`marini_parameter_b`	Parameter B of Marini's spreading equation
`friction_coefficient`	Friction coefficient μ

2 Usage instructions

The plugin can be loaded under the name `pyroll_marini_spreading`.

An implementation of the `width` hook on `RollPass` is provided, calculating the spread using the equivalent rectangle approach and Marini's model.

Several additional hooks on `RollPass` are defined, which are used in spread calculation, as listed in Table 1. Base implementations of them are provided, so it should work out of the box. For `marini_parameter_a` and `marini_parameter_b` the equations 1 and 2 are implemented. Friction coefficient can be adjusted individually. Provide your own hook implementations or set attributes on the `RollPass` instances to alter the spreading behavior.

References

[1] N Marini. "Nuova teoria sulla laminazione". In: *La Metallurgia Italiana* (1941), pp. 292–309.