Analysis of spinner straightening utilizing the Finite Element Method

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ABSTRACT

This paper presents analysis methods utilizing the Finite Element Method for spinner straightening, and shows a guideline for optimum conditions. Spinner is a straightening method, which is used for straightening bars. Spinner is located between drawing process and two-roll straightener. There are many research works for two-roll straightener [1, 2], while there are few ones for spinner straightening, even though spinner straightening may play important roles as twostraightener.

This paper focuses upon spinner straightening. Two types of analysis methods were composed. Type 1, "full actual model with explicit scheme", considers the rotational movement of dies as the actual process using the explicit scheme. Tool rotation, centrifugal force and twist of the work are all considered. Type 1 have some abilities that tell the fact over engineers' imagination, though it takes long time for calculation.

Type 2, "ideal model carrying out fundamental analysis based on simple bending in FEM", uses the FEM for only calculation of simple bending without rotation for obtaining the deformed bar shape. A fundamental analysis is carried out based on the obtained deformed shape considering the rotation of a couple of cross-sections of the bar. Type 2 would show an idealistic result in straightening.

A series of experiments were conducted in an actual production line as well as the analyses by Types 1 and 2. The examination mainly focused upon the effect of straightening intensity by changing the die positions. The experiment and Analysis Type 1 showed that the straightness was deteriorated with increase of the straightening intensity against the engineers' intuition when the intensity was stronger than a certain amount. Analysis Type 2 showed the mechanism that the increase of intensity increased the short-range warp, which would lead to the long-range warp. These results showed a basic guideline for the optimum working condition. (297 words)

REFERENCES