Straightening at higher temperatures is of great industrial interest due to the bottle neck function of the cooling bed. By solving the problems encountered during hot straightening, the production performance can be increased significantly. The curvature change during cooling after straightening is the main issue that has to be faced.

Hot straightened sections, cooled down in stacked piles and rails straightened at higher temperatures and cut to delivery length, demonstrate grave deviations in straightness.

Hot straightening sections with the FS-straightening technique, a method with discs acting not into the web root areas but at the flange edges, allows the target aimed for to be achieved to produce straight sections. The success of the FS-straightening operation is independent of the straightening temperature; i.e. no matter whether FS-straightening takes place in the 'cold', 'warm' or 'hot' condition, the straightening result is always determined by the screw-down of the straightening machine. And the cooling of sections FS-straightened at higher temperatures has only a minor effect on the straightness deviation. In this way the FS-straightening method demonstrates itself as a progressive straightening technique not only with a high priority for the production process but also with qualitative advantages for the product and with great economical benefit.

The straightness of rails is one of the important quality features. Because of deviation in the straightness, the rails have to be straightened again. Normally gag press machines are used for conventional rail production routes. From an economical point of view, efforts are made to reduce the amount of straightening with gag presses. The Testra project can be evaluated as the first step for reaching and realizing the economical objectives. The complex geometry and high straightness standard of grooved rails fundamentally complicate the investigations. After two and a half hours of cooling the temperature distribution in the rail shows a temperature difference of ca. 5 oC between head and base. Higher straightening temperatures are followed by higher temperature differences in the cross section of the rails. Constant curvature in the cut off rails is achieved after approximately two days of storing with greater curvatures straightened at elevated temperatures. A change is not observed in the residual stress distribution between the state after cutting and two weeks. Correlations between curvature and residual stresses are not detected.

The main simulation achievements of the modelling research group are focused on the finite element (FE) modelling integrating the cooling and the straightening process. As these processes are sequentially located in the real manufacturing process of the long products studied ('H' sections and grooved rail), the coupling of both FE models is the relevant aim during the project. The main objective was to model the straightening process in a realistic way and for this it was necessary to simulate the initial conditions of the cooling process. In this way the following sections present in a resumed manner the development of each FE model and their coupling. Additionally a methodology based on genetic algorithms to automatically improve the straightening process in the sense of roller deflections has been developed.

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