New Method for Statistical Roll Pass Design

1. Introduction

We offer **roll pass design** (RPD) solutions based on knowledge extraction (data mining) from company's data and databases in public domain. Our Company has developed a method that significantly improves key factors that affect development, operations and maintenance in hot rolling mills.

2. Rationale

Manufacturing by rolling consumes immense amount of resources (tools – rolls, water and fuel) and produces considerable environmental pollution. A major part of our method focuses on RPD improvements. A variety of RPD tasks appear not only at the commencement or reconstruction of a new product or plant, but also as an important routine within the continuous improvement of the production process. The most direct function of RPD is to determine the quality of the product. However, the efficiency of rolling process is determined by interaction of numerous factors over the subsequent stages of this multistage process. For example, roll wear ought to be included amongst the key criteria for devising a rational roll pass design.

3. Benefits

Our method allows for improvements in hot steel rolling process efficiency, resource consumption, product quality and ecological sustainability.

Rolls can be configured at the same costs to produce grooves of quite differing geometries with significant economic benefits for both maintenance and operations. Our roll pass design allows for

1. progressive optimization of roll pass design by means of detecting the weak points, the elimination of which will optimise the observed rolling system.

2. modification of the breakdown passes to enhance roll bite by increasing drafts and rolling velocity (recently we collected additional supporting evidence by rolling hot steel samples at 1000 ^{0}C using an experimental rolling mill).

3. RPD data mining and optimisation of pass sequences (ranging from break-down passes and grooves to schedules for rolling structural and universal sections).

4. improving the key performance indicators and techniques used to evaluate and control the rolling process performance.

4. Method

Databases of rolling pass schedules are analysed using a special analytical approach. Significant improvements can be identified by statistical analysis of manufacturing series of long steel products and by extracting knowledge from public databases. Our method makes use of the increasing availability of data to extract essential RPD correlations. This is followed by identifying the bandwidth limits of promising pass parameters. Similar cases of pass designs recorded in a single mill or several mills are translated into new generic functions that allow for drawing statistical inferences with increased precision. Pass sequence is expressed by means of mathematical functions,

which are then statistically analysed. The statistical models can be combined with deterministic relations and used to optimise similar pass sequences by means of mapping the parameters of the most successful cases. The existing pass geometry can be modified precisely within fine geometric tolerances without causing major changes in the rolling schedule. Special effects, such as curved surfacing, can be used to modulate the groove geometry. The principal framework of the process, such as the number of passes and the RPD system, may remain unchanged. Application of special analytical functions for tracing the groove contour enables profound corrections which lead to better control of lateral spread, decrease in groove wear, increase in yield and productivity.

Obviously, even if the quality of the final product at the start of campaign is satisfactory, high roll wear means that the process is not viable. This method enables trying a safe-side option first, i.e. roll grooves will be cut in an optimal manner while still allowing for eventual corrections. Moreover, the groove geometry is tuned for each redressing to accommodate for stepwise decrease in roll diameter.

5. Our team and services

Our team consists of experienced consultants (Dr Sven-Erik Lundberg, Dr Sead Spuzic and Dr Zlatko Kovacic) with over 30 years of experience that combines work in industry, academia and research. We can perform the above analyses based on the customer company's technical data, or we can provide training for the company's engineers with the new RPD method. Once RPD engineers learn the relevant principles, they can perform the complete analysis themselves. We also offer our further expert consulting help on a need basis.

6. Contact information

For further information please contact Dr Sead Spuzic (Sead@mystatisticalconsultant.com).

7. Background information

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